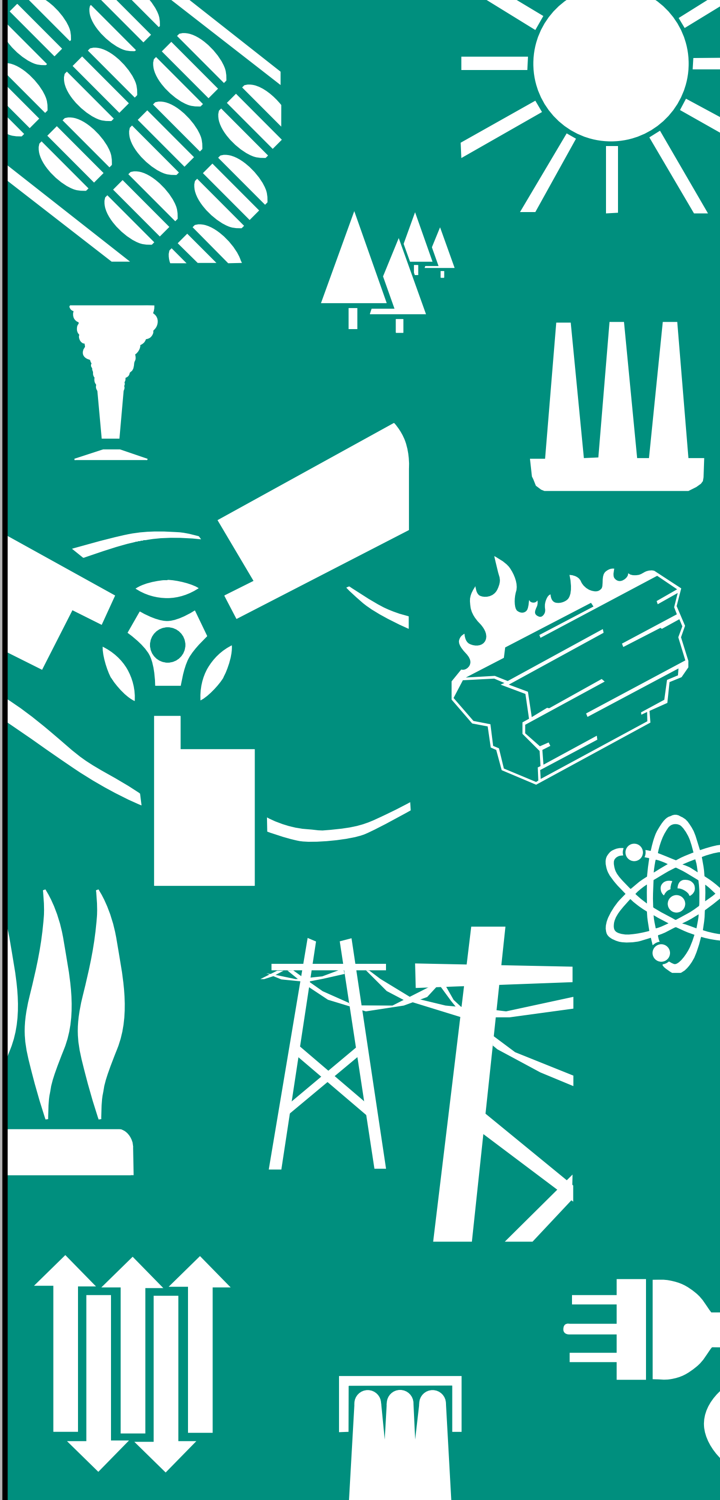
ENERGY AWARE



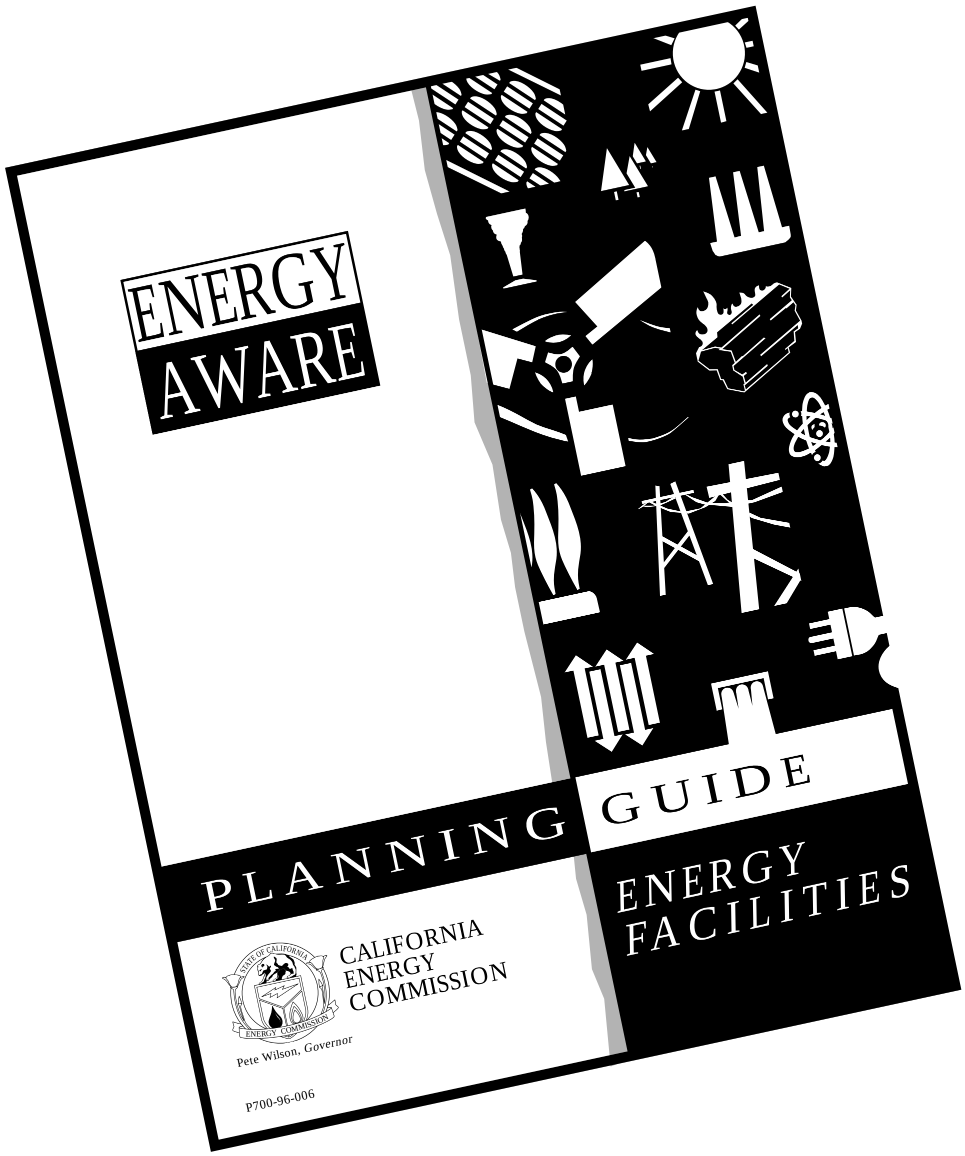
PLANNING GUIDE

ENERGY FACILITIES

CALIFORNIA
ENERGY
COMMISSION

Pete Wilson, *Governor*

P700-96-006



CALIFORNIA ENERGY COMMISSION

PREFACE

Energy use is an integral part of our daily life. It is a foundation of our economy and it provides many comforts and conveniences. Yet energy, and its availability, are often taken for granted.

This Energy-Aware Planning Guide is intended to help meet the California Energy Commission's mandate under Public Resource Code section 25616 which directs the Commission to:

1) assist local agencies in the siting of energy projects which are not otherwise subject to the Commission's power plant site certification process,

2) encourage local agencies to expeditiously review permit applications to site energy projects, and

3) encourage project developers to consider all cost-effective and environmentally superior alternatives that achieve their project objectives.

This Guide focuses on energy facilities, and is a companion to the 1993 *Energy-Aware Planning Guide* on energy use. The information in this Guide is intended to benefit local governments and their communities, as well as electric utilities or other providers and energy project developers, with permitting energy facilities.

ACKNOWLEDGEMENTS

The production of the *Energy-Aware Planning Guide: Energy Facilities* was partially funded by Petroleum Violation Escrow Account (PVEA) monies provided to the Energy Commission's Siting and Permit Assistance Program by the State Legislature.

We are particularly grateful for the time and effort spent by thirty-three representatives of local governments and thirty-three representatives of municipal and investor owned utilities from throughout California who attended six workshops to contribute their ideas for the contents of the *Guide.* Representatives from other state agencies also attended. (See Appendix A)

Numerous additional representatives of local governments took time to provide information by telephone about issues they have faced about energy facilities as well as their ideas for the *Guide.* We are especially pleased to have the agreement of many individuals and organizations to provide case study material and to be listed as contacts for the *Guide.*

The subject of energy facilities planning and permitting can be controversial for the communities where they are located and for all parties involved. We were fortunate that the Guest Authors listed below were enthusiastically interested in contributing thought-provoking articles for this *Guide*. *These articles are provided in the interest of sharing ideas which may need to be addressed in the planning and permitting of energy facilities. The articles may include controversial opinions of the authors and do not necessarily represent the views of the California Energy Commission or its staff.*

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There were many contributors to the writing of this *Guide*, both inside and outside the Energy Commission. Our main contractor, the Local Government Commission (LGC), organized and conducted five of the information-gathering workshops and Pat Stoner of LGC prepared important sections of Chapter 4 and lay the groundwork for Chapter 5 on the critical permitting issues of energy facilities. We are also grateful that Pat spent many hours editing the document. Criterion (Eliot Allen, principal), a subcontractor in Portland, was the primary author for Chapter 3. Carolyn Baker with the firm of Edson + Modisette prepared Appendix C.

Numerous Energy Commission staff contributed as authors for the *Guide.* From the Energy Facilities Siting and Environmental Protection Division (EFS&EPD) were: Robert Therkelsen, Robert Haussler, Judy Grau, Lorraine White, Matthew Layton, Rick Tyler, Rick York, Gary Walker, Joe O'Hagan, Obed Odoemelam, Steve Baker, Jackie Stroud, Linda Davis, Dave Maul, and Eileen Allen. Contributing authors from the Energy Technology Development Division (ETDD) included: Heather Raitt and Jonathan Teague. Authors from the Energy Forecasting and Resource Assessment Division (EFRAD) were: Dale Trenshel and Kat Calhoun.

Special thanks go to Douglas Anthony and the Santa Barbara County Planning and Development Department for their help with the *Energy Facility Closure/ Abandonment* chapter and for their ideas on other areas of the *Guide*.

The following utilities provided review and many useful comments for the *Guide,* particularly for the chapter on electric and magnetic fields: Los Angeles Department of Water and Power, Modesto Irrigation District, Pacific Gas and Electric Co., PacifiCorp, Sacramento Municipal Utility District (SMUD), San Diego Gas and Electric, Sierra Pacific Power Company, and Southern California Edison. We also acknowledge SMUD for its comments on Appendix B, as well as Keith Shorey's astute comments on the interface between the community planning and energy facility permitting processes incorporated into Chapter 3.

Reviewing and editing a document such as this is a major task. Energy Commission staff who assisted were: Gregory Newhouse, Robert Haussler, Norm Wilson, Robert Strand, Chuck Najarian, Lorri Gervais, Chris Tooker, Roger E. Johnson, Tony Rygg, Don Kondoleon, Linda Davis, Albert McCuen, Eric Knight, Nancy Hanson, Elaine Hebert, Bert Fegg, and Dale Edwards of the EFS&EPD; Ken Koyama, Art Soinski, Jairam Gopal, Dara Salour, Pramod Kulkarni, George Simons, Roger Peake, Valentino Tiangco, Michael Kramer, Jay Guettler, Jack Janes, and Nancy Jenkins of the ETDD; Gerry Bemis, Karen Griffin, and Calvin Wire of the EFRAD; and Arlene Ichien, Erik Saltmarsh, Caryn Hough, Dick Ratliff, David Mundstock, and Jeffrey Ogata from the Office of the Chief Counsel; and Claudia Chandler, Jackie Goodwin, and Mary Ann Costamagna of the Media and Public Communications Office.

The Energy Commission also wishes to thank the following agencies for their review and comments: Federal Energy Regulatory Commission, U.S. Forest Service, Bureau of Land Management, California Public Utilities Commission, California Department of Health Services EMF Program, and the State Water Resources Control Board. Antero Rivasplata at the Governor's Office of Planning and Research was especially helpful with his comments on Chapters 3 and 4.

Additional reviewers for Appendix B were Abbas Ahkil at Sandia National Laboratories, David O'Kain at the Oak Ridge National Laboratory, and Don Bender at the Lawrence Livermore National Laboratory.

Jacque Gilbreath, Cartographer/Graphic Artist in the Energy Facilities Siting and Environmental Protection Division, deserves many accolades for her graphics, layout, and many hours of providing numerous drafts and finalizing the document. She was assisted by Abigail Ocampo, and Cathy Siebensohn.

Jackie Stroud
Project Manager
Energy Facilities Siting and
Environmental Protection Division

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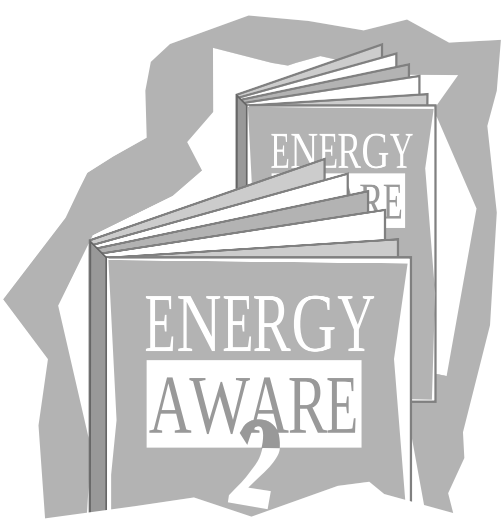
CHAPTER 1: USING THE GUIDE

INTRODUCTION

This Guide is intended to benefit both local governments and developers of energy facilities. It provides local government decision makers and planners with ideas and information vital to achieving an effective, less costly, and expeditious energy facility permitting process. The Guide addresses health and safety, environmental, public involvement and economic considerations important to energy facility planning and permitting activities, as well as to overall community planning activities. It also presents ideas on how local governments can influence other agencies which permit energy facilities that impact their communities.

Energy project developers will benefit from the information presented in this Guide because it can help them work with local governments, resulting in more certainty and less cost in obtaining permits.



Energy facilities which produce or transmit electricity, heat, or fuel are an integral part of our everyday life. Several factors listed below are now converging which may dramatically change the nature of energy project development in California and the ability of local officials to respond effectively to proposed developments.

• Changes in federal and state laws to deregulate the electric utility industry and allow competitive forces to determine supplier, price and services are being implemented. Competition may result in different state regulatory oversight of power plant and electric transmission line selections and locations. Deregulation could increase the role of local government land use planning and permitting processes.

• While deregulation is taking place, the demand for electricity continues to grow. By the year 2005, the Energy Commission estimates that approximately 6,000 megawatts of new electrical capacity will be needed for California's electrical generation system (Electricity Report for 1994, Chapter 9). New power plants and transmission lines will be needed to satisfy this demand. Local governments may be required to permit many of these facilities, or will be requested by the Energy Commission to provide comments on facilities under the Commission's jurisdiction.

• Electrical generation technology is changing and may result in new and unfamiliar energy facilities. These facilities will have unique permitting issues. Local governments may be faced with processing permit applications for these emerging technologies.

• As population grows, there will probably be increasing conflicts between existing and future land uses which can affect the economy, environment and quality of life for Californians. The local government land use planning process will be a critical component in determining how energy can either contribute to, or reduce, these conflicts.

• While energy development is changing, local governments continue to lose funding needed to meet the demand for project planning and permitting.

This Guide is designed to help local governments make the transition to the future under difficult fiscal circumstances. It can facilitate tasks associated with the planning and permitting of energy facilities, thereby reducing overall costs.

If your jurisdiction will be:

- Permitting power plants or other energy facilities

- Working with utilities and agencies responsible for new and/or upgraded transmission lines

- Integrating energy generation with industrial or commercial development

- Looking for ways to increase the economic prosperity of your region

- Working to reduce the air pollution often associated with energy production and generation

- you will have energy facility permitting issues.

For the purpose of this Guide, "energy facilities" refers to projects used primarily for the production, generation, transmission, distribution, and storage of fuel, electricity, or heat. These five categories of energy facilities are defined on the following page (*Five Energy Facility Categories* chart) and in Appendix B. This Guide focuses primarily on, but is not limited to, power plants and electric transmission lines.

THIS GUIDE CAN BE USED TO:

◩ Process energy facility permit applications and renew permits (and influence other agencies' permitting processes when local agencies do not have jurisdiction).

See:
- Chapter 4 for general permitting assistance
- Chapter 5 for actions local governments can take to address specific energy facility permitting issues

- Appendix B for brief technology/facility descriptions and the permitting issues most commonly associated with each type of energy facility

◩ Prepare for future energy development by providing ideas for general plans and program development and encouraging coordination among all stakeholders.

See:
- Chapter 2 for energy facility trend information, and opportunities and challenges for local governments

- Chapter 3 for energy facility planning information which will facilitate the permitting process and relationship-building among stakeholders, and better communication and resolution of issues with developers.

- Chapter 5 for general plan and implementation ideas useful for siting energy facilities

START WITH ENERGY EFFICIENCY

Local planning roles and processes are particularly applicable to the reduction of local energy consumption. Such planning can in turn influence what power plants, transmission lines and natural gas pipelines are needed by a community. The types and quantities of energy needed by communities are heavily influenced by plans for land use, transportation and infrastructure. Energy facility permitting, and its associated costs, staff time, and environmental impacts can be reduced, delayed or avoided. If communities conserve energy they can also keep money in the local economy. This information is addressed in the original, or first volume of the *Energy-Aware Planning Guide.*

Specifically, the first volume of the *Energy-Aware Planning Guide* addresses energy use associated with land use, transportation, buildings, water and waste management. It identifies significant local energy-use issues, and over forty strategies for reducing energy use for economic and environmental benefits. Examples of some of the urban design and management strategies include:

- Mixing residences and worksites
- Diverse and compact housing
- Pedestrian and transit-oriented development
- Telecommuting
- Energy efficient construction and landscaping principles

Persons desiring more information about the first volume of the *Energy-Aware Planning Guide* should contact Nancy Hanson, Energy Commission, (916) 654-3948.

To obtain a copy of the first volume of the *Energy-Aware Planning Guide* submit the order form in Appendix H or contact the Energy Commission's Publications Office at (916) 654-5200.

FIVE ENERGY FACILITY CATEGORIES

1) Energy Production Facilities

These facilities involve the extraction or processing of energy resources. Examples include oil, gas, geothermal wells/fields; refineries; biomass fuel production facilities; and landfill gas extraction sites.

2) Energy Generation Facilities

These facilities include electric generation facilities and heat generation facilities. (Some can produce both electricity and heat in a process called cogeneration). Electric generation facilities may be categorized as either thermal or non-thermal.

> Thermal power facilities - rely on the conversion of fuel to heat to produce electricity.
>
> Non-thermal power facilities - do not rely on the conversion of fuel to heat. Examples include hydroelectric, solar photovoltaic, wind and ocean wave power plants.

3) Energy Transmission Facilities

These are linear facilities which transport large quantities of electricity (transmission lines) or fuel (pipelines). Also included are electrical switchyards (which transform the voltage from the level at which it is generated to the level of transmission) and substations (which transform the voltage from the level of transmission to a lower distribution level).

4) Energy Distribution Facilities

Much smaller than transmission facilities, distribution facilities include the electrical distribution lines [typically about 50,000 Volts (50 kiloVolts) and less] and substations which carry electrical energy from the transmission substations, through several levels of voltage reduction, to the customer (at 120 Volts). Distribution facilities also include natural gas distribution pipelines and associated equipment which carry natural gas from higher-pressure transmission lines to the customer, through several levels of pressure reduction.

5) Energy Storage and Management Facilities

These facilities include those that store electrical energy, natural gas, liquefied petroleum gas, or alternative fuels such as compressed natural gas, methanol, or hydrogen. Examples include: vehicle fueling/charging stations, hydroelectric pumped storage projects, compressed air energy storage, and utility-scale batteries.

- Appendix B for brief technology/ facility descriptions

◩ Address public concerns and improve public involvement.

See:
- Chapter 3 for fully integrating the public in energy facility planning activities
- Chapter 4 for fully integrating the public in energy facility permitting activities

◩ Understand the relationship between energy facilities and important community issues, such as land use, air quality, health and safety, and economics.

See:
- Chapter 3 for energy facility planning as it relates to the broader community context
- Chapter 5 for specific permitting issue information

INSIDE THE GUIDE

This Guide provides:

◩ Guest Author Articles. Distributed throughout the Guide, these provide the views of individuals and organizations on a variety of often controversial topics. A diversity of opinions can be valuable to the reader in sorting out how to proceed on these topics. These articles do not necessarily reflect the views of the Energy Commission or its staff.

◩ Chapter 2 - Energy Facilities Development In Perspective. A historical view of the California electricity industry and information about possible trends in facility development and the planning and permitting opportunities and challenges they create for local governments.

◩ Chapter 3 - Planning for Energy Facility Development. A description of the usefulness of Energy-Aware Planning for energy facilities, the local authority for such planning, and a collection of planning and program information ideas which emphasize working with all parties. Case studies are also provided to prepare local agencies for energy facility permitting and development.

◩ Chapter 4 - Permitting Energy Facilities. A collection of ideas for developing interagency cooperative efforts, addressing public concerns and expediting local government permitting where applicable. Information is included to aid in determining agency jurisdiction. Energy facility application review process flow charts help focus on potential opportunities for local government to influence state and federal agency and municipal utility permitting processes.

◩ Chapter 5 - Critical Permitting Issues. A collection of background information and ideas for local action on significant energy facility permitting issues including:

- Air quality
- Biological resources
- Hazardous materials handling and storage
- Water use and quality
- Visual and noise impacts
- Public concerns about electric and magnetic fields (EMF)
- Energy facility closure/ abandonment

LOCAL COMMENTS

"The use of the California Energy Commission's first *Energy Aware Planning Guide* was critical to the development of San Luis Obispo County's Energy Element, now adopted as an important element to our county's general plan. The guide was not only useful, but easy to follow because of the understandable format and relevant graphics. It provided us with practical examples, sound technical information, and a wealth of ideas for preparing the element.

The purpose of the San Luis Obispo County Energy Element is to 1) increase energy efficiency, 2) provide energy information and policy guidance, 3) document the county's energy resources, 4) establish land use and environmental criteria for evaluating future energy projects and 5) provide alternatives which encourage projects that exceed the state's energy regulations. The Energy Element not only provides a common currency to help bridge the gap between environmental and economic concerns, but also recently won a California Chapter American Planning Association Outstanding Planning Award. Our thanks go to the Energy Commission for preparing the *Energy Aware Planning Guide*, without which we could not have prepared our award-winning general plan element."

Alex Hinds, Director,
San Luis Obispo County Department of Planning and Building

Chapter 5 also provides regulatory information, general plan and implementation ideas, case studies, information resources, and contacts.

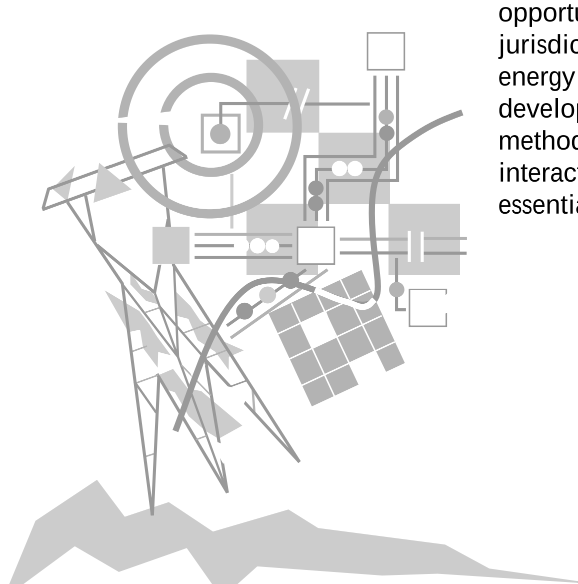
- Appendix A lists the participants in workshops held to gather ideas for the development of the Guide.

- Appendix B contains descriptions of various types of energy facilities, the permitting issues most commonly associated with them, and a matrix showing the significance of permitting issues related to these energy facilities.

- Appendix C contains descriptions of the roles and responsibilities of various state and federal agencies in terms of energy facility permitting.

- Appendix D lists the addresses and phone numbers of numerous state and federal offices which may be involved in energy facility permitting.

- Appendix E lists organizations, publications, helplines and electronic resources for further energy facility-related information.



- Appendix F provides in-depth background information on power plant generating efficiency. It addresses why generating efficiency is important and how it is measured. The characteristics which influence efficiency and the efficiencies achieved by different types of facilities are included. A procedure for performing a detailed efficiency analysis for proposed power plants and ideas for ensuring efficient electricity generation are also provided.

- Appendix G is a glossary of some of the terms used in the Guide.

- Appendix H contains an order form to acquire a copy of the first volume of the Energy-Aware Planning Guide which addresses how to use energy more efficiently through the land use planning process.

FUTURE UPDATES

In 1997 we plan to publish a new chapter on distributed generation. (See the Chapter 6 placeholder for more information.) We also plan to revise this Guide periodically to address rapidly evolving technologies, regulatory changes and local opportunities. Your particular jurisdiction's experience with energy facility permitting and development, as well as with new methods of local government interaction with developers, is essential to this process.

Please let us know about:

- Information you would like included in future updates

- Useful local energy facility planning and permitting strategies

- Illustrative case-study material

- Additional information resources

- Local agencies developing their own energy facilities

Send your ideas and requests for copies of this document to:

Siting and Permit Assistance Unit
California Energy Commission
1516 9th Street, MS-48
Sacramento, CA 95814
(916) 654-4079.

You can also use the internet or e-mail as follows:

Internet: http://www.energy.ca.gov

E-mail: siting@energy.ca.gov

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ENERGY FACILITIES DEVELOPMENT IN PERSPECTIVE

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CHAPTER 2

ENERGY AWARE
PLANNING GUIDE: *ENERGY FACILITIES*

CHAPTER 2: ENERGY FACILITIES DEVELOPMENT IN PERSPECTIVE

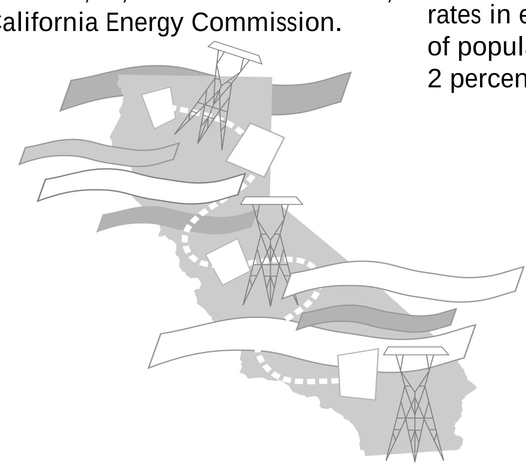
INTRODUCTION

This chapter discusses the recent history of California's energy system, focusing primarily on electricity generation and transmission. It also explores the major changes taking place in the regulation of energy development (or areas that ultimately affect energy development). Finally, the chapter introduces major opportunities for local agencies in planning for and permitting facilities needed in the future, including the provision of early guidance to energy project developers and working with all stakeholders during the planning and permitting processes.

GUEST AUTHOR ARTICLES

Guest Author articles are found at the end of this chapter. These articles contain opinions of the authors and do not necessarily reflect the views of the California Energy Commission or its staff.

The Rise of the Cardiff Giant: Electricity Market Restructuring & the Police Powers by Emilio E. Varanini, III, former Commissioner, California Energy Commission.



Municipalization Issues by Gerald Jordan, Executive Director, California Municipal Utilities Association.

CALIFORNIA'S ENERGY SYSTEM

California's energy system, particularly the electricity generation and transmission system, has evolved into one of the most diverse and reliable in the country. As California's population increases and demand for services grows, the need to expand and improve this energy system will also increase. What does this mean to you? Energy facilities such as power plants, transmission lines and pipelines will continue to be built in the state, and some of these new or expanded facilities may be located in your community.

Currently, about one-half of all energy consumed in California is used by the transportation sector to move people and goods. Energy needs are supplied by fossil fuels (including natural gas), renewable resources (i.e., biomass, solar and wind), nuclear and out-of-state sources. The Energy Commission anticipates that annual growth rates in energy use will follow that of population growth rates, roughly 2 percent annually.

ENERGY FACILITIES DEVELOPMENT IN CALIFORNIA: A HISTORICAL VIEW (LATE 1960s TO PRESENT)

In the late 1960s and early 1970s, multiple and often sequential federal, state and local permits were required before the construction of large energy facilities could begin. At a time when the demand for electricity was ever increasing, power plant permitting was lengthy and expensive, typically taking three years or more to complete. (See California Department of Water Resources, 1970, in Information Resources). Most power plants proposed at that time were very large (500 megawatts [MW] or greater) nuclear or fossil fuel-fired generation units owned and operated by investor-owned utilities (i.e., Pacific Gas and Electric, Southern California Edison and San Diego Gas and Electric).

By the end of 1972, the number of agencies concerned with the siting of large energy facilities (including power plants, refineries, and transmission lines) included nearly a dozen single-purpose federal agencies, 16 state agencies, air pollution control districts, plus many city and county agencies. With this regulatory structure, a needed energy facility project with state-wide significance could be stopped conceivably at the local level unless the site had specifically been condemned for public use by a higher agency. (See Rand Corporation, 1972, in Information Resources.)

Despite the amount of federal, state and local control over energy facilities development, many environmental and land use conflicts persisted. (See Rand Corporation, 1972, in Information Resources.) The regulatory system of the time encouraged utilities to take the lead role in planning for new power supplies without serious challenge to their choice of the quantity, type of generating resources or facility location by these regulatory agencies. (See California Legislature, 1979, in Information Resources.)

In addition, the public rarely participated in the planning or licensing decisions. The regulatory system itself limited public involvement until relatively late in the process, often too late to ensure consideration of alternatives or to make meaningful changes to the proposals. (Rand Corporation, 1972, in Information Resources.) Public concerns over environmental degradation from unchecked development such as that of the electricity industry eventually prompted the passage of the National Environmental Policy Act of 1969 and the California Environmental Quality Act of 1970.

Transmission line planning and permitting was even less open to public involvement or regulatory scrutiny than power plants or other energy facilities. Investor-owned utilities had (and continue to have) special privileges such as the power to condemn land for right-of-way. (Rand Corporation,1972, in Information Resources.)

In 1970, the California Public Utilities Commission (CPUC) approved General Order 131 which required that the utilities obtain a Certificate of Public Convenience and Necessity for transmission lines in excess of 200 kilovolts (kV). (Rand Corporation, 1972, in Information Resources.) However, utilities essentially were allowed to control transmission and distribution lines below this amount.

◩ The Warren-Alquist Act. By 1974, three conflicting forces converged, resulting in a change to the regulatory structure of power plant licensing:

1) An apparently insatiable demand for more power, with CPUC projections for needed generation in excess of 80,000 MW from 1972 to 1991

2) An overly complicated, sometimes conflicting regulatory permitting process

3) An apparent public unwillingness to live with the environmental consequences of large industrial facilities such as power plants and transmission facilities

In response, the Legislature passed and the Governor signed into law the Warren-Alquist Act, creating the California Energy Resources Conservation and Development Commission, better known as the California Energy Commission. The Act vests the Energy Commission with sole authority for the licensing of thermal power plants 50 MW or greater in generating capacity and their related facilities.

One of the Energy Commission's primary missions is to ensure that needed power generation facilities are sited to provide reliable electric energy in an affordable and environmentally acceptable manner. The Energy Commission was designed to serve as a common forum for energy facility planning and power plant siting. Since most of the electricity generation projects being considered in the mid 1970s were thermal power plants greater than 50 MW proposed by investor-owned utilities, local governments' role as lead agency in siting generation facilities diminished significantly.

◩ The Public Utility Regulatory Policies Act. During the late 1970s and early 1980s, changes took place that affected the types of power plants being developed. In 1978 Congress passed the Public Utility Regulatory Policies Act (PURPA) to encourage the development of non-utility and alternative power sources (i.e., renewable and cogeneration technologies). (16 U.S.C. section 2601 et. seq.) Under implementation regulations issued by the Federal Energy Regulatory Commission (FERC), PURPA specified criteria which, when fully met, enabled small power producers called "Qualifying Facilities" (QFs) to sell electricity to utilities at a price equal to the utility's "avoided costs" (i.e., the cost the utility would incur to generate the power itself or purchase it from another source). It was the intent of Congress to maintain the conventional power distribution systems while creating a market for small power producers. To this end, Congress sought to increase electric utility efficiencies and to expand the development of new energy technologies.

The CPUC aggressively pursued implementation of PURPA and, as a result, the majority of the state's biomass-fired plants, wind turbine farms, small hydroelectric and cogeneration facilities are owned and operated by independent energy producers. Essentially nonexistent before 1980, independently owned (i.e., QF and self-generator) energy projects were being proposed and permitted in California. Since many of these QF projects were outside the state's jurisdiction, local agencies began to play a significant lead role in permitting power plants once again.

By opening the electricity generation industry to independent, "third party" developers and offering the avoided cost payment incentive, as well as favorable tax treatment, the development of non-traditional power sources was greatly expanded. The type, size and ownership of facilities developed in California changed from large conventional technology facilities burning fossil fuels and owned by utilities to smaller alternative technologies and more efficient fossil fuel-fired cogeneration facilities owned by independent power producers.

By 1985, the CPUC began actively to restrict the number of QFs entering the electricity industry because of concern over an excess in generating capacity. By the late 1980s, the number of QF-proposed projects began to taper off.

Many small to medium sized power plants have been developed in California due to the changes initiated by PURPA. One hundred and thirty-four independently-owned power plants (excluding four hydroelectric plants) with a generating capacity between 20-49.9 MW were operational as of March 1996. The combined generating capacity of these facilities in the state is greater than 4,500 MW and comprises roughly nine percent of the state's electricity system.

RECENT CHANGES AFFECTING ENERGY FACILITIES DEVELOPMENT IN CALIFORNIA

Past events are sparking additional changes in the regulation of energy development. These changes will affect energy facility planning activities, permitting processes and mitigation requirements. As with past changes, the type, size, ownership, location and cost of these facilities may also be affected.

FEDERAL ACTIONS

In 1992, Congress passed perhaps the most important and far-reaching federal energy legislation since the 1978 passage of PURPA. The National Energy Policy Act of 1992 (NEPAct) was aimed at providing a major dose of competition to the electric industry by creating a new class of wholesale-only electric generators, called "exempt wholesale generators," and expanding the access of these generators to the transmission system. These power producers do not have the technology, size, and fuel limitations imposed upon them as QFs do. Unlike QF power, utilities are not obligated to purchase exempt wholesale generator power.

A key feature of NEPAct is that it enhances the access of non-utility generators to the transmission grid by giving FERC the authority to order wholesale power wheeling.[1] NEPAct obligates transmission system owners to make a good-faith effort to expand facilities, if needed, to meet wheeling requests by electricity market participants. FERC Order 999, dated April 24, 1996, implements these provisions.

REGIONAL ACTIONS

As a result of recent federal actions (NEPAct and its implementation), the opportunities for coordinated regional transmission planning and access to western regional power markets are greatly enhanced. FERC is encouraging the formation of voluntary regional transmission groups to address issues associated with transmission planning and dispute resolution.[2]

Future state actions to promote direct access to generation providers for all retail customers could place further emphasis on the need to use the existing transmission system efficiently and to plan for coordinated future expansion. The siting of high-voltage transmission lines, however, is becoming increasingly difficult. Concerns about the possible health effects of electric and magnetic fields from high-voltage power lines, coupled with land use constraints, may make it more difficult to obtain new rights-of-way for transmission projects despite regional planning efforts. In such cases, another choice for utilities and communities to consider would be the use of distributed generation. (For additional comments on distributed energy systems, see page 2.6 and the Chapter 6 placeholder.)

STATE ACTIONS

◩ Transmission line planning. In 1988, the California Legislature and governor approved Senate Bill 2431 (Garamendi) which directed the Energy Commission to study the need for transmission lines in the future and to examine alternatives to creating new rights-of-way. The 1988 law also identified four principles to guide the use of the existing system and the development of new facilities, as follows:

• Encourage the use of the existing rights-of-way by upgrading existing transmission facilities where technically and economically justifiable.

• Encourage the expansion of existing rights-of-way, when technically and economically feasible, when construction of new transmission lines is required.

• Provide for the creation of new rights-of-way when justified by environmental, technical, or economic reasons, as determined by the appropriate licensing agency.

• Seek agreement among all interested utilities on the efficient use of new transmission capacity whenever there is a need to construct additional capacity.

In its 1992 report to the Legislature, *Transmission System and Right of Way Planning for the 1990s and Beyond,* the Energy Commission identified several significant study findings, including:

• Some utilities allow little or no opportunity for effective public involvement in transmission planning.

• Lack of access by some utilities or private power producers to existing lines may result in the building of new lines.

• It is not always appropriate or possible to build new or expand lines in an existing right-of-way.

• The current transmission planning and licensing process is fragmented and lacks coordination.

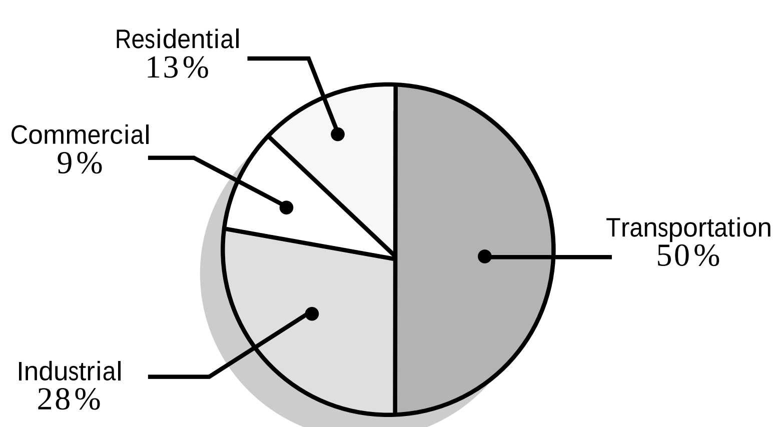
◩ Transmission line licensing. The CPUC in June of 1995 adopted General Order 131-D which clarifies its authority over Investor-Owned Utilities (IOU) electric power lines and substations. Under its predecessor, General Order 131C, only investor-owned transmission lines over 200 kV were regulated by the CPUC's Certificate of Public Convenience and Necessity process (substations were exempt from CPUC authority). With the issuance of General Order 131-D, investor-owned transmission lines between 50 and 200 kV and their related substations become subject o the CPUC's Permit-to-Construct process beginning January 1996.

The Permit-to-Construct process is intended to be simpler and less time-consuming than the Certificate of Public Convenience and Necessity process. It does not require a determination of need per se, but instead assumes that the project is required in order for the utility to carry out its obligation to serve. In addition, the CPUC's decision, of which General Order 131-D is a part, requires a Permit-to-Construct for substations also.

Several factors influenced the creation of General Order 131-D. In many cases there were increasing delays in siting transmission facilities as a result of jurisdictional confusion among local agencies and disagreements between utilities and local government entities. A need arose to ensure adequate environmental review and compliance with CEQA, as well as address uniformly the growing local public concerns over the potential health effects of electric and magnetic fields. The General Order 131-D Decision points out, however, that even with the CPUC's preemptive authority to site transmission lines and substations between 50 and 200 kV, utilities are not relieved of their obligation to work with local agencies and authorities during the permitting process.

◩ Regulatory restructuring. In the mid-1980s, the natural gas industry began a process of deregulation. This has allowed competitive pressures to drive resource development and cost. After two years of intense scrutiny, on December 20,1995, the CPUC issued a decision to start a transition to a competitive electricity

CALIFORNIA'S ENERGY CONSUMPTION BY USES



Source: California Energy Commission's *The California Energy Policy, 1994.*

market. The new market will start on January 1, 1998, with all consumers participating by 2003. Consumers will be able to choose among electricity generators; power producers will have non-discriminatory access on the state-wide transmission system to buy and sell power in a competitive market; and a new independent system operator will be created to control operation of and provide access to the transmission network and essential network services. In the future, new generation will be built by many competitors who are vying to provide power to a central market or to their own direct access customers. Public policy programs related to energy efficiency, renewables, research and development, and low-income individuals will continue, but with new funding and operational mechanisms.

The first major milestone of this transition occurred on April 29, 1996, when the investor-owned utilities filed a proposal with the Federal Energy Regulatory Commission to implement the independent system operator and power exchange. Significant portions of this structure have now been enacted by the legislature. (Chap. 854, Stats. of 1996.) There are an enormous number of restructuring steps to be taken over the next seven years. By then, we expect to have an electricity system which offers more varied and tailored services, is responsive to competitive pressures, and provides the reliable, environmentally-sensitive, and safe electricity service California expects. During this transition period, new generation construction will probably be less than would have happened in a business-as-usual world. There may be more sales, refurbishments, or retirements of existing generating facilities.

ENVIRONMENTAL REGULATORY ACTIONS

◩ Air quality regulation. In its 1990 amendments to the Clean Air Act, the federal government established national caps on allowable utility emissions of sulfur oxides (SO_X) and provided for tradeable allowance programs for these emissions. These caps, below currently-allowed emissions levels, apply to both new and existing facilities. The amendments also commit to a reduction in nitrogen oxide (NO_X) emissions to specified amounts below 1980 levels. In addition, the federal government is endeavoring to reduce carbon dioxide (CO_2) emissions but has not yet established standards. These measures to reduce SO_X, NO_X, and CO_2 emissions will go into effect over the next few years.

In 1991, the South Coast Air Quality Management District began work on the Regional Clean Air Incentives Market (RECLAIM) program. RECLAIM is an alternative market-based approach to regulating air quality. It is intended to reduce attainment costs and increase flexibility in meeting reduction requirements.

Under the market-based approach, all major stationary sources with NO_X and SO_X emissions (generally greater than four tons per year) will receive an initial annual emissions cap or allocation. The annual emissions allocation for each source will be reduced annually, based on a complex formula. It is believed that under this market approach, emission reductions will be achieved by applying emission controls, modernization or replacement of existing sources, processing improvements, activity cutbacks and shutdowns, or through emission trading with other sources which have excess emission allocations.

◩ Biological resources regulations. Since its enactment, the federal Endangered Species Act of 1973 (PL 93-205) has gone from a primary focus on species loss due to trapping and hunting-related activities to more indirect impacts of habitat destruction. Congressional hearings on the Act's reauthorization, among other things, have focused on its economic implications.

Changes to the Act may require greater consideration of the economic costs and private-property implications related to efforts to protect wildlife and conserve species through habitat designations and mitigation requirements. The debates over the Act's reauthorization continue and it is unclear what final form it will take. In the near term, however, it is still likely the Endangered Species Act will continue to influence resource options, particularly hydroelectric, over the next decade.

As with the federal Act, California's Endangered Species Act is also receiving close scrutiny and various changes have been proposed. Currently, no changes have

been made. The state Act will undoubtedly continue to impose requirements regarding the protection of California's endangered species.

◩ Water quality regulation. The federal law regulating water quality, the Clean Water Act, was originally enacted in 1948, but was extensively amended, reorganized, and expanded in 1972 (PL 92-500). The law's primary objective is to control the release of pollutants into the nation's rivers, lakes and coastal waters. In Jefferson County PUD No.1 and the City of Tacoma v. Washington (1994) (114 S. Ct. 1900), the Supreme Court ruled that states may establish minimum streamflows for hydroelectric facilities under the Clean Water Act. Prior to this decision, FERC had relatively exclusive authority over hydroelectric projects under the Federal Power Act of 1920. This decision is expected to affect such things as the operation, mitigation and decommission requirements of hydroelectric projects facing licensing renewal.

SYSTEM CHANGES

◩ Needed facilities. Additional energy can be provided by building new facilities, improving generation efficiency of existing facilities, or using energy more efficiently. California's demand for electricity will continue to grow due to population increases, future economic development, and in response to environmental needs (e.g., electric vehicles to reduce air pollution).

A growing number of oil- and natural gas-fired generation units are approaching the end of their projected lifespans. California utilities own 11,155 MW of generation placed in service in 1963 or earlier. Of that amount, 2,591 MW were placed in service in 1953 or earlier. Aging facilities are likely to be closed, upgraded or replaced within the next several years.

In addition, some of the non-utility generators face contract specified reductions in the payments they receive from the utilities for the power they produce. These contracts were originally drafted to allow for significant recovery of capital costs within the first 10 years of operation. It is possible that this reduction in payments may result in some of these projects no longer being economically viable and ultimately closing or having to be sold.

Demand-side management programs or "end-use efficiency" programs (e.g., air conditioner cycling, advanced building energy efficiency, and more efficient lighting and appliance technologies) will meet a portion of the state's future energy needs. Some older facilities will be retrofitted or repowered to operate more efficiently. Yet, new generation facilities will be needed despite these efforts.

◩ Growing use of natural gas. The Energy Commission's forecasts suggest that natural gas will be plentiful and relatively inexpensive (when compared to oil and nuclear) for at least the foreseeable future. Current resource additions are dominated by natural gas-fired generation facilities. Several gas turbine manufacturers have been able to improve the efficiency with which energy from natural gas is converted to electricity while simultaneously reducing the air emissions from these turbines. As a result, there is increasing availability and cost-effectiveness of new gas turbines which produce less emissions, have lower water usage, are less expensive to build and operate, and use less natural gas per unit electricity generated than their predecessors.

◩ Technology developments and distributed energy systems. Increased competition in the electricity industry is expected to influence future generation technology advancement and the role current technologies will play. Equipment manufacturers may upgrade their existing products and devote research dollars to promising technologies in efforts to gain more market share. As environmental challenges increase, the market may seek the development of cost-effective new technologies which produce fewer emissions, use less water, and pose fewer risks to the public. They also produce new jobs for Californians. Further development of renewable resources (i.e., solar, wind, and biomass) may also occur. The use of "distributed energy systems"[3] (also called "distributed resources") may be expanded to displace separate generation, transmission and distribution projects. (See the Guest Author articles in Chapter 3 by Donald Aitken and Carl Weinberg for viewpoints on these topics).

◩ Electricity industry competition. Increased competition in the generation sector could also lead to an increase in the amount of electricity imported to California to meet this need. In this scenario, power producers with large out-of-state power plants may find it economical to build new transmission lines to get their power to California consumers. If greater competition in the electricity industry takes place, short-term costs and budgets may drive the industry's decisions.

ISSUES FACED BY LOCAL GOVERNMENTS

All energy facilities have potential social and environmental impacts. The extent to which they are significant impacts, and the extent to which they can be mitigated, depends on many factors including the technology type, the specific characteristics of the project and the site. Some of the major issues local governments and project developers may face are briefly discussed. Later chapters address these in greater detail.

- Land use compatibility. Conflicts may arise with new or existing land uses when identifying the most appropriate site for various new energy facilities. Even with the re-use of existing industrial sites, concerns may arise regarding the impacts of continued industrial activities on surrounding mixed uses.

- Public concern. Community residents may take issue with the impacts or perceived impacts (e.g., environmental justice, potential health effects, loss of biological resources and others discussed in Chapter 5) of various projects.

- Efficient use of natural resources. Requirements of power plants (e.g., substantial amounts of water for cooling for thermal facilities) and the future consequences of fuel choices (e.g., additional infrastructure for natural gas transmission and delivery) may have direct and indirect impacts on communities.

- Management of potential energy supply sources. Particularly as it pertains to some "renewable" resources (e.g., geothermal and biomass), the long-term sustainability of certain projects may be an issue.

- Air quality. The difficulty and expense associated with obtaining offsets which meet California's ambient air quality standards may increase as regulations become tighter in non-attainment areas of the state. Also, depending on local air quality conditions, offsets may or may not be available to fully mitigate the impacts associated with the facility.

This list is in no way complete, and the issues your community faces may be quite different. The Guide explores these and other issues in more detail in terms of the opportunities and challenges that may be created for you. Some of the major opportunities and challenges include: planning for energy facilities in your community; establishing policies that balance a variety of issues and needs; developing and implementing effective permitting and monitoring processes; dealing with specific permitting issues; and taking effective action to influence other agencies' permitting activities.

PLANNING CHALLENGES AND OPPORTUNITIES

- Balancing the state's needs with local needs. Local governments are charged with protecting their interests when energy projects with statewide significance (i.e., large generation facilities, pipelines and transmission lines) are proposed within their jurisdictions. Local governments have the opportunity to follow and, where possible, get involved in the energy resource planning processes of municipal and investor owned utilities, the Energy Commission and the CPUC. By doing so, the local agencies will be informed about many of the energy resource developments expected to occur in the future and their associated issues.

- Staying current on major energy issues and technologies. Local officials and decision makers are challenged with keeping current on major energy issues and new technology developments and determining the extent to which these changes affect their community. For example, changes in air quality regulation may affect existing facilities as well as future energy developments. New, small-scale distributed energy technologies could affect the number and types of generating facilities local governments will permit. Local officials and decision makers can determine the effects of these developments and various changes on their community through the use of geographic information systems (GIS) and other sophisticated computer systems. GIS systems can map resource and facility locations and overlay them with, for example, land use plans, community growth areas, and areas of environmental constraints.

REGIONAL CONSENSUS

"By building regional consensus prior to state-level deliberations, the region will be able to exert greater influence at the state level, and obtain quicker decisions that are ultimately more responsive to regional needs and preferences. More responsive state policy should arguably improve San Diego's economic prospects."

San Diego Regional Energy Plan, adopted December 1994.

◩ Ensuring that overall community goals and needs are addressed in local land use plans. Successful community developments of all kinds require adequate infrastructure and services. The opportunity exists at the planning stage to consider the energy requirements (including associated infrastructure) created by various types of development whether industrial, commercial or residential. Working with utilities or other energy service providers at the planning stage to evaluate development-related energy needs and appropriate alternatives can work to minimize difficulties in providing the required services. Successful community planning is thus associated with informed energy planning, development, and resource management efforts. The efforts coordinated with other agencies such as air pollution control districts, regional water quality control boards and state regulatory agencies can avoid conflicting policies and regulations, local opposition, and can reduce subsequent permitting costs.

Communities can prepare for energy projects that will likely come to them by ensuring their planning documents and policies reflect their development objectives. These activities will also help energy facility developers to plan ‘do-able’ projects. One method to accomplish this is to identify suitable sites for such things as power plants, pipelines or transmission line corridors. Also, plans can prevent conflicts between new development and existing energy facilities that have the potential for expansion by ensuring that incompatible uses do not encroach on the existing use.

Energy facilities offer an opportunity to address multiple needs of a community which can be encouraged through local policies and planning efforts. For example, it is possible to use energy facilities for “win-win” situations which can be a part of a community’s overall planning process. Facilities that use biomass can offer a viable alternative to landfill disposal. Also, policies can express a community’s preferences for alternatives such as the application of distributed energy systems in remote or otherwise constrained areas.

◩ Seeking public involvement and acceptance. Getting the public involved in the local planning process early is an important tool for identifying and addressing potential conflicts that may arise when specific energy projects are proposed. By obtaining public input at the planning stage, local officials can identify the types and locations of energy projects they want to encourage and discourage in their community. Working with the utilities or energy facility developers, officials can educate the community on the merits of certain types of energy development to address the needs of the community. Issues and solutions identified in the planning stage can be incorporated into the permitting process to make it more effective and efficient.

PERMITTING PROCESS CHALLENGES AND OPPORTUNITIES

◩ Developing effective permitting processes for future energy facility types. Regulations that clearly specify what is expected of development under a local government’s jurisdiction can help prevent delays and minimize costs for both communities and developers.

◩ Tapping into the expertise of others. To improve the consistency by which CEQA is applied from project to project, local officials have the opportunity of increasing coordination with other entities which may have more knowledge and experience with various types of energy projects.

For example, local governments can take advantage of assistance programs offered by federal and state agencies when developing and enforcing mitigation strategies throughout the permitting, construction, operation, and eventual decommissioning of energy facilities.

◩ Working with project proponents early in the permitting process. Local governments can inform project proponents of the community’s preferences and concerns (i.e., fears of impacts on health or property) early. Local officials can become educated about the technology proposed, clarify their permitting process, and explain the community’s economic situation. Developers will need expeditious permitting in order to meet market driven needs. Local governments can let project proponents know how previous developers have fared with projects of similar types in their jurisdiction, particularly with respect to environmental mitigation costs and measures.

- Seeking early public involvement and understanding acceptance. As in planning, early public involvement in the permitting process is very important. Early understanding of public concerns and recognition of their suggestions allows project developers the opportunity to make appropriate modifications to avoid impacts or conflicts.

- Participating in municipal, state, and federal energy facility permitting processes. Local authority over certain energy facilities is preempted by state and federal laws. Understanding the process of the permitting lead agency and getting involved as early as possible allows the best use of local resources by directing them where they can have the most influence. Local policies, ordinances and standards regarding energy facilities, which reflect a community's interests and needs, will strengthen the position of the local agency when participating in other agencies' permitting processes.

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Endnotes:

1 "Wholesale wheeling" is a procedure in which a transmission system owner provides transmission service to a third-party electricity generator for purposes of delivering power to a wholesale buyer. NEPAct did not give FERC the authority to mandate retail wheeling (a procedure in which a control area operator provides transmission and distribution services to allow electricity transactions to occur between a third-party supplier and one or more retail electricity users within that control area).

2 The Western Regional Transmission Association representing utilities from throughout the western states received final certification as a regional transmission group from FERC on May 17, 1995.

3 Distributed energy systems ("distributed resources") are small electric generation and storage, demand-side management techniques, located in the distribution system which serve local areas only. Such devices include photovoltaics, fuel cells, small gas-fired generation and cogeneration systems, small-scale wind turbine development, and small-scale batteries. They do not interconnect with the high-voltage transmission system, but rather are strategically targeted for areas of the distribution system where they can contribute to meeting local demand peaks, or parts of the system which might otherwise have to undergo upgrading due to increasing load. For further information, see Distributed Energy Systems in the Glossary (Appendix G) and the relevant technologies in Appendix B.

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THE RISE OF THE CARDIFF GIANT: ELECTRICITY MARKET RESTRUCTURING & THE POLICE POWERS

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.

For the last year and a half, considerable attention has been focused on "restructuring" or "deregulating" the electricity industry in California. One important impetus for deregulation has been the high rates paid for electricity by Californians, and the assumption that through greater market competition these rates would be lowered.

The debate over restructuring has turned on how it should be accomplished. Questions in this debate include: what to do about utility "stranded investment"; what to do about environmentally beneficial programs such as the promotion of conservation and renewable energy; what to do about potentially vulnerable residential customers, local governments, and others who may have less market power than large industrial users; what role a "power pool" would play and who would control the pool; how restructuring would be phased in, and so forth.

Less attention has been paid to the governance or police power implications of so-called "deregulation."

The assumption seems to have been that in "letting the market decide," government environmental as well as health and safety regulation will be simplified per se. Such an assumption, however, betrays a lack of appreciation of history.

> *"We need to ask if and how environmental, health and safety, and other public interest regulatory functions would be performed in a restructured industry."*

In the mid 1970s, when California's electricity landscape was dominated by large-scale oil and nuclear plants, with dozens of additional nuclear plants and large-scale coal plants on the utility drawing boards, California adopted the Warren-Alquist Act creating the California Energy Commission. The Commission was given the environmental and natural resources policy responsibilities to adopt independent forecasts of electricity demand and to determine the number and mix of power plants which were needed to meet that demand. The immediate result was a scaling back of the demand levels that the utilities had forecast, and the replacement of utility-asserted "low cost" proposals for large-scale central power plants with a then revolutionary proposal for a diverse mix of conservation and alternative energy resources, principally co-generation, geothermal and renewable energy sources.

The Energy Commission's adoption of a relatively environmentally benign independent forecast and "demand conformance" policy brought about an alternative energy future that was clearly preferable— from both environmental and economic perspectives— to the energy future California faced before their institution. We need to ask if and how environmental, health and safety, and other public interest regulatory functions would be performed in a restructured industry. If they are not performed, what consequences might we— and especially local government— expect? In particular, would the government approval requirements or power plants be simplified under restructuring, or would they in fact become more complex?

To answer these questions, it is important to note the California Environmental Quality Act (CEQA) requirements for siting power plants. The Energy Commission's siting procedures under its enabling legislation have been certified by the California Resources Agency Secretary as the equivalent of CEQA, so that a separate Environmental Impact Report (EIR) is not prepared and reviewed. Under the Energy Commission siting procedures, proposals receive thorough environmental scrutiny and individual power plants are also evaluated against the independent forecasts and need assessments representing far ranging programmatic EIR equivalents.

Thus, the Energy Commission's forward planning makes it possible to analyze the implications of the "no project" alternative, as well as nongeneration and technology alternatives in a way that would be quite difficult, if not impossible, absent the statewide and regional demand forecasts and need assessment determinations which the Energy Commission currently provides .

Assuming that "restructuring" would not abolish CEQA, and assuming that it truly is a market rather than a utility refinancing structure, would a city or county be the CEQA lead agency for power plant siting in a restructured electricity industry? If so, on what basis would the "no project" and other macro alternative analysis be performed? Would it be sufficient to deem all new power plants "needed" so long as some market player is willing to bear the financial risk of developing the facility? If so, would a potential proliferation of power plants reawaken environmental and public interest groups opposition such as that in the early 1970s? Would policy and ideological opponents of proposed power plants argue that "if everything is needed, nothing is needed"?

And if not enough power plants were built to meet the demand for electricity, how would the market attend to the need of all customers for reliable electric service at reasonable costs? These questions suggest that, to the extent forward planning is "politically incorrect," and eliminated or reduced by political fiat, more than likely conventional CEQA litigation in the exercise of the police power will expand proportionally.

[Note to reader: The California legislature recently passed a bill (AB1890) about electric industry restructuring. However, this legislation did not change or address CEQA implementation.]

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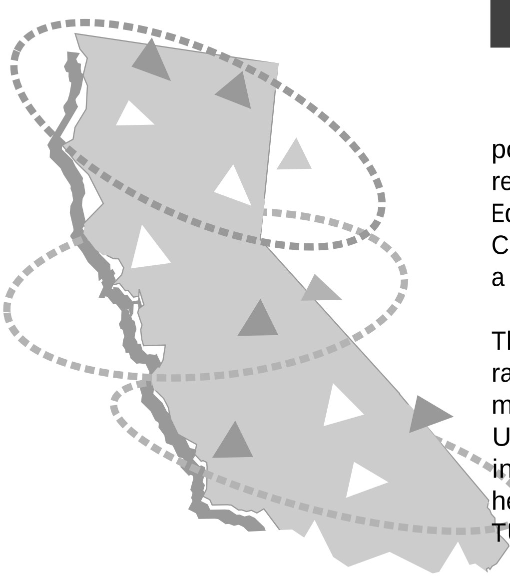
MUNICIPATLIZATION ISSUES

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.

The future for public power in California looks generally bright because of its natural advantage of lower cost as a nonprofit institution. In an era of increasing competitiveness in the electric service industry, however, low cost alone will not be enough to assure the future. Communities have formed their own utilities for a variety of reasons including lower rates, local control and closeness to customers. A key to the future success of municipal utilities will be quality service; price alone won't be sufficient.

Since 1980, 56 municipal electric utilities have been sold and 31 have been formed in the U.S. Three of California's 30 consumer-owned electric utilities have been formed since 1980. None has been sold.



The quest for relief from the high rates of California's investor-owned utilities (IOUs) has spurred municipalization drives in several California cities from Palm Springs to San Francisco. An effort is under way to form a consortium of 15 cities in the Los Angeles Basin to buy power for their residents and replace Southern California Edison as the supplier. The proposed-joint powers agency led by Culver City represents about 9 percent of Edison's customers. And Calaveras County is exploring the creation of a municipal utility district.

"A key to the future success of municipal utilities will be quality service; price alone won't be sufficient."

This drive to protect the residential rate-payer was behind the "community access" proposal of Toward Utility Rate Normalization (TURN) in the Public Utilities Commission's hearings on industry restructuring. TURN's proposal would authorize cities, counties or other local entities to establish consumer-owned utilities to distribute power purchased from other suppliers without taking over private utility distribution systems.

Potential low rates are the positive side of municipalization. But the cost of acquiring the distribution system needed to serve the municipal customers can be high. The value will almost always be disputed by the targeted IOU and the magnitude of dispute may be in the range of 3 to 1. The cost of severance, including reconfiguration of the system to continue to serve their remaining customers is a contentious issue and a potential major expense.

The cost ledger also must consider current interest rates, estimated legal costs, the time required between start and finish of the acquisition, and availability and cost of power resources. Municipalization entails initial financial risk associated with the cost of feasibility studies, legal costs and the possibility of higher than anticipated costs of acquisition and operation. Most of the initial costs cannot be recovered if for any reason the acquisition does not move forward.

There is also a large political risk and cost. The process of municipalization is divisive. The owning utility rarely wants to sell its business and typically will put tremendous effort into stopping the process, including media campaigns, community and political action. IOUs can spend vast sums opposing the ballot proposition necessary for acquisition. Public agencies by law cannot spend funds supporting ballot propositions.

Finally, there is the issue of industry restructuring. The electric utility industry is currently experiencing an upheaval similar to the breakup of AT&T and the resulting proliferation of long distance phone companies.

Even if local governments enter only the distribution sector of the industry, they need to understand that the business will be more competitive. Customers will have better price information and will be able to pressure local officials to provide competitive distribution rates. Large customers are also pressuring state officials to allow them to switch back and forth between suppliers. If they are successful, such actions could impact the ratepayers.

The changing industry has not diminished the attractiveness of municipal utilities. Indeed, a recent study by the American Public Power Association reported residential rates of publicly owned utilities to be 33 per cent lower than investor-owned utilities nationally.

The road to municipalization is long and filled with peril. The most important consideration for any community pondering municipalization is political. Communities need the support of local politicians, community business groups, local media and most importantly, the local public. Next, a sound financial analysis needs to be done, taking local conditions into account. If those two elements are positive, then municipalization can be a viable tool for communities wishing to deal with the impending electric utility changes. Understanding the factors involved is the vital first step.

Municipalities will need to decide which business they want to be in. Restructuring is already resulting in the creation of a separate and competitive generation industry. This is likely to be the most risky of the restructured utility sectors and is likely to be unregulated. On the other hand, the distribution sector of the business probably will continue to be regulated either by local elected boards or an appointed state agency and thus less risky. Transmission access has been assured by enactment of the Energy Policy Act of 1992. Thus, municipals can buy power in the competitive generation market without taking ownership risks in generation.

NOTES NOTES NOTES

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PLANNING FOR ENERGY FACILITY DEVELOPMENT

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CHAPTER 3

ENERGY AWARE
PLANNING GUIDE: *ENERGY FACILITIES*

CHAPTER 3: PLANNING FOR ENERGY FACILITY DEVELOPMENT

INTRODUCTION

This chapter contains information and ideas for local planning related to energy facilities, as well as the legal authority for doing this planning. The role of local government in this type of planning is complex and not always easily discernible. The value of planning may be questioned in situations when the local government is not the permitting authority. This chapter and those which follow will show that local governments do have an important role and that this role may increase as the electricity industry proceeds through the ongoing restructuring process.

In the restructured environment the electric utilities will be less involved in generating power. In addition, an increasing use of small generation units located within urban areas will necessitate increased local agency planning and permitting activities in consultation with energy service providers.

Although there may be a growing awareness of the importance of electricity in our society, local decision makers and planners are often confronted with public concerns about these facilities.

Important community issues that may be related to energy facilities include public health and safety, air quality, water supplies and quality, aesthetics, sensitive species habitat, and local economic health. Energy facility planning is thus key to a community's future and presents both challenges and opportunities for local governments.

This chapter makes linkages between planning for energy facilities and important issues being addressed by communities and the permitting process. The benefits of such planning relate to all communities providing for growth and development.

Advance guidance to energy facility developers is an important benefit discussed, as well as relationship-building with the public, other agencies, and utilities. The energy facilities planning process is described, including ideas for the information base needed and for doing location suitability analyses. The chapter provides numerous examples of communities addressing their planning challenges in order to benefit them.

GUEST AUTHOR ARTICLES

Guest Author articles are located at the end of this chapter. These articles contain opinions of the authors and do not necessarily reflect the views of the California Energy Commission or its staff.

Energy Facility Siting and Recognizing Local Opportunities by Bill Center, former supervisor, El Dorado County.

Permitting Energy Facilities: Issues Related to Local Agencies by Donald W. Aitken, Senior Scientist, Union of Concerned Scientists.

Emerging Energy Technologies by Carl J. Weinberg, Weinberg Associates and former Executive Director for Research and Development, PG&E.

THE BENEFITS OF ENERGY-AWARE FACILITIES PLANNING

Energy facilities are indispensable pieces of a community's infrastructure. The energy they produce and distribute makes homes comfortable, moves people and goods, operates the machinery of industry, and powers other infrastructure that underpin communities. The growing importance of electricity in an increasingly technological society becomes especially apparent during power outages.

The availability, reliability, and price of energy in a locality often affect plans for local development, especially commercial and industrial development. Just as local planners and economists may include the price and availability of such infrastructure as water and roads, energy information is often utilized in projecting local growth.

It is also important for communities to consider in their plans the effect of local development on energy infrastructure and the price and availability of energy in their communities. This can best be done in consultation with the local utility or other energy providers.

An informed community that is aware of the interrelationships among land use, environmental sensitivities, and infrastructure needs is better prepared to discuss new community development and associated energy needs with the entities involved in these developments. (Please also refer to the Guest Author article by Thomas Sparks in Chapter 4.)

Also, energy choices that a community makes today will have significant effects on tomorrow's economy, environment, and quality of life. Therefore, communities that plan for energy facilities will be better equipped to obtain reliable, affordable, and environmentally-sound energy supplies needed to accommodate community growth and redevelopment.

In addition, energy facility planning can affect the permitting process in two ways:

- Improves local permitting processes and their relationship to key community issues
- Helps influence permit decisions made by non-local agencies and utilities by demonstrating strong local preferences

With energy facilities already integrated into community plans, subsequent permitting decisions will be better-informed, be processed more expediently, and have fewer costs and less controversy for all stakeholders. This is no different than planning commonly done for other key facilities such as schools, parks, water and wastewater systems.

- Provides advance guidance to energy facility developers on desirable and undesirable project types and locations
- Avoids or minimizes land use conflicts between energy facilities and what can be incompatible uses such as residences, schools, and parks
- Avoids or minimizes conflicts with environmental and economic resources such as wildlife habitat and scenic qualities that support tourism and recreation
- Creates jobs from local energy resource and facility development
- Increases public familiarity with energy facilities and their critical role in community livability and economic competitiveness
- Builds a relationship among stakeholders, including developers, utilities, government agencies, and local interest groups, that can facilitate future siting and permitting of energy facilities

These benefits led the San Diego Association of Governments to prepare the regional energy plan outlined in the insert on the next page entitled *SANDAG's Use of Regional Cooperation and Resource Flexibility.* The preferences for certain types of energy facilities and resources expressed in the San Diego plan are now helping communities and facility developers in that region plan more confidently and with less controversy for needed energy supplies. This plan also illustrates the practical integration of the demand and supply sides of energy planning.

PLANNING FOR LOCAL GOVERNMENT PERMITTING ACTIVITIES

Local governments are most likely to be the permitting authority for generators under 50 MW and for any non-thermal independent generators, except for facilities such as dams, which are under federal jurisdiction.

As the electricity industry enters a restructuring process, the electric utilities will likely be less involved in generating power. This role will likely be picked up by independent generators with units of varying sizes including the distributed scale (roughly 5 kW to 25 MW). The developers of the distributed generation units will be seeking local permits which underscores the need for local planning and policies for energy facilities. (See Carl Weinberg's and Donald Aitken's Guest Author articles about meeting generation needs close to the consumer.)

THE LEGAL AUTHORITY FOR LOCAL ENERGY FACILITIES PLANNING

In contrast to *permitting*, where local governments often have limited authority, local *planning* for energy facilities is fully authorized under California's land-use planning statutes. This can be planning that guides subsequent local permitting where a community has lead siting authority or planning in an advisory manner as input into municipal, state or federal permitting processes.

The legal authority to plan locally for energy facilities is found in California statutes relating to general plans, area and community plans and specific plans.

SANDAG's USE OF REGIONAL COOPERATION AND RESOURCE FLEXIBILITY

The scale of the energy industry often means that more than one community is affected by supplier decisions about new resources. The San Diego Association of Governments (SANDAG), composed of 18 municipalities and 1 county, took the opportunity in their Regional Energy Plan to articulate a common statement of preferred future resources for all communities in the region. As shown in the accompanying table, these local governments and other stakeholders prioritized a comprehensive set of supply preferences that provides voluntary guidance for public and private decision makers. The intent is to maintain a flexible and diverse "portfolio" of resource options that can be known as desirable for implementation (subject to standard project-specific detailed evaluation). San Diego local governments estimate that use of the portfolio's resources to the year 2010 will save the region nearly $1.5 billion in energy costs; eliminate over 300,000 tons of air pollutants; and create over 5,000 new jobs. A copy of the Regional Energy Plan is available from SANDAG's Public information office, (619) 595-5347.

REGIONAL RESOURCE PORTFOLIO

End-Use Sector	Energy Resource Type Sector	Preferred Resources (in descending order of preference within ea. type)
Transportation	Fuels/Technologies	Electric (mini/special purpose) Natural gas Vehicle fuel efficiency improvements Methanol (M85) Hydrogen (R&D) Ethanol Propane
	Demand Management	Commute travel reduction Goods movement improvements College travel reduction Non-commute travel reduction
	Capacity Expansion	Bicycle facilities Pedestrian facilities Bus service Rail service Vanpooling Park/ride facilities High-occupancy vehicle lanes
	System Management	Improved traffic flow
	Land-Use Coordination	Mix/density intensification Locational efficiency Parking management Efficient site design
Residential, Commercial, Industrial, and Public Facilities	Demand-Side Management	Lighting Appliances/equipment/motors Water heating Pools/spas Space conditioning/ventilation Load management
	Direct Application Renewables	Solar Biomass Geothermal Ocean (R&D)
	Land-Use Coordination	Mix/density intensification Locational efficiency Efficient site design
	Electric Generation Fuels & Resources (regardless of location)	Wind Solar photovoltaic Geothermal Natural gas Biomass Hydroelectric Solar thermal Ocean (R&D)
	Electric System Efficiencies & Generation Configurations	Transmission & distrib. loss reduction Small in-region distributed plants Repower existing large in-region plants Large out-of-region purchases Large in-region central plants
	Direct Combustion Thermal Fuels	Natural gas Propane
	Transmission Capacities	Natural gas Electricity

General Plans.

• "The general plan shall include a land use element which designates the proposed general distribution and general location and extent of ... public and private uses of land." Government Code Section 65302(a).

• "The general plan may include any ... elements or address any ... subjects which, in the judgement of the legislative body, relate to the physical development of the county or city." Government Code Section 65303.

Additionally, Government Code Section 65300 requires that every jurisdiction adopt a "comprehensive general plan." A truly comprehensive general plan will cover all locally-relevant physical, social, and economic issues. The Governor's Office of Planning and Research guidelines for general plans advise that such issues include " ... the general locations, appropriate mixtures, timing, and extent of land-uses and *supporting infrastructure.*" (emphasis added)

At present, about 45 California cities and counties have used this authority to fashion general plan energy elements. The insert on the next page entitled *Cities & Counties with Energy Plans* lists these and other jurisdictions where local energy plans are in place; and on page 3.6, the insert entitled *General Plan Elements Affecting Energy Facilities* illustrates the range of general plan topics related to various types of energy facilities.

Area and community plans. Area and community plans address a particular region or community within a planning jurisdiction. They are legally part of the general plan, and serve to refine general plan policies as they apply to a smaller area. Since they are legally part of the general plan, they can address energy facilities under the same statutory authority cited above.

Specific plans. Specific plans, which are separate and legally distinct from general plans, provide criteria and standards for specific development projects or areas. In this instance, the enabling statute, Government Code Section 65451 (a), explicitly cites "energy facilities" as a required planning topic as follows:

> *"Public involvement, community preferences and agency coordination occur throughout the process. The energy facility planning process illustrates the importance of developing working relationships among all the stakeholders."*

"A specific plan shall include a text and a diagram or diagrams which specify all of the following in detail:

1) The distribution, location, and extent of the uses of land, including open space, within the area covered by the plan.

2) The proposed distribution, location, and extent and intensity of major components of public and private transportation, sewage, water, drainage, solid waste disposal, *energy,* and other essential facilities proposed to be located within the area covered by the plan and needed to support the land uses described in the plan. [emphasis added]

3) Standards and criteria by which development will proceed, and standards for the conservation, development, and utilization of natural resources, where applicable.

4) A program of implementation measures including regulations, programs, public works projects, and financing measures necessary to carry out paragraphs (1), (2), and (3)."

THE ROLE OF LOCAL PLANS IN STATE AND FEDERAL PROCESSES

In addition to the legal authority for communities to conduct facility planning, the resulting local plans also have worthwhile roles in state and federal planning and permitting processes. State and federal agencies with energy facility responsibilities encourage local planning as a means of expressing local preferences, reducing jurisdictional conflicts, and expediting the timely and orderly development of energy facilities when they are ultimately needed.

Traditionally, California's investor-owned and municipal electric utilities (munis) have planned for new facilities in their service areas. It is therefore important that utilities and communities consult on planned facility developments so that the permitting process can be efficient and reflect local preferences as presented in local land use plans and local ordinances as much as possible.

State law provides that munis provide their own permitting. The California Public Utilities Commission (CPUC) permits energy facilities of investor owned utilities. The Energy Commission permits thermal power plants of 50 MW or more. The federal government is involved for hydroelectric facilities and facilities on federal land. (More information on the determination of lead agencies is in Chapter 4.)

In the above cases local government has had an advisory role regarding local policies and preferences for the location and type of facilities. Although advisory, local policies can be informative and helpful. The Energy Commission considers them important, with the staff carefully assessing each proposal for a new facility for compliance with local laws, ordinances, regulations and standards. Regulations require that this information be reported and considered at Commission hearings on the facility application.

When planning for or considering proposals for linear facilities such as transmission lines, it is extremely helpful to have some written policies discussing the nature and location of the resources such as wetland habitat areas that the city or county considers valuable. Another example is that many counties have local ordinances requiring that linear facilities such as pipelines and transmission lines share common corridors through farmlands. As a result, when the Energy Commission or the CPUC

CITIES AND COUNTIES WITH ENERGY PLANS

California

- Alameda County
- Buena Park
- Chula Vista
- Costa Mesa
- Colusa County
- Emeryville
- Fairfield
- Gilroy
- Glenn County
- Grass Valley
- Imperial County
- Irvine
- Kern County
- Lake County
- Lassen County
- Livermore
- Los Angeles
- Los Angeles County
- Los Gatos
- Modoc County
- Mono County
- Novato
- Pasadena
- Poway
- Ridgecrest
- Roseville
- San Bernardino
- San Clemente
- San Diego
- San Diego County
- San Francisco City & County
- San Luis Obispo County
- Sacramento County
- Santa Barbara County
- Santa Maria
- Shasta
- Siskiyou County
- Solano
- Sonoma County
- Sunnyvale
- Trinity
- Turlock
- Yolo County

Energy plans are optional for California cities and counties. Current plans cover a broad range of conservation, renewable resource, and facility planning issues.

Oregon

Mandatory for all 264 cities and counties statewide since 1974. Required scope includes conservation, renewable resource protection, facility planning, and energy consequences of land use conflicts.

Washington

Mandatory for all cities and counties in high growth areas since 1993. Emphasis placed on energy, facility planning and utility infrastructure coordination.

Arizona

Optional for cities and counties. Phoenix, Tucson, and other communities have national model plans that stress renewable energy facility planning.

British Columbia

Optional for municipalities and regional districts. Vancouver recently added energy facilities to its comprehensive plan determinants. In November 1994, the B.C. Utilities Commission directed the provincial electric utility, BC Hydro, to include community land-use and urban design as determinants in electric planning.

certifies a project in those counties, the ordinance may be incorporated in the design of the facilities.

The U.S. Forest Service and Bureau of Land Management both require that their land management plans consider local land-use policies. For the U.S.F.S., refer to Title 36, Code of Federal Regulations, section 219.7. There are identical provisions applicable to the BLM. Consideration of local land-use plans is also a requirement during CEQA (Public Resources Code section 21104 and CEQA Guidelines section 15125) and NEPA reviews of energy facilities being permitted by state and federal agencies. (See Chapter 4 and Appendix C for further information.)

THE LOCAL ENERGY FACILITY PLANNING PROCESS

This section describes the process of energy facility planning, particularly from the viewpoint of local governments. Planning related to energy facilities requires little new information for local planners, but requires a new application of information typically used by local jurisdictions. Public and developer involvement, community preferences and agency coordination occur throughout the process. The energy facility planning process illustrates the importance of developing working relationships among all the stakeholders. (Please refer to the box on the next page, *PLACE³S: A Coordination Tool for Communities and Energy Utilities*.)

Planning topics are illustrated in the inserts on pages 3.8 and 3.9 entitled *General Planning Process for Energy Facilities* and *Framework for a Local Energy Facility Plan.* The information base needed during the process is discussed in the next section of this chapter.

The process of local energy facility planning can be broken down into the following major steps:

1) Identify and create a stakeholder advisory group. This will be an important mechanism for information gathering, issue analysis, and local policy formulation. Its members can include local electric and natural gas utilities, independent power producers, environmental interest

GENERAL PLAN ELEMENTS AFFECTING ENERGY FACILITIES

General Plan Elements	Affected Energy Resources and Facilities				
	Indigenous Resources	Power Plants	Electric Lines	Pipelines	
Mandatory					
Land Use	✓	✓	✓	✓	✓
Circulation	✓	✓	✓	✓	✓
Conservation	✓	✓	✓	✓	
Open Space	✓	✓	✓	✓	
Noise	✓	✓			✓
Safety	✓	✓	✓	✓	✓
Optional (examples)					
Air Quality	✓	✓			✓
Historic Preservation	✓	✓	✓	✓	✓
Infrastructure		✓	✓	✓	✓
Economic Development	✓	✓			
Parks and Recreation	✓	✓	✓	✓	
Community Design	✓	✓	✓		✓
Energy	✓	✓	✓	✓	✓

groups, local business interests, state and federal agencies with energy responsibilities, and representatives of the public at large.

2) Inventory current energy usage. An examination of current energy usage will be helpful in determining future energy needs for all sectors of the community including: residential, commercial, institutional, industrial, agriculture, transportation, and infrastructure. It will also be helpful to examine the environmental and economic impacts of local energy usage.

3) Determine future demands for energy supplies. The trends of energy usage and the amounts of electricity, natural gas, transportation fuels, and other supplies needed in the future will largely dictate energy facility needs. Consider influences such as population growth impacts, economic and environmental impacts and constraints, and community plans and preferences for addressing growth.

4) Determine the potential for meeting future energy demand. This determination includes the following interrelated steps:

• Assess how well existing energy facilities can meet future energy requirements; and then what new or modified facilities can be used or will be needed. For example, a community's existing electric system may be able to accommodate community growth for the next 10-15 years, but after that it may require new generation, transmission, and distribution capacity. In the transportation sector, communities' existing networks of gasoline stations will have to be supplemented by new alternative fueling stations to serve the emerging fleet of low and zero emission vehicles required by California air quality standards.

PLACE^{3}S: A COORDINATION TOOL FOR COMMUNITIES AND ENERGY UTILITIES

In the past, energy facility planning has been constrained because of uncertainties about future geographic location and nature of consumer demands in a jurisdiction. In many cases, energy utilities have had difficulties planning confidently for future facilities because of unknowns in community growth patterns and future land use designations. Since these growth patterns and land uses translate directly into consumer loads that must be met by energy facilities, creating linkages between these elements can help all stakeholders obtain more efficient and economical energy services.

PLACE^{3}S (Planning for Community Energy, Environmental, and Economic Sustainability) is a tool developed for the Energy Commission to accomplish such a linkage. Using computerized geographic information system (GIS) technology, PLACE^{3}S enables a local government to convert its growth management and land-use plans into geographic expressions of future energy demand. This is accomplished by:

1) Estimating energy requirements for a given use, including electricity, natural gas, and transportation fuels;

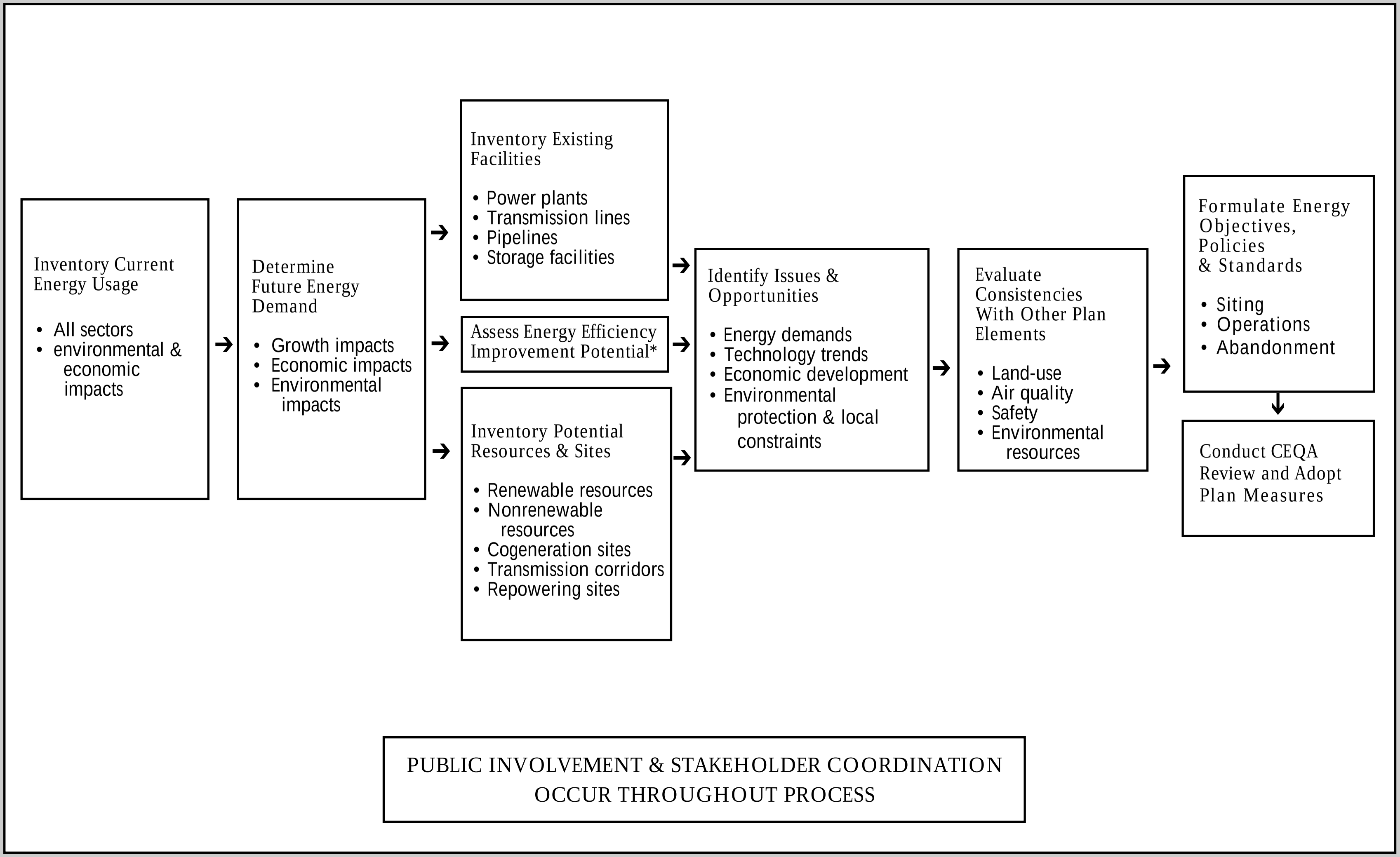
2) Linking these energy demand coefficients to the land uses contained in local plans; and

3) Using GIS to geographically display resulting demands.

This mapping can then be evaluated by energy utilities to determine if their facilities are properly located and sized to meet the displayed needs. In turn, utilities can respond to local governments with recommendations for modifying community plans in ways that may avoid or reduce the need for new energy facilities. For example, a community may be considering new growth in an area that does not have sufficient electrical infrastructure to accommodate projected land uses. By evaluating alternative land use arrangements with PLACE^{3}S, it may be possible for that growth to be wholly or partially redirected into an area with surplus electrical capacity, thereby avoiding or delaying the construction of new substations and distribution lines.

Additional information on PLACE^{3}S and its energy facility applications is available from: Nancy Hanson, California Energy Commission, (916) 654-3948.

GENERAL PLANNING PROCESS FOR ENERGY FACILITIES



* Refer to the first Energy-Aware Planning Guide. See Appendix H for order form.

FRAMEWORK FOR A LOCAL ENERGY FACILITY PLAN

Key Issue Questions	Stakeholders/Information Sources	Policy & Implementation Choices
What is the forecasted increase in energy demands from population growth, and have demand-side efficiency improvements in land use, transportation, and infrastructure already been accounted for?	Electric and natural gas utilities, Energy Commission, CPUC	See *Energy-Aware Planning Guide* (first volume) options such as mixed worksites and residences, compact and diverse housing, integrated street networks, and transit-oriented development.
What facilities currently deliver energy supplies into the community from the surrounding region? How diverse and reliable are they?	Utilities, independent power producers (IPP), Energy Commission, CPUC	Coordination mechanisms with other communities sharing the same regional supply networks, participation and advocacy in regional planning processes.
What energy facilities presently exist in the jurisdiction, and what are their capacities and condition? Any being abandoned or repowered?	Utilities, IPPs, Energy Commission, CPUC	Trade-offs between abandonment, repowering, and new facilities.
What new energy facilities will be required in the future to accommodate local growth? What are preferable fuels and technologies?	Local interest groups, utilities, IPPs, Energy Commission, CPUC	Advocacy of preferred fuels and technologies used by others, self-development of preferred facilities by local governments.
What locations in the jurisdiction are especially suitable or unsuitable for energy facilities? What are major siting issues?	Natural resources agencies, local interest groups, utilities, IPPs, Energy Commission, CPUC	Site-banking and protection of significant long-term energy production areas, designation of unsuitable energy facilities areas.
What local natural resources are attractive to energy developers, and how acceptable is their utilization?	Natural resources agencies including the State Lands Commission, local interest groups, utilities, IPPs, Energy Commission, CPUC	Sustainable resource management practices at sites deemed suitable for facilities.
How many local jobs are currently supported by energy facilities, and how many new jobs are possible in the future with new facilities?	Utilities, IPPs, economic development agencies	Incentives for facilities with positive local employment effects.
What legal authorities and regulations apply to energy facility development?	Energy Commission, CPUC, FERC, natural resource agencies	Coordination and mechanisms for efficient intergovernmental action.

• Assess efficiency improvement potentials. Community efficiency improvements can be considered as a means of meeting community energy needs and as an alternative under CEQA to needing new facilities. (Please see the box *Los Angeles County's Civic Center Cogeneration Plant, below,* and the box on page 1.2*, Start with Energy Efficiency*).

• Assess potential energy resources and sites. The local jurisdiction may want to consider in its general plan the development of local renewable and/or nonrenewable energy resources. Many California jurisdictions could develop, for example, potential for solar energy, use of landfill gas, and opportunities for cogeneration. Communities may want to consider possible sites for additional transmission corridors.

5) Determine community environmental and economic preferences for meeting future needs, considering the feasible facility options. For example, if new electric supplies are needed, a community can consider its preferences for repowering existing plants; developing renewable resources; cogeneration opportunities; building new, large central plants; or building new, smaller plants distributed closer to consumers, thereby avoiding or delaying electric power line expansions. Each of these options has different environmental and economic implications that need to be weighed by the locality in collaboration with utilities and other stakeholders.

6) Formulate and adopt policies and standards for siting, operating, and abandoning energy facilities expected in the jurisdiction. This can include clear designation of geographic areas suitable and unsuitable for energy facilities; and design and performance standards that compatibly integrate facilities with their surroundings. Geographic suitability surveys should be focused in particular on appropriate locations and zoning for electric power plants and transmission lines since these are often the most intrusive types of facilities to be developed in a community. The insert on the next page entitled *Colusa County Transmission Line Element* describes one county's approach to transmission line siting in its general plan.

Completing the energy facility planning process effectively requires a solid information base, thorough stakeholder involvement, and effective interagency coordination. Each of these is discussed below and in accompanying inserts, including other examples of local projects and sources of assistance.

THE INFORMATION BASE NEEDED FOR ENERGY FACILITIES PLANNING

To effectively conduct energy facility planning, communities must compile and maintain up-to-date information on relevant energy issues and trends affecting energy facility development. A solid information base is particularly important because of changing technology, market, and regulatory conditions in the energy industry; and local economic and environmental constraints. A thorough and well-organized information base, particularly if computerized, can help stretch limited staff resources, and facilitate planning and permitting coordination with all stakeholders.

To undertake energy facility planning, local jurisdictions should assemble the following types of descriptive and analytical information:

LOS ANGELES COUNTY'S CIVIC CENTER COGENERATION PLANT

The heating and cooling load of Los Angeles County's six million square feet of Civic Center buildings is supplied by a Civic Center Cogeneration plant. In 1982, faced with replacing aging boiler equipment, the County seized the opportunity to upgrade the energy efficiency of the plant by installing a 28 MW cogeneration system. The system was sized to meet current thermal requirements while being expandable to accommodate future facilities.

Most of the power generated is exported into the power transmission system of the Los Angeles City Department of Water and Power (DWP), a large municipal utility. A wheeling agreement with DWP is the vehicle by which the power is allocated to 106 electric meters in County facilities within the DWP service area. The County received offsetting electric credits based on DWP tariffs and transmission costs for these meters.
Contact: John Kallok, Los Angeles County, Energy Management Division, 550 S. Vermont Avenue, 11th Floor, Los Angeles, CA 90020, (213) 738-2179.

COLUSA COUNTY TRANSMISSION LINE ELEMENT

Colusa County is a northern California agricultural area facing significant land use changes, including growth that leads to new electric transmission lines. Some of these new lines are local, and others are occurring as a result of statewide growth and the consequent need for larger intrastate transmission capacity. Thus, energy facility planning is a tool for Colusa County to deal with both internal and external influences affecting its environment.

Long-range energy planning of this sort provides benefits to both local government and utilities. It can reduce political controversy when a specific transmission line is eventually proposed; improve land use and resource compatibility; avoid redundancy in siting new lines; and improve coordination between the public, the utilities, and community agency staff.

The Colusa County Transmission Line Element does not identify specific corridors where all new lines must be located. Instead the Element sets forth guiding principles for siting new lines and presents sensitivity maps which signify preferred locations. The real focus of the Element is mitigation or ways to reduce adverse impacts of transmission lines. Mitigation measures are presented in the form of policies for tower design, the alignment of lines across sensitive areas, construction practices, and maintenance and operating procedures among others. The Transmission Line Element has three guiding objectives:

- To assist public officials and staff In evaluating present and future proposals to construct or expand transmission lines in Colusa County
- To provide direction to utility companies and private enterprises that may propose transmission line alignments within Colusa County
- To inform the public about transmission line issues and create policy that expresses local priorities and reflects public sentiment

The purpose of the Element is not to obstruct transmission lines or bar them from Colusa County. The Element acknowledges that increased energy transmission through the county is inevitable due to its location between the energy-rich Pacific Northwest and Sierra Nevada and the energy consumers of coastal and Central California. Instead, the purpose of the Element is to minimize adverse impacts on Colusa County as statewide increases in energy demand are accommodated.

The Transmission Line Element consists of chapters that are organized as a framework for evaluating local siting issues. The first of these describes the operational components of transmission lines. The second describes the existing transmission line system in the county and evaluates the potential for new lines based on known proposals, energy forecasts, and local resources. Finally, environmental issues associated with transmission lines and the implications of these issues for Colusa County are discussed. Issues receiving emphasis are agriculture, aesthetics, health and safety, and fiscal and economic issues. Ultimately, the Transmission Line Element reduces these issues into goals, objectives, and policies for dealing with them in a coordinated manner within the county's overall general plan.

The Element provides a good example of obtaining public input regarding attitudes and issues of transmission line planning in rural areas. Land owners, as well as the General Plan Committee members, were queried to rate landscape suitability for new transmission lines. The property owners affected by existing transmission lines in the county were either surveyed by questionnaire or interviewed. The importance of specific agricultural as well as other issues regarding the siting of new lines was determined.

For additional information on Colusa County's energy facility planning, contact the Colusa County Department of Planning and Building, (916) 458-8877.

◩ Population growth trends and basic demographic information. Population growth and trends will be important in determining potential future energy facility-related needs including powerline corridors. Particularly for some jurisdictions, basic demographic data will be useful to prevent a disproportionate share of overall environmental impacts to any particular area or neighborhood. (Please see insert *Environmental Justice* on page 3.19.)

◩ Regional energy supply system characteristics. Communities are supplied with energy largely from regional systems that produce and distribute electricity, natural gas, and transportation fuels. The map on the next page of California's energy facilities illustrates the regional systems that serve localities. A first step in local planning is learning what these systems are, who owns them, and how they operate. Systems of interest will include:

1) Electric power plants with output that serves the region

2) Large electric transmission lines that move electricity from power plants to communities

3) Petroleum refineries that refine crude oil into petroleum products

4) Large pipelines that convey natural gas and petroleum products from production sites to communities

Because of the influence these systems have over local facilities, it is important to know if regional systems are operating satisfactorily; if there are plans to expand them and where; and the types of impacts that future regional changes may have in the local jurisdiction.

◩ Existing energy facilities in your jurisdiction. In addition to regional facilities, it is also important to know what types of facilities are present locally. The same type of data should be inventoried, particularly facilities that may be expanded, or in the case of some older power plants, repowered. Any pending proposals for new energy facility development should also be included. These data will indicate where the jurisdiction's energy services are adequate or constrained.

This information is particularly relevant to growth management coordination where a jurisdiction's land use planning could be designating growth in areas presently underserved by energy facilities, versus growth that could be targeted toward areas possessing sufficient energy infrastructure, such as electric distribution lines. The insert on page 3.7 entitled *PLACE³S: A Coordination Tool for Communities and Energy Utilities* describes one method for geographically linking local growth management with energy facility planning.

◩ Industry trends affecting new energy facility development. An understanding of industry trends provides insight into the types of new energy facilities likely to be built in the future. Current examples include the popularity of natural gas as an electric generation fuel, which is triggering natural gas pipeline expansions; and increasing competition among various power producers; which, in some cases, may continue a shift from the use of large, central power plants toward smaller, dispersed plants.

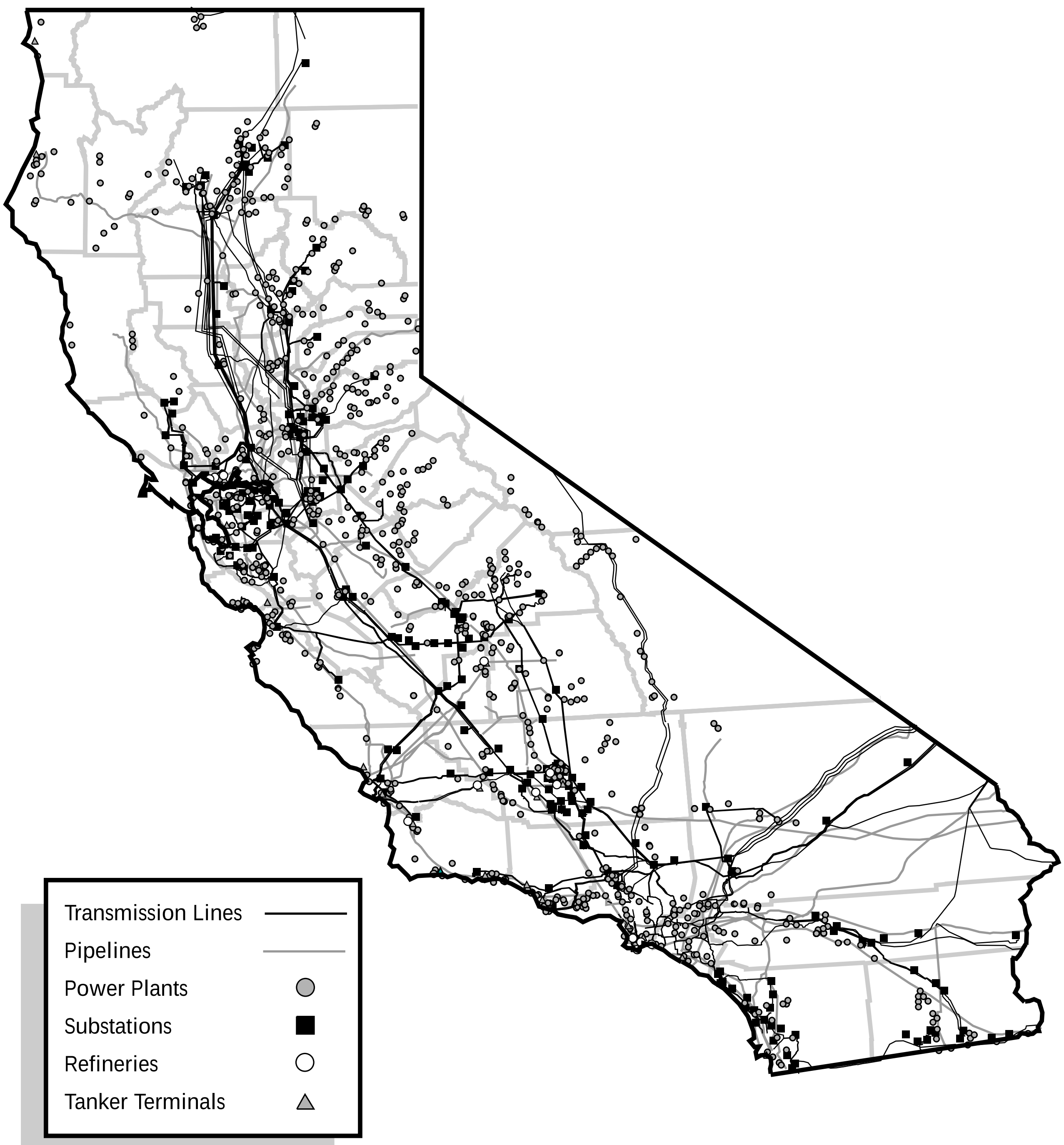
Industrial cogeneration also remains popular, where factories use their waste heat in electric turbines to generate power (or, conversely, electric generation facilities make their waste heat available to industrial or commercial processes). This suggests that communities would be wise to survey their industrial zones for cogeneration site potentials and acceptabilities. The box on page 3.10 entitled *Los Angeles County's Civic Center Cogeneration Plant* provides an example of replacing aging equipment by installing a more efficient cogeneration system and selling most of the generated power. (Please see the Guest Author articles at the end of this chapter regarding industry trends.)

◩ Technologies likely to be used in new energy facilities. An understanding of the technologies used in energy facilities is necessary to assess their probable operating characteristics and environmental impacts; and, in turn, the types of policies and standards that should be applied to them. Some facilities will operate very passively, such as buried natural gas pipelines, and therefore may require relatively limited attention. In contrast, an industrial cogeneration plant could include a variety of fuel-handling and pollutant control technologies that warrant consideration when formulating local siting standards.

◩ Indigenous natural energy resources that may be developed for use by energy facilities. Energy facilities are often developed in conjunction with local indigenous resources used to fuel the facilities. Renewables such as wind and solar resources are "fuels" that must be considered along with the electricity generation facilities that utilize them. Use of these resources may involve large land areas, raising

MAJOR ENERGY FACILITIES

WHICH TYPES ARE LOCATED IN YOUR COMMUNITY?



significant planning issues about compatible land uses and environmental impacts. The same is true for oil and natural gas fields that require collection and storage facilities. Examples of major energy resources in California that warrant consideration are shown in the map *Major Energy Resources,* on the next page.

If a jurisdiction has significant indigenous energy resources, advance planning allows communities to determine which sites should be protected for future energy production or reserved for a more important competing use. This type of planning can protect significant energy sites from conflicting uses and insure long-term energy availability and output. The insert on page 3.16 entitled *Resource Site Banking* describes the approach used in Oregon by cities and counties for their local energy resources.

◩ Environmental conditions and constraints. Energy facilities can have significant requirements for land area, water supplies, pollution control technologies, and hazardous materials handling. They can also have significant impacts on local aesthetics, noise levels, wildlife habitat, and other sensitive environmental resources. A thorough environmental database is essential for correctly gauging these potential impacts and formulating plans accordingly.

Chapter 5 reviews important issues bearing on energy facility permitting and development, and presents ideas for addressing them. Appendix B notes some of the permitting issues associated with specific types of energy facilities.

◩ Economic development opportunities. In addition to providing needed supplies, energy facilities also provide jobs and other economic benefits. (See the insert *Los Angeles County's Civic Center Cogeneration Plant* on page 3.10.) When establishing local policies and standards, it is important to recognize the job creation, goods and service purchases, and tax revenues that can result from energy facility development. For example, a jurisdiction whose goal is energy supply diversification could give preference to local renewable resource development for both its diversity benefits and the local employment created by renewable energy production. This employment can include resources production, such as geothermal steam supply jobs; power production, such as turbine operators at a wind farm; and maintenance jobs needed for supporting such facilities and operations. All of this energy facility employment, in turn, creates "multiplier" jobs that are spin-offs from direct energy jobs. (The Guest Author articles at the end of this chapter provide opinions on this topic.)

◩ Non-local regulatory authorities and standards. An understanding of permits and regulations that will be applied to facilities by regional, state, and federal agencies is important when determining appropriate local policies and standards. For example, hydroelectric power plants are already subject to extensive state and federal rules, whereas wind power facilities are not. Local planning should be structured consistent with other governmental authorities to avoid duplication or conflict, and should focus on topics of local concern not addressed by other agencies. Chapter 4 details the various permitting powers of state and federal agencies.

THE IMPORTANCE OF PLANNING GUIDANCE FOR FACILITY DEVELOPERS

One of the most important benefits of local planning is the guidance it provides to energy facility developers in advance of their specific project preparations. Local plans that contain policies and standards for evaluating and siting facilities help developers better understand community preferences and expectations. Facilities can be sited and designed to address guidelines from the outset, thereby avoiding or minimizing disputes and delays in providing needed energy supplies. Project-related costs are also reduced for all participants.

To be effective, local energy facility policies and standards should have the following characteristics:

1) Clearness and objectivity

2) Satisfactory protection of the environment

3) Practicality and cost-effectiveness for participants

4) Legally defensible and politically feasible and

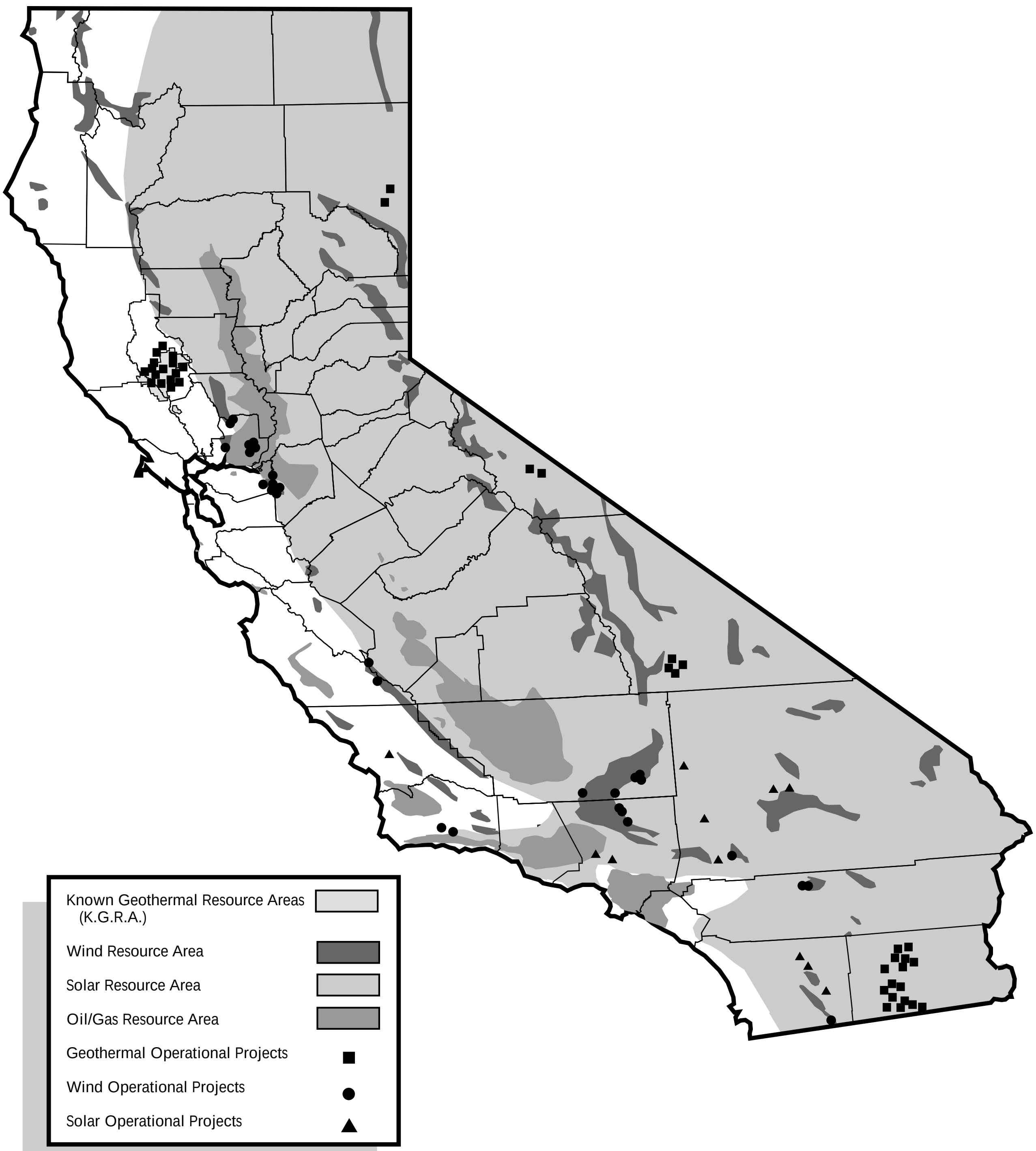
5) Implementable in a predictable and timely manner. (Please refer to Thomas Sparks' Guest Author article in Chapter 4.)

HOW TO DO LOCATION SUITABILITY ANALYSES

◩ Suitability surveys and geographic information systems. A valuable method for guiding facility development is using geographic surveys of a jurisdiction that designate suitable and unsuitable facility locations. Such surveys can alert developers to areas that have significant environmental constraints or conflicting land uses,

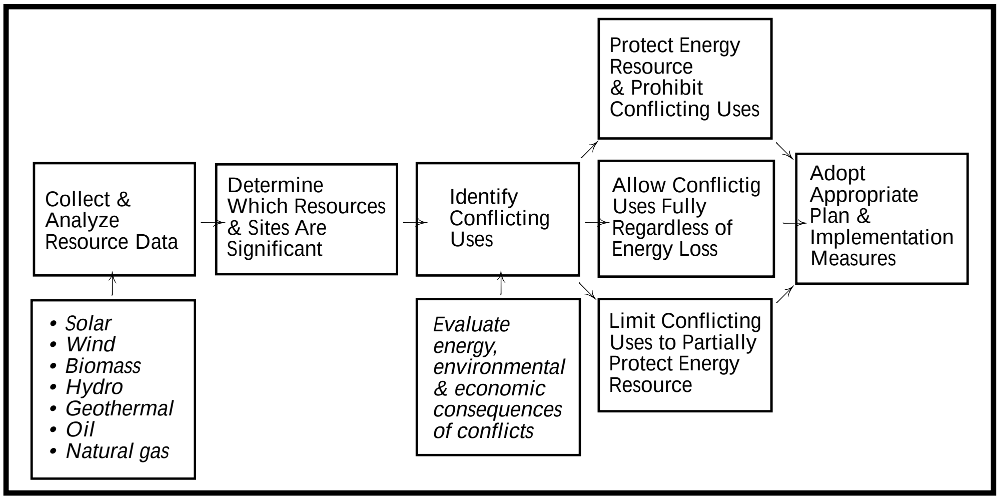
MAJOR ENERGY RESOURCES

WHICH ONES WARRANT PROTECTION IN YOUR COMMUNITY?



RESOURCE SITE BANKING

One of the most important benefits of local energy planning is the opportunity to identify and protect major energy resource sites, both renewable and nonrenewable. Under a 1974 state law, cities and counties in Oregon must address these indigenous energy resources in their comprehensive plans as shown in the diagram below. The objective is to identify important sites and to protect them as much as possible from incompatible uses that could reduce their energy value in the future.



The inventory process for energy resources begins with the collection of available data from as many sources as possible including experts in the field, local citizens and landowners. The local government then analyzes and refines the data and determines whether there is sufficient information on the location, quality, and quantity of each resource site to properly complete the process. Based on analysis of those data, the local government then determines which resource sites are significant and includes those sites on the final plan inventory.

The local government then identifies conflicts with inventoried energy resources. This is done primarily by examining the uses allowed in the zoning districts established by the jurisdiction. A conflicting use is one which, if allowed, could negatively affect a resource site. If there are no conflicting uses for an identified resource site, the jurisdiction must adopt policies and ordinance provisions, as appropriate, which ensure preservation of the energy resource. If conflicting uses are identified, the economic, social, environmental, and energy consequences of the conflicts must be determined. Both the impacts on the resource site and on the conflicting use must be considered in analyzing the consequences.

Based on the economic, social, environmental, and energy consequences of the conflict, a jurisdiction must develop a program to mitigate the conflict. A jurisdiction is expected to resolve conflicts with specific sites in any of the following three ways:

1) A jurisdiction may determine that the energy resources site is of such importance, relative to the conflicting uses and the consequences of the conflicts, that the energy resource should be protected and all conflicting uses prohibited.

2) A jurisdiction may determine that the conflicting use should be allowed fully, notwithstanding possible negative impacts on the energy resource.

3) A jurisdiction may determine that both the resource site and the conflicting use are important relative to each other, and that the consequences should be balanced so as to allow the conflicting use in a limited way that still protects the energy resource to some desired extent. To implement this decision, the jurisdiction must designate with certainty what uses and activities are allowed fully, what are not allowed at all and which uses are allowed conditionally.

Additional information on Oregon's statewide land use planning program is available from the Department of Land Conservation and Development, (503) 373-0050.

versus locations that are relatively compatible with energy facilities and their operations. This approach can apply to indigenous natural resource areas, transmission corridors, and power plant sites. The Colusa County Transmission Line Element (see box on page 3.11) provides a good example of the use of landowner questionnaires to determine suitable locations for transmission lines.

A powerful tool for conducting suitability surveys is a computerized geographic information system (GIS) that allows efficient comparison of numerous suitability criteria over large geographic areas. An example of a successful energy facility planning project using GIS is described for Siskiyou County in the insert entitled *Energy Facility Planning with a GIS* on the next page.

◩ Master Environmental Assessment (MEA). A Master Environmental Assessment is another tool that can be used by a jurisdiction to identify and organize environmental characteristics and constraints of an area. It can be used to influence the design and location of individual energy facility projects. It can provide information that can be used in initial studies to decide whether certain environmental effects are likely to occur and whether they will be significant. It can also provide a central source of current information for use in preparing individual Environmental Impact Reports (EIRs) and Negative Declarations. A MEA can assist in identifying long-range, area-wide, and cumulative impacts of individual projects.

◩ Program ElRs and Master ElRs
Other approaches to generalized suitability analysis include the preparation of program-level EIRs (PEIRs) or Master EIRs (MEIRs). These approaches are recognized under the California Environmental Quality Act (CEQA) as appropriate for evaluating the cumulative, growth-inducing, and irreversible significant effects of future energy facility development in a jurisdiction. Either of these approaches can be used to assess a series of smaller individual projects or acts that are to be carried out in phases. Neither PEIRS nor MEIRS will have much application to larger generation projects, with the exception of possible Known Geothermal Resource Area (KGRA) developments. They may have greater application to wind farm projects, small hydro, or certain kinds of transmission projects within the same local government jurisdiction.

PEIRS are applicable to “actions which can be characterized as one large project” that are either (1) geographically related, (2) logical parts of a chain of contemplated actions, or (3) similar actions subject to the same permitting authority with similar environmenttal effects and subject to the same kinds of mitigation. (Guidelines, section 15168 (a).) PEIRS require no subsequent environmental document if the agency finds that no new impacts will occur and no new mitigation is necessary for the subsequent activity.

In 1993, the California Legislature added the MEIR as a tool for implementing CEQA. MEIRs may be prepared for general plan energy elements; specific plans that include energy facilities; or a large energy project consisting of smaller individual facilities being phased in over time. A MEIR must present information about expected subsequent projects and their impacts, including general sizes, locations, intensities, and scheduling.

The lead agency and responsible agencies identified in the MEIR may use the MEIR to limit review of subsequent projects. In contrast to PEIRs, MEIRs always require an Initial Study to determine whether the subsequent project and any significant environmental effects were included in the MEIR. If the agency, however, finds the subsequent project will have no additional significant environmental effect and that no new mitigation measures or alternatives are required, it does not have to prepare a new environmental document.

In lieu of such a finding, the lead agency must prepare either a mitigated negative declaration or a “Focused EIR” for the subsequent project. A Focused EIR is another streamlining option that allows jurisdictions to analyze only those additional project-specific environmental effects, mitigations, or alternatives that were not addressed in a MEIR.

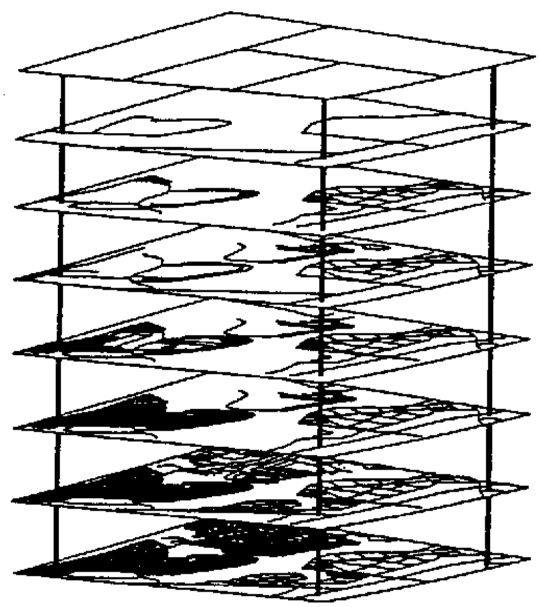
This approach was recently used by San Luis Obispo County when it prepared a Program EIR for its general plan Energy Element. As explained in the insert on page 3.20 entitled *Programming the Environmental Process,* San Luis Obispo County hopes to streamline future energy facility permitting by having already analyzed major county-wide environmental concerns. Any developer contemplating energy facility development in the county can look to the Program EIR and readily determine which parts of the county, and what environmental resources, are problematic for facility development.

HOW TO IMPROVE PUBLIC INVOLVEMENT IN FACILITY PLANNING

Building public acceptance of energy facilities is an important challenge for government at all levels. Although they are indispensable to communities, energy facilities are often locally unwanted because of legitimate citizen concerns over aesthetics, land use compatibilities, the public health and safety effects of facility operations, and environmental justice concerns. These public concerns make it increasingly difficult to install needed projects in a timely, efficient, and economical manner. (See the insert *Environmental Justice* on the next page.)

A major benefit of local planning is the opportunity it creates to reduce these barriers through public education and involvement in advance of actual facility permitting and development. If the public is involved in long-range planning that recognizes the necessity and benefits of reliable energy supplies, as well as local efforts to maximize the efficient use of energy, it will

ENERGY FACILITY PLANNING WITH A GIS



Sample GIS Database

Land ownership (private, state, federal)

Existing power plants (fuel type, capacity, age)

Electric transmission and gas pipeline corridors

Industrial areas with cogeneration potential

Renewable resource areas (hydro, wind, geothermal)

Nonrenewable resource areas (oil, natural gas)

Sensitive environmental areas (wildlife, noise, floodplains)

Community growth areas requiring new energy services

Many local jurisdictions are now using computerized geographic information systems (GIS) to compile and analyze natural resource and land use data. Energy facility planning is an ideal application for GIS in cases where linear facilities, such as transmission lines, cross extensive terrain with varying environmental sensitivities. Power plant siting can also be strengthened through suitability analyses that identify locations with the least amount of environmental disturbance. In 1993, Siskiyou County used its GIS to help prepare a general plan Energy Element that promotes renewable power generation and the use of existing electric transmission and gas pipeline corridors. The GIS was populated with an inventory of renewable energy sites that were geographically plotted against environmental sensitivities such as seismic hazard areas and critical wildlife habitat, to identify locations where energy facilities should be encouraged or discouraged. As the County's GIS database expands over time, these suitability analyses can become more comprehensive and detailed; and can be readily available for use in general plan updates.

For additional information on Siskiyou County's use of GIS for energy planning, contact the Siskiyou County Planning Department, (916) 842-8202.

ENVIRONMENTAL JUSTICE

Local governments should be aware of potential environmental justice issues in relation to the possible location of energy facilities and the process for permitting these facilities. Failure to consider the patterns of siting polluting or toxic facilities and the process used for obtaining public input in decision-making may result in inequities as well as long and expensive legal confrontations.

Some studies suggest that certain racial, cultural, and socio-economic groups bear a disproportionate share of our society's environmental burden, such as exposure to landfills, toxic dumps, freeways, and industrial facilities. Various groups have charged that corporations and government place polluting industry in minority or poorer neighborhoods because real estate is less costly and residents historically tend to be less out-spoken, vote less often and contribute less money to political campaigns. They also feel that low-income or minority groups are excluded from permit decisions, notices are not published in other languages despite large numbers of non-English speaking residents, and hearings are scheduled when residents cannot attend. Lawsuits have been filed based on these charges and environmental justice principles.*

Environmental justice, as defined by the U.S. Environmental Protection Agency, is the fair treatment of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. The two primary goals of environmental justice are:

1) Equal protection of the health, safety and environmental quality of all people, and
2) Equal access and participation of all people in the environmental decision-making process

On February 11, 1994, President Clinton signed an Executive Order on Environmental Justice. Its purpose is to protect Americans, particularly those who can least afford it, from pollution and to help provide safe, clean communities. It calls on federal agencies to prevent disproportionate environmental equities, collect and analyze information on environmental and human risk, and increase public participation in the decision-making process. Section 1-103 of the Order requires all federal agencies to develop an environmental justice strategy to identify and address disproportionately high and adverse health and environmental effects on minority and low-income populations of its programs. It specifically requires each agency's strategy to:

1) Promote enforcement of all health and environmental statutes;
2) Ensure greater public participation;
3) Improve research and data collection relating to health and environment; and
4) Identify differential patterns of natural resource consumption.

While the Order was directed to federal agencies, some groups contend that it also applies to any agency that receives federal funding.

Local governments can play a role in ensuring equal protection of all communities and equal access to the decision-making process. Some of the actions they may take include:

1) Hold public meetings or hearings on projects in the local community and at times that will allow all the public to attend.
2) Consider a full range of possible alternative sites, not just those evaluated by the project developer.
3) Establish a compliance monitoring program that ensures enforcement of permit conditions and provides a clear public complaint response and resolution process.
4) Thoroughly assess cumulative impacts of previous, present and likely future projects on all environmental concerns, particularly those related to public health.

* Cases in California include: Padres Hacia Una Vida Mejor v. County of Kern, California Superior Court, Fresno County, 1/13195. The same group filed an administrative complaint with the EPA in Padres Hacia Una Vida Mejor v. Laidlaw, Inc., U.S. EPA Docket #1R-95-R9, 1219195.

likely be more accepting of facilities when and where they are eventually needed. (See the box, *Winning Public Support...* on the next page.)

An effective public involvement program will have the following characteristics:

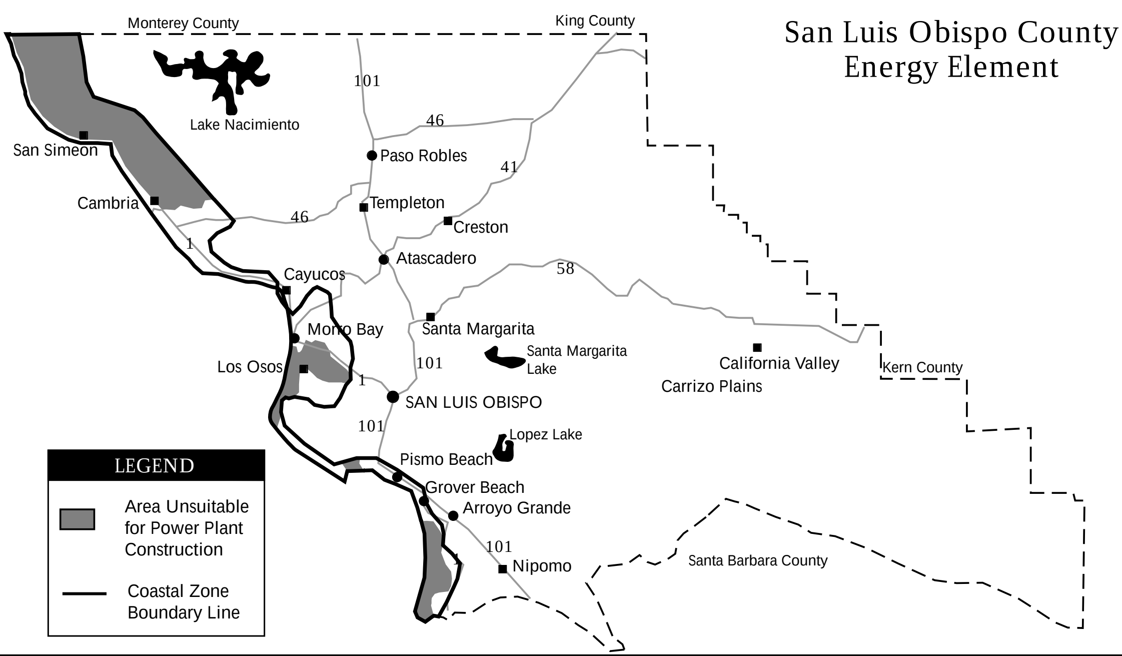
- Inclusion of all stakeholders. It is important for all affected interests to participate in energy facility planning so they can share consistent information and establish dialogue among disparate groups. In addition to local electric and natural gas utilities and the general public, these efforts should also involve local elected officials, independent energy industry representatives, environmental interest groups, and relevant regulatory agencies. An effective method of involving these stakeholders is their appointment to a special energy facility planning advisory committee or task force. Such groups can

PROGRAMMING THE ENVIRONMENTAL PROCESS

Section 15168 of CEQA offers local governments a two-tiered approach to environmental review of energy planning that can help identify potential long-range or cumulative problems in advance of specific development proposals. This approach uses a Program EIR to evaluate broad environmental concerns first, followed by project-specific EIRs later that can be streamlined to the extent that issues have already been addressed by the Program EIR.

San Luis Obispo County used this approach in preparing its general plan Energy Element in 1994. The program EIR that accompanies the county's Energy Element is focused on jurisdiction-wide and cumulative energy facility impacts, and identifies program mitigation measures for future facility development. Citizens and facility developers alike can use the Program EIR to determine what environmental issues may apply to a project, where projects may be sited (as shown in the map of the county's coastal area), and what mitigations may be required. This type of broad environmental analysis is also helpful in increasing public awareness of long-range energy facility issues, rather than merely coping with public reactions to specific projects after they have been proposed. The 1993 California Legislature reinforced this approach to environmental review by amending CEQA to also authorize "Master" and "Focused" EIRs that can offer similar two-tiered benefits.

Additional information on San Luis Obispo County's environmental review process can be obtained from David Church, Planning and Building Department, (805) 781-5620.



contribute valuable technical input to the planning process, and serve as a sounding board for proposed local policies and standards.

- Developer participation in public involvement activities. As previously discussed, an important part of a local energy facility plan is the guidance it gives developers before they prepare specific projects. One component of a local plan can be guidelines for developer participation in public involvement during facility permitting. Such guidelines can ensure developer presence at local meetings, convenient access to proposal documentation, and dependable responses from developers to public questions and comments. The existence of such assurances will help build public confidence in the planning process and consensus about energy facility issues.

- Information sharing. The information base described previously should be widely and thoroughly disseminated, and the public should be invited to help expand and refine the information. Facility planning processes should be publicized at their outset, and outreach efforts made to the stakeholders listed above. Publicity should clearly describe the planning process, the location and availability of planning data, and specific opportunities for public input. In addition to meetings and printed material, information can be increasingly shared electronically through computer bulletin boards or similar local networks.

- Formal participation events. Because of the technical, environmental, and regulatory complexities of energy facilities, it may be useful to formalize public involvement into special educational workshops, and perhaps such events as tours of exemplary facilities already sited and operating. It may also be helpful to invite presentations by local governments that have completed facility planning processes. The inserts entitled *Linking Growth, Livability and Energy Supplies* (on the next page) and *Finding Common Problems and Solutions* (page 3.23) describe projects in Washington State and British Columbia where utilities, government agencies, and other stakeholders are undertaking formal planning processes together in order to better understand each other's needs and concerns, and to work together toward mutual goals.

- Informal collaboration. An important adjunct to formal events can be informal, nonjudicial forums of collaborative "brainstorming" among developers, citizens, and regulators. Using the architectural technique of a design "charette," energy facility stakeholders can jointly develop preliminary facility siting and performance ideas for consideration in more formal processes when appropriate.

- Budgetary commitment. Despite today's tight budgets, it is still important for communities to make a firm, if only modest, commitment to funding public involvement. Sometimes local funds can be leveraged with developer and interest group monies using a cooperative approach to public participation. In the insert entitled *Planning Via Partnerships* on page 3.24 describes the Electric Power Research Institute's Community Initiative program that seeks to partner electric utilities with local governments in solving common community problems.

- Ongoing activities. Public involvement needs to be an ongoing process that periodically examines current events, and monitors the need for revision or fine tuning of established plans. The stakeholders advisory group mentioned earlier can be reconvened every few years to re-examine the local energy plan and recommend appropriate updating where warranted.

WINNING PUBLIC SUPPORT BY MAXIMIZING ENERGY EFFICIENCY

"Our society has become extremely dependent on energy services to support modern life-styles, yet few issues are more controversial than the siting and development of energy facilities. Good planning maximizes the efficient use of energy and minimizes the need for new infrastructure. As an added benefit, energy-related projects are more likely to be accepted by the community when serious efforts have been made to avoid them. A community's energy plan provides an opportunity to reduce environmental impacts and inevitable controversy by promoting the efficient production and use of energy resources and services. A good, well-implemented energy plan provides the best evidence that the community has made every effort to avoid the need for new energy facilities."

Rich Ferguson, Director of Research, Center for Energy Efficiency and Renewable Technologies

LINKING GROWTH, LIVABILITY AND ENERGY SUPPLIES

The population of the Vancouver area of British Columbia, Canada, is expected to grow to nearly three million by the year 2021. Managing this growth to maintain and enhance the livability of the region will require a coordinated and innovative approach to planning and delivering the services desired by the citizens of the region. In British Columbia, BC Hydro is the electric utility responsible for delivering virtually all of the province's electricity.

To meet the challenges of growth, BC Hydro is using a new approach to planning that it believes will improve the efficiency of electricity generation, delivery, and use. Simply stated, BC Hydro is contacting the communities it serves and volunteering to assist them with the integration of electricity information into the community planning process. Since the physical shape and content of communities dictates the demand and distribution requirements of an electric utility, BC Hydro recognizes that efficient community and utility planning are inextricably linked. This approach also supports other goals such as preserving open space, improving air quality, and providing opportunities for economic growth.

A central theme of this approach is the notion of choice. Communities have choices about how they grow and develop, which in turn influence electricity requirements and the options available to meet those requirements. If communities are more aware of the energy implications of their decisions, they can make more informed choices about growth and development. In turn, if BC Hydro better understands community goals and values, it can make better informed choices about the options to pursue for supplying electricity services in the region.

BC Hydro is going about this by several methods:

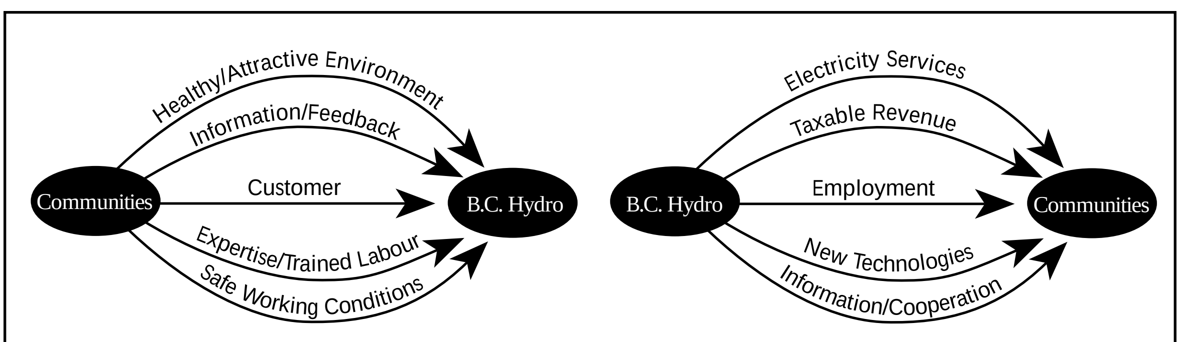
- Establishment of a provincial stakeholder advisory committee composed of community planners and other utility providers

- Sponsorship of workshops and distribution of information materials to increase awareness of energy facility challenges and opportunities among community officials

- Co-sponsorship of pilot projects to analyze and demonstrate the specific benefits that can be obtained from energy-efficient urban design and growth management

To date, BC Hydro's efforts have focused on the area around the city of Vancouver in British Columbia where population growth and urbanization is the highest. Working with municipalities, BC Hydro is explaining how electricity is produced and delivered in the region; where problems and constraints are emerging because of rapid growth and limited capacities; and the different options that communities have for meeting future electricity needs, including efficiency improvement, expanded transmission lines and/or new power plants.

Additional information on BC Hydro's program is available from Allan Grant, BC Hydro, (604) 528-7749.



HOW TO STRENGTHEN INTERAGENCY COORDINATION

Long-range energy facility planning also creates an opportunity for improving coordination between local government, utilities, and other agencies that have planning responsibilities, and that may ultimately be involved in facility permitting and monitoring. The process of energy facility planning can be an occasion for strengthening interagency coordination as shown in the page 3.25 insert on *Creating a Local Hub: Coordination Among Plans,* including the following capability-building techniques:

- Improvement of the local information base with additional data and technical analyses
- Strengthening of the public education and involvement process with other agencies' resources and capabilities
- Increasing the expertise of local staff through interagency contacts and informal training opportunities
- Improved consistency and effectiveness among different agency policies and standards, and minimized duplication or conflicts among agencies

A strong base of interagency coordination during the planning phase will ultimately translate into more effective siting and permitting processes because of established contacts, familiarity with respective authorities and rules, and up-to-date knowledge of local issues and preferences.

FINDING COMMON PROBLEMS AND SOLUTIONS

The Puget Sound area, centered around Seattle, is Washington State's fastest growing metropolitan area. Cities and counties, and electric and natural gas utilities, are all scrambling to keep pace with population growth and increasing demands for services. Using the concept of integrated resource planning (IRP), where efficiency improvements and new supplies are evaluated equally, Puget Sound energy stakeholders have embarked on an innovative project that can serve as a model for cooperative energy facility planning.

The Puget Sound Fuel Blind IRP Project was launched in 1992, with Puget Sound Power and Light Company, Washington Natural Gas, Seattle City Light, State Energy Office, Washington Utilities and The Transportation Commission, and local governments in the region. The group developed a set of ground rules for participation in the Project, designed to encourage open discussion to elicit active participation by all members and to achieve consensus wherever possible. The goal of the Project was to identify ways that utilities and communities can work together to reduce costs, increase efficiency, and enhance the environment.

Over the course of a year and a half, the Project participants developed a course of action that led to the identification of a number of opportunities for working together. The group singled out joint trenching for new service lines, capacity-sharing of natural gas pipelines, and formulation of common policies governing service extension to new customers.

Each of these issues was studied to determine where cost savings could be captured; where procedures currently cause bottlenecks and delays; and how infrastructure planning can be more closely coordinated among multiple utility providers in dense urban environments. The group found that it shared the following three common goals:

- Enhance consumers' ability to choose among fuels
- Improve public education concerning energy resource costs
- Address and remove inefficiencies in energy delivery mechanisms

One of the key strategies that the group agreed to in achieving these goals is greater local government coordination. All stakeholders recognized that to be genuinely integrated, energy resource planning must be integrated with all planning processes, particularly local land use policies and standards.

Additional information on the Puget Sound IRP project is available from Debrah Ross, Washington State Energy Office, (360) 956-2124.

INFORMATION RESOURCES

A variety of resources is available to local governments to assist in energy facility planning. These range from staff expertise in other agencies, to national laboratories, to current periodicals. Appendix E provides a roster of major information sources, including the following key resources:

- Utilities and independent power producers. One of the best sources of assistance will be the electric and/or natural gas utilities that serve a planning area, as well as independent power producers who may have local plants. All California electric and natural gas utilities maintain service territory plans for their generation and distribution systems. These plans are essential information baselines for any local planning effort, since they form the backbone of a community's energy system. Utilities will also have useful data on future energy demands; available conservation and efficiency improvement opportunities; electric and magnetic field (EMF) management (see Chapter 5.6); and the feasibility of employing new, innovative technologies in the local area.

- Energy Commission. The Energy Commission can be helpful when assembling a local energy plan by providing information, including that for energy technologies, electricity and fuels use and forecasts, energy facility siting and generating efficiency, and environmental assessments. In particular, the local agency Siting and Permit Assistance Program staff can help in providing sources of information and advice.

- Other state and federal agencies. Several other state and federal agencies have technical staff and publications relevant to local energy resources and facility planning and development, including the Governor's Office of Planning and Research; the California Public Utilities Commission; the Division of Oil, Gas and Geothermal Resources in the Department of Conservation; California Environmental Protection Agency; Department of Forestry; Department of Water Resources; Air Resources Board; and the Integrated Waste Management Board. At the federal level, the U.S. Department of Energy, Environmental Protection Agency, and their national labora-

PLANNING VIA PARTNERSHIPS

One of the best ways to plan for energy facilities is through a partnership with affected stakeholders. This type of partnership approach is being used by the Electric Power Research Institute (EPRI), which conducts research and development for its member electric utilities across the nation. Under its "Community Initiative," EPRI is providing cost-shared assistance to help local governments and their electric utilities form planning partnerships to solve mutual problems. Some of these concerns are explicitly energy-related, and others are associated with the need to maintain economic competitiveness or to confront mounting social or environmental problems.

Examples of community partnership projects that are underway or planned include:

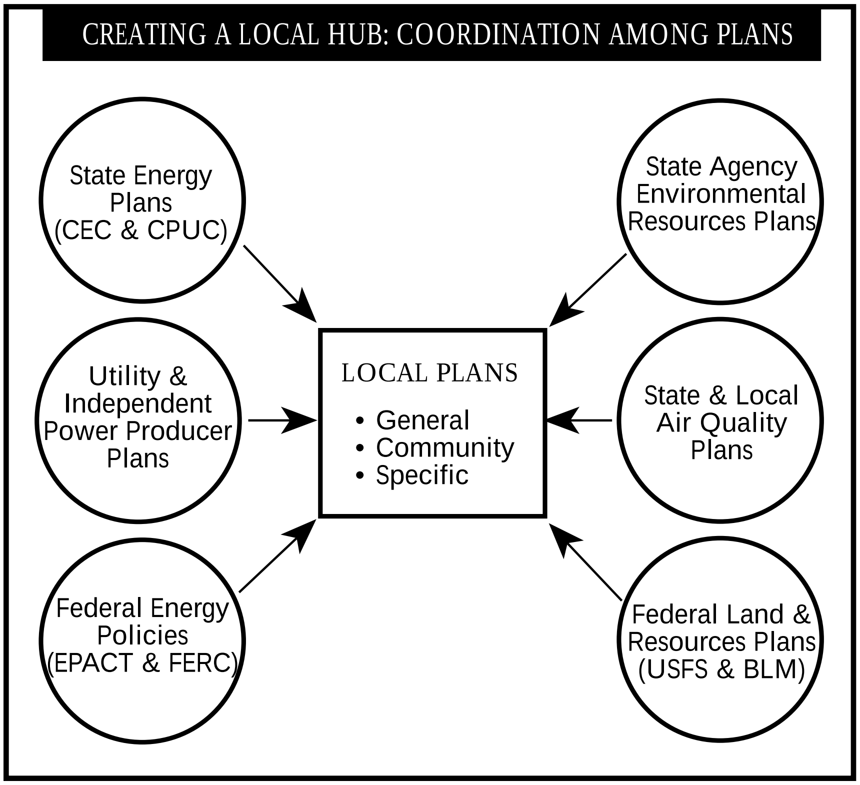
- Improving the environment. EPRI and member utilities are working with some communities on developing energy efficient land use plans; pollution prevention techniques; and increased waste recycling.

- Creating telecommuting opportunities. Utilities are exploring ways to help employers and schools in their communities to offer options for telework and distance learning.

- Streamlining transportation. Increased use of electricity in the transportation sector not only can improve air quality but also encourages more efficient, intermodal approaches to moving people and goods.

- Offering new services. Innovative communication links with customers provide new opportunities for demand-side management, distribution automation, and real-time pricing.

Community Initiative projects are possible where member electric utilities and local community planners have interests and resources that can be applied to a mutual challenge or opportunity. EPRI can strengthen this partnership with additional technical and financial assistance. Additional information on EPRI's Community Initiative can be obtained from Stephen Baruch at (415) 855-8912.



CREATING A LOCAL HUB: COORDINATION AMONG PLANS

tories, all have technical assistance programs and publications that address energy resources, technologies, and impacts.

◩ Other local governments. The informal network of local jurisdictions that have already prepared energy-related plans can also be an efficient and relevant source of assistance. Counterparts in other communities can often identify likely issues and effective methods for addressing and resolving them.

◩ University research centers. California universities and associated national laboratories offer a large array of research and analytical capabilities that communities can use in compiling and evaluating technical planning information.

◩ Energy industry trade groups. The energy industry is represented at the state and national levels by several trade groups that can provide useful information on technologies and industry trends.

Examples include:

- American Wind Energy Association
- Biomass Processors Association
- California Electric Transmission Coalition
- California Gas Producers Association
- California Municipal Utilities
- California Solar Industry Association
- Electric Power Research Institute
- Geothermal Resources Council
- Independent Energy Producers Association

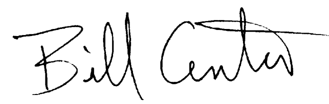
Assistance is also available in the form of periodicals, research studies, and conference proceedings. Many energy conferences are annual events that local staff can plan on attending for regular updates. Also, numerous electronic bulletin boards are expanding the availability of technical information.

NOTES NOTES NOTES

Former Supervisor, El Dorado County, Distric 4

ENERGY FACILITY SITING AND RECOGNIZING LOCAL OPPORTUNITIES

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.

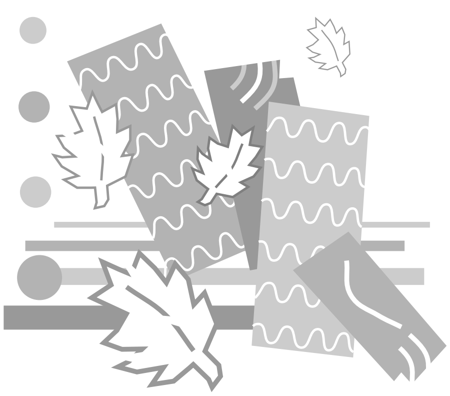


The siting of new energy facilities and the re-licensing of existing energy facilities is an issue which has generally been ignored by local government unless a crisis erupts. Yet an assertive, proactive approach by local decision makers can achieve huge gains in at least three areas.

- First, important public policy goals can be met. Promoting the siting of new and the retention of existing biomass plants can provide a means to reduce the landfilling of burnable solid waste. Air quality goals can also be met by reducing open air burning while using renewable fuels rather than fossil fuels. Critical emerging problems can be addressed while complementing the achievement of existing goals. For example, in virtually all of California there needs to be an aggressive natural fuels reduction program; yet burning the accumulated waste faces air quality restraints, and landfilling it reduces capacity. Counties that have access to disposal at a biomass plant will not only be contributing to energy production, they will be creating local jobs and saving tax dollars. Similarly, by becoming actively involved in the licensing of hydroelectric projects, local needs for water supplies, recreational areas, enhanced tourism opportunities, or increased revenues can be addressed.

> *"Local interests must be defined. They are rarely identical to those of the power producer, but they don't have to be in conflict."*

- Second, local government can save potentially large amounts of money by becoming a direct customer of a local energy facility. While the details of a myriad of proposed regulatory changes remain uncertain, inevitably there will be new opportunities for local governments to reduce their energy bills by directly contracting to purchase locally produced power. This can save millions of dollars for cash strapped counties.



- Third, the interests of the public and the environment can be much better met when locally defined and developed goals are agreed upon early in the process. All too often public hearings become a "jobs versus the environment", or a "not in my backyard" debate. By waiting too long, interests get lost and positions become entrenched, resulting in frustration, poor decisions, and continuing confrontation. When clear community goals and interests are defined up front they can be presented early on as opportunities to create partnerships.

In truth, the debate over locally sited energy facilities has rarely been framed at the local level. When it has, it has too often been in the context of mitigating a necessary evil, instead of exploring opportunities to solve local problems. The process is burdened by the regulatory, economic and social environment. We have an international electricity grid; affected by national energy policies and world markets; regulated by a variety of state and federal organizations; owned and operated by a mixture of private enterprise, administrative arms of local, state and national governments, directly elected special districts, and private, public or private-public consortiums; all of which are pressured by a variety of social and environmental organizations. It is a messy and complex system.

Largely because of this complexity the historical trend has been to centralize regulation and decision making. Ironically, this has not disempowered local government. On the contrary, in today's political, legal and regulatory climate it is simply impossible to ignore well articulated local concerns over locating or licensing a project. The sophistication, legitimacy, and resources of even the smallest local government is sufficient to tie most projects in knots if a confrontation takes place.

This gives the local government decision makers the power to significantly affect the outcome of the decision, while not having jurisdictional responsibility for the decision. So what should local government do to deal with locally sited energy projects?

Local interests must be defined. They are rarely identical to those of the power producer, but they don't have to be in conflict. There are many areas where a local energy facility will affect local public policy goals. Some that are common to many local jurisdictions are air quality, disposal of biomass, water supply enhancements, environmental restoration, even undergrounding of power lines. Changes in grid access rules [by the Federal Energy Regulatory Commission] may also provide opportunities for wholesale power purchases and energy savings. The key is to be proactive, to participate in the process up front, and make it clear that ways to create opportunities are being sought, rather than ways to impede the project. There is no risk, since early involvement is the best way to affect the project. It also makes it clear to the project proponent that local government will be a major player.

Sometimes a proactive approach involves seeing an opportunity and pulling potential players together in a collaborative effort. In El Dorado County a local lumber mill has a major investment to make in order to meet air quality standards for boilers burning wood waste. The municipal utility in Sacramento wishes to reduce its dependence on non-renewable fossil fuels, and has transmission lines from its Sierra hydroelectic project running close to the mill. The county, U.S. Forest Service, California Department of Forestry, and local fire departments are very concerned about the wildland fire interface and have a variety of fuels reduction programs which will generate huge amounts of biomass. The county is looking for a way to divert stumps and other wood and burnable organic wastes from its landfill.

The opportunity exists here for a public-private partnership involving multiple jurisdictions to build a biomass cogeneration plant, which can use state-of-the-art equipment to burn wood wastes, generate steam for use in the mill and electricity to meet the renewable energy goals of Sacramento. However, capitalizing on it is has proven to be difficult, in part because traditional governmental approaches are not activist or proactive, and in part because the shifts in the regulatory environment, both in terms of timber supply and energy regulation, are being viewed as obstacles rather than opportunities. To succeed, local government must become proactive and entrepreneurial. In the case of the mill, someone must get the players together, explore the opportunities and define the barriers, and then get all the stakeholders together and try to make a project happen. While such a project could save local government millions of dollars of landfill space and fire departments millions in fire suppression costs, for a county to actually appropriate any resources to facilitate the project is politically risky simply because it is not required: "it's not our job." This mindset needs to change.

Similarly, a proponent of a particular project may do everything that is required in terms of notice of affected agencies and organizations, and then wonder why the hearing room on a draft EIR is packed with upset people after several million dollars and years of time have been spent on siting and environmental studies by a series of consultants. The reason is simple. No meaningful early and proactive discussion occurred with the stakeholders, [emphasis added] and probably many stakeholders and even potential allies were never identified, because it wasn't required.

Nowhere is such early discussion more critical than in the licensing and re-licensing of hydroelectric projects. Rural California is no longer as rural as it once was, and even our smallest counties have substantial stakes in how their resources have been and will be developed. Substantial tourism and recreational industries have created new needs, expectations and opportunities while new rural residents bring an increased sophistication and environmental awareness to local governments. Again, multiple jurisdictions with often checkered histories of interaction have to work together or nothing will happen.

Local jurisdictions should have a single individual or department who is given early responsibility to coordinate energy facility siting. Yes, it is an added responsibility for someone whose plate is almost certainly overflowing. But it will pay dividends and reduce conflict. Local alliances can be built and local interests met in collaboration with, rather than in opposition to, the proposed project. This individual must have the ability to look at interests rather than getting locked into positions, should have experience or training in putting together collaborative efforts, and most important, must have the ear of and support of policy makers. Such an individual, by working with everyone from community activists to business leaders, from elected officials to sister agencies, can build alliances that make a final decision on a project seem anticlimactic, rather than a civil war.

There is no better place for such an approach to succeed than at the local government level. The traditional strength of local government is the same as that of small business - it is responsive, flexible, hungry and innovative, and therefore often on the cutting edge of progress and success. It appears likely that Sacramento and Washington recognize this, and will respect it. Hopefully local government can take advantage of it, to everyone's benefit.

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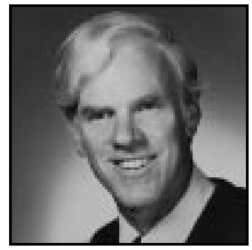
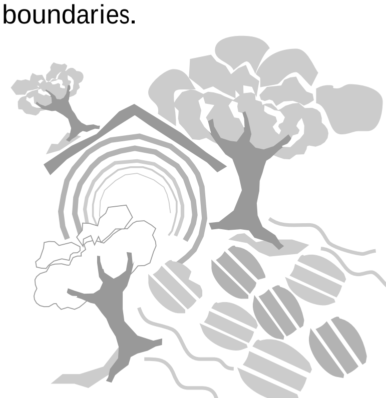
PERMITTING ENERGY FACILITIES: ISSUES RELATED TO LOCAL AGENCIES

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.



In the 1970s renewable energy was seen largely as a curiosity, but perhaps with sufficient energy saving potential to warrant considerable federal and state tax credits to promote its use in homes. While this was intended to accelerate commercialization along with producing energy savings, it ended up seriously distorting the market and giving false price signals. These tax credits were removed by the mid 1980s, along with almost all national support for renewable energy resources in general, and the brief "market" collapsed. Or so it appeared.

But a quiet revolution began in the early 1980s. The remaining manufacturers and distributors of solar water heaters became more cost and reliability conscious; some builders began to learn that passive solar homes and daylit commercial buildings offered important market advantages; and important experience in wind-electric generation, solar thermal-electric generation, and photovoltaic electric generation was gained through the world's largest examples of all three technologies, all installed within California's boundaries.



Not only did the costs of all of the solar-electric technologies drop dramatically during the 1980s. while reliability of the systems improved, but the ways of determining their benefits also changed significantly. For example, California's cities and counties began to learn that dollars spent within their boundaries for energy resource avoidance, such as home weatherization or shade tree planting, or for passive solar heating or commercial building daylighting, kept energy dollars working locally with greater economic and environmental benefit, and created more jobs in the community, than the conventionally fueled supply alternatives. The boundaries for examining the economic impacts of energy policy decisions expanded out to encompass the interwoven economic, environmental and labor systems, rather than just the energy users.

> *"Energy decision makers will be the vehicle to promote new businesses and jobs, to improve the healthful quality of local environments, and to facilitate the more efficient and productive use of local energy expenditures...."*

During the previous decade the electric utilities also began to appreciate that solar water heating, commercial building daylighting and careful shade tree planting were cost-effective ways to reduce hot summer peak loads on the utility system, thereby saving all ratepayers money. The framework for viewing the benefits had again been expanded to encompass all who receive them (that is, to all "stakeholders"), rather than confined to just those who apply the technologies.

More recently solar electric cells ("photovoltaics") located adjacent to distribution substations next to urban areas, or on urban building surfaces, have been shown to produce "distributed utility" benefits in California environments of at least twice the value of the electricity output of the cells, leading to the confident expectation that even relatively costly photovoltaics will prove in this larger economic framework to be fully cost-effective this decade.

In addition, state and local environmental quality improvement standards will continue to require reductions in environmental emissions related to energy production and use, and the United States will increasingly participate in international protocols that will require reductions in the use of fossil fuels (e.g. President Clinton's Climate Action Plan, to meet carbon emission-reduction targets that have been set internationally). Renewable energy resources are increasingly being appreciated for their contributions to these goals.

The result of these considerations is that energy decision makers are going to be faced with new kinds of decision making circumstances involving energy efficiency and renewable energy resources within this decade, ones that will also require cooperation by the same decision makers to assure that the benefits of these efficiency and indigenous resource applications actually accrue to their constituencies. For example, long-term supply and price stability for urban electricity users can be enhanced by assuring a diverse "portfolio" of resources, especially those that are independent of international price-fixing cartels located in politically unstable regions of the world.

With renewable energy resources in those portfolios, the chances for continuity of supply, enhanced environmental quality, and absolute price stability are all improved, frequently in circumstances that also create new local businesses and provide new jobs.

While municipalization now permits urban areas to contract directly for such portfolios (e.g. the Sacramento Municipal Utility District's aggressive renewable energy program), it is very likely that the result of the electric utility competitive restructuring that is just now beginning may also provide the opportunity for energy resource portfolio optimization by non-municipalized communities and otherwise aggregated purchasers.

To realize the energy-saving "passive" benefits of solar space heating through appropriate architectural design and from properly placed shade tree planting, energy decision makers will need to work with developers in ways that enhance the building market without increasing builder costs, while providing both solar "access" and west-side and street tree shading. Experience has already shown this to be quite feasible and practical. This usually only requires subdivision redesign services and other procedural incentives or assistance to the cooperating builders. City and county agencies should also be prepared to work with electric energy suppliers to provide the necessary expertise for the adoption of additional cost-effective "passive" energy saving and space quality-enhancing measures, such as daylighting and daylight-controlled electric lighting.

The application of "active" solar energy techniques can also be expected to see a resurgence. These include solar water preheating with electric utility support to reduce the costs of peak power management and to provide support for the transmission and distribution systems, and low-cost solar ventilation air preheating, cladding the south sides of buildings with now-available and very cost-effective materials that enable sunshine to replace gas-fired preheating.

Encouraging or subsidizing the inclusion of electric service to the south-facing roofs of all new exposed residential and commercial structures can provide a very low-cost way to accommodate the forthcoming "distributed utility" application of photovoltaics. Furthermore, solar-electric glass, sized for commercial curtain-wall and skylight applications, is even now beginning to appear from the manufacturers of low-cost thin-film photovoltaics, suggesting emerging opportunities for the full integration of distributed utility electric service with the very structure of the building.

These developments are all remarkable, all new, and all rapidly heading toward full commercialization. By the end of this decade everything discussed in this brief essay will begin to be commonplace, and will certainly mark the transformation of urban energy markets during the first decade of the next millennium. Energy decision makers will need to keep abreast not only of these exciting developments, but of the full scope of benefits that each brings to the full range of affected stakeholders.

Energy decision makers will be the vehicle to promote new businesses and jobs, to improve the healthful quality of local environments, and to facilitate the more efficient and productive use of local energy expenditures, through their energy resource and policy decisions. Energy efficiency techniques and technologies and renewable energy resources and technologies will provide the tools to accomplish those worthy aims.

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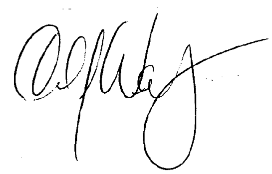
EMERGING ENERGY TECHNOLOGIES

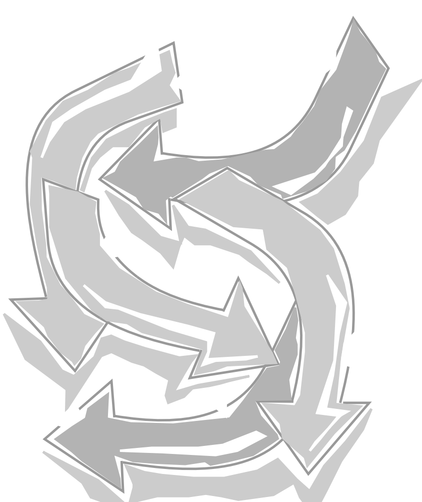
Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.



Emerging energy technologies point toward satisfying energy needs much closer to the ultimate user, and have the potential of producing electricity in our homes and businesses rather than at some distant powerplant. Emerging technologies also hold the key to resolving such energy issues as a cleaner environment and lower costs. Perhaps, more importantly, they might be the instruments for substantial change in the way we produce and use electricity to provide for our needs.

Older technologies, boiler type steam generating plants, like coal, oil and nuclear, rely on economies of facility scale to obtain efficiencies in both fuel conversion and costs. Since the turn of the century increasing the size and the operating temperature in power plants has led to a continuing lowering of electricity costs. This trend came to an end in the 1970's and in many cases there are no more economies of facility scale left to capture. The newer emerging technologies tend to be cleaner, smaller, and modular. They achieve their cost efficiencies through economies of manufacturing, or mass production. For example, instead of making bigger heat pumps, on-site generator sets, wind machines, solar photovoltaics, or high-efficiency compact fluorescent lamps, factories need to make more of them to reduce costs. This concept is a fundamental change of mindset for the utility industry, which is more familiar with capturing economies in field construction rather than economies in manufacturing. This shift from constructed energy to manufactured energy will have a major impact on how we produce and use energy.

> *"If the smaller more modular technologies are allowed to enter the market they will rapidly begin to penetrate, and a new era in energy services will emerge."*



Why is this important? The implication is that the decisions about energy production and use will move closer to the customer. And by inference closer to local government decision makers. This is readily understood by those that are working in energy efficiency, since efficient appliances, windows, passive solar design are always related to the customer. And efficient homes already have to meet designated standards enforced by local agencies. Previous technologies, however, have led us to believe that the production of electricity would always be far away from the actual point of use. The new technologies tend to challenge that notion and should cause us to rethink that premise. The concept of a much more integrated energy production and use is being discussed under the name "The Distributed Utility".

If we count distributed benefits properly we will find that they are worth double or more than what standard utility economics (designed for large powerplants) say they are worth. One has to take into account the whole chain of energy use from production to transport to actual conversion. This makes many distributed renewable technologies, such as photovoltaics or solar hot water heating cost effective in many cases right now. The SMUD Photovoltaic Pioneer program is an example of this approach. It uses photovoltaic panels on the rooftop to produce electricity when needed most, during the hot summer days.

A recent Allison paper for General Motors suggests that polymer fuel cells (PEM) might be mass-produced for about $47/kW. At this cost it would be more competitive than electricity brought in over the wire. The development so far has been primarily for the electric vehicle market. A hybrid electric vehicle is really a miniature utility. It contains an electric generator, an electric storage device and a computer controlled smart energy management system; all the components that you need to have your own utility in your home. This leads to the potential ability to plug your home into your vehicle. If you can produce electrical energy in a fuel cell (which has no hazardous emissions) in your car, there really is every reason to operate your car to produce electricity for your home when the car is in the garage. You have already paid for the powerplant, why not use it. (This is the exact opposite of what most people are thinking; that is, plugging your car into your home to recharge the batteries.) It is also not a great leap to then think of plugging your business into your car when you have parked it for the day. It also means that the energy use of your home or business is now integrated with the transportation planning in an entirely new way. These technologies therefore not only impact the energy sector but may well cross over to the transportation sector.

If mass production of PEM fuel cells occurs for the automotive market, it could occur for fixed sites also. Proposals have been made that a small fuel cell could be incorporated into the bottom of a waterheater and you would buy the combination as a small mini-cogenerator at your local hardware or Sears. If this is then combined with a super efficient home it is not even clear that you would have an electric grid if it didn't already exist. In that case you could just have a gas grid, or ultimately a hydrogen grid.

> *"Because these technologies are much more dispersed and distributed, they will enter the domain of decision making or at least permitting of local governments."*

Progress in dispersed electrical storage is also continuing, and the storage devices are making rapid headway. Again, because of the electric and hybrid car development and markets, a cost effective way to store small amounts of electricity will have major impacts on energy uses and production. There are at least a dozen companies working on flywheels. (They may be cylinders instead of wheels.) All of them integrate smart electronics into the designs. This allows them to be plugged in and all the rest is taken care of. (It won't be quite that simple. It never is, but close.) These devices will look like little beer kegs or small boxes sitting in the basement or garage. Some flywheel models should enter the market by 1995, and by the late 1990s be a common and affordable commodity in the several to tens of kilowatt-hours size range. An additional benefit is that they are superb voltage stabilization devices, as well as being able to provide electricity during those short outages that now make all the clocks in the house blink "12:00," and have the potential to upset your computers.

The distributed generation systems presently being installed and considered run from 10 to 20 megawatts for onsite commercial cogeneration, to five kW motor generator sets, to a single photovoltaics panel on a residential roof. The fuel of choice for those systems using fuel will be natural gas and later hydrogen, and for the renewable generation technologies, photovoltaics, or wind.

The issues regarding distributed generation systems for local government are related to whatever considerations are presently being given to standby generation for hospitals and major emergency centers. The difference is that the distributed generation will run for more hours. This means that emissions will need to be considered. Most of the systems running on natural gas meet the present California emission requirements. Fuel cells are very low in emissions since they do not have a typical combustion process and produce primarily water and carbon dioxide. The requirements for the safe handling of natural gas are well established for both commercial and residential applications.

Hydrogen, as the clean follow-on fuel, may give rise to questions of safety. Hydrogen has not had the history of use that natural gas or gasoline has had and the perception of explosive danger is high. It has been handled successfully in numerous industrial and commercial settings. The form in which the hydrogen will be stored will influence the perception of safety. It can be piped directly, produced as needed from natural gas (reformed), or produced from a stored solid or liquid. Experimental fuel cells with natural gas to hydrogen reforming are running successfully in urban settings today.

The renewable technologies bring with them a different set of concerns. Photovoltaics, as with solar hot water heating, will need to have sunlight. This brings out the issue of shading by new adjacent structures, an issue that has been handled by some municipalities for solar hot water heaters.

Small wind turbines bring in the issues of visual impact and noise. Since the turbines will be elevated they become an intrusive visual object. And as always beauty is in the eye of the beholder. The closest equivalent would be ham radio operator towers. Most modern designed small turbines have very low noise levels and can meet most urban noise ordinances.

And, in all cases, the electrical connections will have to meet local code requirements. As more experience is gained with distributed generation systems, the interconnection requirements have become more realistic.

The changing electric utility industry provides a unique opportunity for these new technologies to emerge. If the present utility regulation is changed and the technology and services are provided by a number of organizations then the issue of consumer protection will become more important. Considering the present knowledge of the average consumer of their energy choices, the potential for consumer fraud is high. It is too early to know exactly what the ultimate outcome will be. If the smaller more modular technologies are allowed to enter the market, they will rapidly begin to penetrate, and a new era in energy services will emerge.

These technologies have the potential to customize energy services beyond just time-of-day, or real-time pricing. This era will be much richer in customer choices and will focus much more attention to the needs of individual customers. Customers are not necessarily interested in low-cost kilowatt-hours, but in low-cost, high-quality energy services, and have overwhelmingly voted for cleaner and more environmentally-sensitive energy provisions. But because these technologies are much more dispersed and distributed, they will enter the domain of decision making or at least permitting of local governments. Photovoltaics on the roof or fuel cells in the garage will call for some permitting procedures and how these are handled will also impact the ability for these technologies to rapidly penetrate the market place.

These new technologies have the ability to fuse together energy production, use and management at the user's location, and will make such concepts as "think globally but act locally" even more important.

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PERMITTING ENERGY FACILITIES

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CHAPTER 4

ENERGY AWARE
PLANNING GUIDE: *ENERGY FACILITIES*

CHAPTER 4: PERMITTING ENERGY FACILITIES

INTRODUCTION

This chapter provides information and ideas to address the inevitable energy project permitting challenges that you will face, to make your permitting process more efficient and effective, and to obtain results that reflect the preferences of your community and the participation of all interested parties. The extent of local authority over energy facility permitting is explained. This chapter provides ideas for improving local permitting, monitoring, and compliance activities in order to obtain results that address the needs of your community. Information is presented about state and federal energy facility permitting processes, focusing on opportunities to participate in and influence these processes. The roles and responsibilities of all participating state and federal agencies are described.

GUEST AUTHOR ARTICLES

Guest Author articles are found at the end of this chapter. These articles contain opinions of the authors and do not necessarily reflect the views of the California Energy Commission or its staff.

Developing Energy Projects in a Given Community by Thomas Sparks, Manager of Government Relations and Utility Affairs, Geothermal Operations, UNOCAL.

> *"... increasing growth in California means that your community may need additional energy resources or be impacted by the demand for them in other areas."*

Participating in Licensing: Opportunities and Advantages by Ernesto Perez, attorney and former California Energy Commission Public Advisor.

Siting Powerlines and Substation Facilities: An Investor Owned Utility's Approach by Michael Hertel, Manager, Environmental Affairs, Southern California Edison Company.

Authorization of Hydroelectric Facilities-Guidelines and Issues by Fred Springer, Director, Office of Hydropower Licensing, Federal Energy Regulatory Commission.

Effective Local Government in the Licensing of Hydroelectric Projects by Stephen Padula, Principal and Senior Consultant, Long View Associates, Inc.

Biomass and Local Government: Challenges and Opportunities by William Miller, President, Board of Directors, Biomass Processors Association.

GROWING ENERGY DEMANDS AND LOCAL ROLES IN PERMITTING

Whether or not your local government promotes new growth and development, increasing growth in California means that your community may need additional energy resources or be affected by the demand for them in other areas. The Energy Commission anticipates that the demand for energy will grow by roughly two percent annually. It forecasts that by 2005, demand for electricity in California will increase by an additional 6,580 MW.

New power plants, transmission lines, pipelines and other energy facilities will be built to address the growing demand for electricity, the retirement of old facilities, and the refurbishment of existing facilities to reduce environmental impacts and improve their economies. In the future there will likely be an

CITY OF HANFORD'S PERMIT EXPERIENCE

This case study concerning the lengthy and controversial permitting process of the GWF Cogeneration Power Plant in Hanford, California is an example of the importance of early, and frequent, public involvement and adequate consideration of environmental reviews in the energy project permitting process.

In October 1987 GWF Power Systems filed an application with the City of Hanford to build a 19.9 MW coal-fired cogeneration power plant in Hanford (Kings County, California). The proposal was designed to provide 35,000 pounds of steam per hour to an adjacent Pirelli-Armstrong Tire and Rubber Company, with electricity to be sold to Pacific Gas and Electric Company.

The original Environmental Impact Report (EIR) was rejected by the Hanford City Planning Commission as inadequate. However, the Hanford City Council overruled the decision and approved the EIR on March 21,1988, about six months after the application was filed. At this point a grass roots environmental group, known as Kings County Citizens for a Healthy Environment (KCCHE), was formed to oppose the GWF power plant. In June 1988, KCCHE's request for the City Council to reconsider the issue was rejected. Lawsuits opposing the plant were subsequently filed in Kings County Superior Court by KCCHE and the Kings County Farm Bureau. Kings County Superior Court ruled in favor of GWF, enabling them to begin construction of the plant. As the plant was being built, the issue went to the California Court of Appeals, Fifth Appellate District.

The Fifth Appellate District ruled that the Hanford City Council had overstepped its authority in issuing permits for the GWF project. Specifically, the Court found that the EIR failed to:

- Consider secondary emissions from rail and truck traffic
- Adequately assess the project's cumulative impacts to air quality and ground water resources
- Provide a meaningful analysis of project alternatives

The Court also determined that the land use, circulation and conservation elements of the City of Hanford General Plan did not comply with statutory requirements. Since these elements directly related to the proposed plant, the project could not be approved until the elements had been properly adopted.

During this litigation process, GWF continued to build the plant. They were unable to begin operation until after a final Court ruling. The final ruling was issued in October 1990 and required the City of Hanford to prepare a "Subsequent Draft and Final EIR" to address the issues that the original EIR failed to consider. The Court also ordered the City of Hanford to take necessary actions to bring the City's General Plan elements into compliance with the requirements of Article 5 of the Government Code. In addition, the final ruling allowed GWF to operate its facility for up to 60 days to test and obtain information concerning the effect of plant operation on the environment.

Almost four years after GWF filed its application with the City of Hanford, a Final Subsequent EIR was approved in August 1991. Additional mitigation measures were imposed to reduce environmental impacts. The process was costly for all parties involved and many lessons were learned, including the need for adequate environmental analysis/mitigation, legally defensible General Plans, and most importantly, early and frequent public involvement.

For more information, contact Jim Beath, Community Development Director, City of Hanford, at (209) 585-2583.

increase in the number of modular generation (5 kW - 25 MW) and storage units located on electric customers' sites or near load centers. Local governments will play a major role in the permitting of many of these new facilities.

Local agencies, therefore, may find that their permitting processes or their ability to effectively participate in other agencies' processes play an important role in ensuring these energy facilities are built consistent with the interests of their community. In light of this potential role, the following suggestions are offered:

◩ Realize planning is key to an effective least cost permitting process. As discussed in Chapter 3, the foundation of a local agency's permitting process is its development plans (General Plan, Specific Plan, etc.). The permitting process is one of the means by which local plans are implemented. Effective and comprehensive permitting processes:

- Provide for early public involvement
- Clearly define permit-related issues
- Minimize delays and costs

> **EXAMPLES OF THERMAL POWER PLANTS**
>
> - Solar thermal
> - Biomass combustion
> - Coal-fired boilers
> - Coal fluidized bed combustors
> - Advanced gas turbines
> - Municipal solid waste combustor
> - Nuclear
> - Oil or natural gas cogeneration
> - Natural gas combined cycle

- Facilitate coordination with developers, utilities, other governmental agencies (federal, state, regional), and interest groups
- Result in reasonable, enforceable mitigation measures

A well designed permitting process will provide economical, reliable, safe and environmentally sound energy facilities in a timely manner. Developing clear, comprehensive energy facility permitting processes that effectively reduce time requirements, cost and contentiousness, therefore, may be a valuable endeavor.

◩ Exert your influence in federal and state permitting processes. In circumstances where federal, state or municipal utilities are the lead permitting agency, local agencies can influence these processes by:

- Knowing and understanding their legal authority and limitations
- Participating as early as possible
- Having adopted policies, ordinances and standards that identify resources of interest and criteria for development
- Staying informed about plans for future energy facilities
- Developing and maintaining cooperative relationships with utilities, governmental agencies and other energy-related organizations
- Utilizing resources and assistance available to them

◩ Understand the needs of developers and the public. Developers and the general public often find permitting processes very slow, costly and without clearly specified criteria or requirements. Lack of agency coordination, inconsistency among agency requirements, and obstacles to public involvement complicate energy facility permitting processes. Developers and the public prefer clear permit requirements and a logical, predictable process. Developers seek some assurance that their projects will be approved if they satisfy all permit requirements and criteria. The public desire a forum in which they can voice their concerns and have their issues addressed. The case study discussing the City of Hanford's experiences on the previous page illuminates some of the pitfalls of inadequate public involvement and unclear permit requirements.

LOCAL AUTHORITY IN PERMITTING ENERGY PROJECTS

The California Constitution, various state statutes and case law give local governments authority to regulate development as an exercise of the protection of the general welfare. This power is exercised through adoption of local development plans (Gov. Code section 65300 et seq.), enactment of zoning (Gov. Code section 65800 et seq.), subdivision of land parcels (Gov. Code section 66410 et seq.), and other enactments to protect the general welfare.

The scope of this power is fairly broad to the extent that it does not conflict with general laws of the state or federal government. Where conflicts arise, the local enactment will often be preempted, depending on the legal circumstances. There are numerous state and federal preemptions for energy projects. These are discussed beginning on page 4.14.

HOW TO IMPROVE THE LOCAL GOVERNMENT ENERGY FACILITY PERMITTING PROCESS

Four general areas in the energy facility permitting process in which local governments can make changes to improve and shorten the process are: developer guidance, permit process streamlining, interagency coordination, and public involvement.

Energy facility developer guidance can include policies, standards and siting criteria, information on the roles of affected agencies, and public information manuals with legal and procedural requirements. Permit streamlining techniques include pre-application packages and meetings, one-stop permitting "shops," use of Master Environmental Assessments and program level EIRs, and establishing an "ombudsperson" to resolve conflicts. Interagency coordination can mean joint application review panels, consistent policies among agencies with jurisdictional overlap, and elimination of duplicate permit approvals where feasible. To be effective, public involvement must occur early in the permit process and may include the use of technical advisory committees, frequent public workshops, and computer simulations.

DEVELOPER GUIDANCE

One of the surest and easiest ways to improve the energy facility permitting process is to ensure that project developers are given adequate information on permit requirements, time frames, and costs. The more information the developer has from the start, the more complete the application will be. If the developer knows all local, state and federal requirements before the application is submitted and the project plans are completed, costly revisions and delays will be less likely to occur.

Information should be provided to energy facility developers as early in the process as possible. The following paragraphs describe the type of information that energy facility developers will need.

- Preferences, policies, codes, standards, ordinances and siting criteria. Local government guidance in various forms for energy facilities can be made available to prospective permit applicants. Even in cases where local authority is limited over a given energy project, these adopted policies and regulations are considered by many of the lead state and federal agencies. Jurisdictions which have not developed such guidance may want to consider doing so. Examples of local government requirements for wind energy conversion systems (WECS) are contained in the matrix beginning on page 4.11.

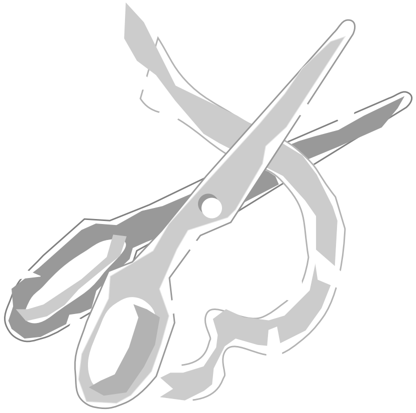
This type of information is beneficial to the local community, the developer, and other regulatory agencies. The community can express its preference for the type(s) and location of facilities it wants. The developer does not have to waste time and money on projects that are unlikely to be approved. In addition, these policies will reduce the number of discretionary approvals needed later, thus reducing the permitting time.

- Screening Criteria and Mitigation Measures. A community can develop CEQA screening criteria for various issues, such as hazardous materials, air quality, noise, etc. Screening information will alert project developers to the type of data needed for review to determine impacts and appropriate mitigation measures. (See the insert about Santa Barbara County.)

SANTA BARBARA COUNTY PERMITTING PROCESSES

Santa Barbara County has made a number of changes in its permitting process. With the help of interested business and community leaders, the County focused on coordinating requirements of the Environmental Health Department, the Fire Department and the local air pollution control district to reduce costs, duplications and conflicts. The County developed "how to" manuals which address compliance with state and local regulations for certain industries, and consolidated certain permitting and inspection requirements. It established an Industry Assistance Program of detailed information packets, workshops and technical assistance, and initiated concurrent review for planning and environmental requirements to speed processing. Santa Barbara County has assigned a Permit Coordinator to resolve conflicts and to ensure that time deadlines are met. The County has also developed a CEQA threshold of significant impact document to alert project developers when mitigation will be required.

Contact: Santa Barbara County Air Pollution Control District, 26 Castilian Dr., Suite B-23, Goleta, CA 93117, (805) 961-8800.



It would be helpful for the local government to provide information on the kinds of mitigation that have been required in the past, and, if desired, to list the kinds of mitigation they would consider for various impacts of future projects. CEQA, however, requires that mitigation be devised on a case-by-case basis to address actual impacts of each project. Therefore, project proponents will need to be able to identify specific project impacts.

The result of advance information to developers will be more complete applications, greater consistency, and improved review efficiency.

- Pertinent siting information. Communities with a data bank or a geographic information system (GIS) can easily provide developers with pertinent siting information. Information such as the location of sensitive receptors, soil types, species of concern and sensitive biological areas can help a developer to choose a facility site that will be more likely to be approved. See the *Energy Facility Planning with a* GIS insert on page 3.18. (See Chapter 3 for more information on useful data for local energy facility planning purposes.)

CUTTING THROUGH THE RED TAPE —*TOGETHER*

The California Council on Partnerships was established in 1983 by the California State Association of Counties as a public-private partnership. This mutual effort on the part of local government and the business community has resulted in *Cutting Through the Red Tape - Together,* the report of its Red Tape Task Force. The Task Force commissioned a study that included a survey of 4,000 businesses and all of California's cities and counties to ascertain their feelings on the permit process and to discover what had been done and what could be done to improve the process. The result is an excellent resource for local governments that wish to understand better the problems that developers face when applying for permits in general. Many of the ideas presented in this chapter have their origins in this document.

Contact: California Counties Foundation, California Council on Partnerships, 1100 K Street, Suite 101, Sacramento, CA 95814, (916) 327-7507.

- Public information manual. A public information manual can include the information in the above sections. It can also contain legal and procedural requirements, projected costs and time frames, and roles and responsibilities of other agencies and utilities for energy facility permits. Such a manual will be useful to energy developers before they start the permitting process by reducing the possibility of delays and associated permitting costs.

PERMIT PROCESS STREAMLINING TECHNIQUES

Permit streamlining will reduce the time and costs of issuing and obtaining permits. Several reference books are available (see the above box *Cutting through* the *Red Tape Together,* and the INFORMATION RESOURCES section of this chapter) that focus on permit streamlining. Examples of useful techniques include: one-stop permit centers, pre-application packages and conferences, simplified permit language, one point of contact for all local permits, cross training of staff, and the use of Master Environmental Assessments and program-level EIRs.

- One-stop permit center. One-stop permit centers provide all local government permitting information for multiple local agencies in one place and can reduce some of the time and frustration associated with the energy facility permitting process. Employees at the center are usually cross-trained regarding the requirements of all local agencies. Ideally, the center contains a shared database so that the applicant fills out only one application. The information contained in the application can be shared by all agencies represented at the center. This step alone will eliminate duplication that would otherwise occur if the agencies were not coordinated. One-stop permit centers can also provide the required forms and information from other local governments, and state and federal agencies as appropriate.

◩ A single "point-of-local government-contact" person. Providing a single "point-of-local-government contact" person for the project developer to work with will reduce the potential confusion and frustration associated with a permit application, particularly when issues or concerns arise over an application. A single contact person can identify and resolve interagency conflicts before dispensing information to a developer; act as an ombudsperson to resolve conflicts between a project developer and local agencies; handle concerns from the public regarding an application; and improve the resolution of conflicts that may occur. Through cross-training, the contact person understands the entire local permitting process and the requirements of all agencies. See the accompanying box titled *County Examples of Permit Facilitation* for an example.

◩ Cross-train staff. When a single local point-of-contact is not possible to dispense permitting information for all agencies, cities and counties can cross-train some staff within each agency so they better understand the entire permitting process, not just their particular area. Understanding the entire process and the ultimate goals of regulations, should help to reduce unnecessary conflicts over insignificant details.

◩ Pre-application packages and conferences. A pre-application package should contain the information noted under "Developer Guidance." A pre-application conference will involve the applicant and representatives from all local, regional, state and federal agencies requiring permits or approvals, or that are otherwise interested in the project. All interested parties have the opportunity to provide the potential developer with their concerns and requirements. The developer can then design in the requirements from the start and should not have to go through costly and time consuming application resubmittals. Information about the type and number of permits, approximate costs, and length of approval time can be identified and discussed. Interagency conflicts regarding permit conditions can also be identified and resolved. See the box below entitled *County Examples of Permit Facilitation.*

◩ Clearly written regulations. Energy facility permit problems can be caused by the intricate and confusing language of some regulations. Writing regulations clearly will help to eliminate any confusion that currently exists. Certain ordinances and regulations will require precise, technical language to ensure their compliance. When this is the case, a lay person's translation should also be provided.

◩ Environmental Documents. Cities and counties can develop Master Environmental Assessments (MEAs) or program level EIRs. A MEA is a document containing data describing environmental characteristics and constraints of an area which can be used in subsequent environmental documents and to influence the design and location of individual projects.

Program level EIRs address impacts from a specific type of program or related projects such as energy or transportation. It can ensure consideration of cumulative impacts that might be slighted in a case-by-case analysis and can allow the lead agency to consider broad policy alternatives and program-wide mitigation measures at an early time when the agency has greater flexibility to deal with basic problems or cumulative impacts. Use of program level EIRs may reduce the work necessary for later

COUNTY EXAMPLES OF PERMIT FACILITATION

Santa Cruz County has adopted and put into effect a number of objectives for their permitting process. These include providing applicants with complete information concerning the application process along with time estimates for each step, a single point of contact person for application processing, early notification of any processing delays, and appeal information. These reforms came about after the county surveyed permit applicants about their satisfaction with the County's process.

Contact: Santa Cruz County Planning Department, 701 Ocean Street, Santa Cruz, CA 95060, (408) 454-2580.

Glenn County requires that energy facility developers attend a pre-application conference with affected local and state agencies. The County has also developed design standards for various energy facility types that can alert developers to the requirements they can expect if they wish to locate in the county.

Contact: John Benoit, Glenn County Planning Department, 125 S. Murdock Street, Willows, CA 95988, (916) 934-6540.

PLACER COUNTY INTERAGENCY PERMIT COORDINATION

The Placer County Permit Streamlining Committee (PSC) was established by the Placer County Board of Supervisors in 1986. Its membership includes a member of the Board of Supervisors, the Planning Commission, and the Business and Industrial Development Commission, the County Executive Officer, the Public Works Director, the Community Development Director, the Health Administrator, and the Administrative Assistant to the Board of Supervisors who serves as the PSC Chair. The PSC serves two functions. First, it acts as the coordinating agency for the land development application and permit process in the County. Second, it provides an internal forum for coordinating review of major projects by several different departments in situations where comments or concerns of one department need to be reconciled with those of another. PSC review does not replace a technical review by separate departmental staffs, but provides a more comprehensive perspective and serves to mediate differences. Comments made by PSC members are advisory only and are not considered a formal recommendation by the county or by a hearing body. The PSC may review an application at any time in the permitting process. The Committee recommends, however, that consideration of the project be requested prior to formal submission of an application to the County, when the project is still in the conceptual stage. Project proponents are urged to use their time before the PSC as a forum to assess a proposal's feasibility and to learn of potential procedural or political issues that must be resolved.

Contact: Administrative Assistant, Placer County Board of Supervisors, 175 Fulweiler Avenue, Auburn, CA 95603, (916) 889-4010.

project specific EIRs. However, CEQA Guidelines provide that where subsequent activities involve site specific operations, the agency should use a written checklist or similar device to document the evaluation of the site and the activity to determine whether the environmental effects of the operation were covered in the program EIR. While program level EIRs do not require the naming of specific projects, Master EIRs do.

Master EIRs may be prepared for a project consisting of smaller individual projects to be phased in, as well as for general plan documents or a specific plan. A Master EIR must include sufficient information about anticipated projects within its scope, such as size, location, intensity, and scheduling. It must also preliminarily describe potential impacts of anticipated projects for which insufficient information is available to support a full impact assessment.

A Master EIR for a phased-in project can effectively reduce the extent of subsequent environmental review if it includes the anticipated projects that fall within its scope. The project lead agency must prepare an Initial Study to determine whether the anticipated project and its significant environmental effects were included in the Master EIR. If a lead agency can make a finding that concludes that no additional significant impacts will occur due to a anticipated project within the scope of the Master EIR, and that no additional mitigation measures or alternatives may be required, it may prepare a written finding to that effect with-out preparing a new environmental document or finding.

If such a finding cannot be made, either a mitigated negative declaration or a focused EIR must be prepared by the project lead agency. The advantage of the latter is that only those project-specific effects on the environment that were not covered in the Master EIR have to be analyzed in the negative declaration or the focused EIR. Significant time savings can result.

◩ Familiarity with energy technologies. Becoming familiar with energy technologies will help to reduce the time associated with their permitting. When confronted with a new technology or facility type, local government agencies are understandably cautious. Once a local community has had experience permitting an energy technology, it can benefit from this experience by focusing more efficiently on key issues and their resolution, making the next application for a similar facility type easier.

INTERAGENCY CONSULTATION AND COORDINATION

Energy facilities often have complicated issues associated with them that require permit approval from many agencies at various government levels. Coordinating permit requirements of the various agencies and jurisdictions involved with energy facility permitting is another way to reduce time and confusion. Coordination can involve joint review of permit applications; sharing information between agencies and jurisdictions; eliminating inconsistent policies, standards and duplicative permit approvals; using parallel permit processing; and delegating permit authority.

◩ Joint review panels. Joint permit application review panels reduce conflict and help ensure complete applications. Preapplication conferences, where the developer and representatives of affected agencies gather to discuss permit requirements, provide the developer with necessary information before the application(s) is completed. Regardless of when joint review happens, it will serve to coordinate the efforts of the various agencies and lessen potential conflicts. Joint review will also help to assure the participation of responsible agencies for compliance monitoring after the facility is in operation. See the insert *Placer County Interagency Permit Coordination* on the previous page.

◩ Interjurisdictional relationships. Cities and counties can develop contacts with other local jurisdictions with previous energy facility siting experience and avoid having to "reinvent the wheel." Jurisdictions may wish to consider forming a regional work group to discuss ideas for developing consistent energy facility permitting processes and/or resolving mutual problems encountered as a result of energy facilities.

◩ Consistent policies and standards among agencies that have jurisdictional overlap. Ensuring consistent policies and standards among agencies that have jurisdictional overlap will eliminate conflicts between jurisdictions when permits are sought. There may be instances, however, when there is a need for differing requirements.

◩ Intrajurisdictional policy and ordinance consistency. Inconsistencies may exist with regulations within a single jurisdiction. Local policies, ordinances, regulations and standards enacted at different times or by different departments may be in conflict. Local government agencies can review local policies and ordinances for consistency, and change or eliminate those that are not in line with the community's guiding goals and objectives. Cities and counties may also consider consolidating or reorganizing departments and/or their jurisdictional authorities to eliminate overlapping requirements.

◩ Eliminate duplicative permit approvals. If cities and counties have developed relationships with other local, regional, state or federal agencies, they can work to eliminate duplicative permit approvals where feasible. If a state permit for a particular project characteristic protects the local government's concern in the matter, two permits may not be necessary. However, state permits usually preempt local authority and the elimination of a local permit is usually due to this preemption.

◩ Parallel and combined processing. Parallel processing can speed up the permit approval process. Often when multiple approvals are necessary, the application must be approved in a specified order. Sequential processing is usually done to avoid unnecessary work. If one department does not approve a

LAKE COUNTY PERMITTING PROCESS

Lake County has large geothermal reserves including one of the largest geothermal developments in the world, the Geysers. Geothermal development at the Geysers was initially characterized by protracted environmental conflicts. In response, Lake County formed a Geothermal Advisory Board. It is composed of residents, industry, and public agency representatives covering a broad spectrum of resource interests who are appointed by the Board of Supervisors. The Advisory Board's role is to work together with the Planning Commission and Board of Supervisors to ensure that:

1) All phases of the planning process are open to public and industry participation

2) Technical information is made available to the public for explanation and interpretation of resource and environmental issues

3) Two-way communication occurs between County officials and the public and industry on the rationale used to reach decisions

The County has also implemented a Request for Review form to coordinate the permit process. The form is circulated to all county, state and federal agencies at the time a geothermal facility application is received. Agencies with permitting or review authorities are identified early and the project proposal is then circulated for their comments.

Contact: Mark Dellinger, Energy and Resource Manager, Lake County Special Districts, 255 N. Forbes Street, Lakeport, CA 95453, (707) 263-2273.

permit, there is no reason to have other departments spend time on it. Unfortunately, this often increases the time necessary to obtain a permit. Parallel processing works as long as the application does not change in a way that affects the concerns of other departments.

Combined processing is often used if there are co-lead agencies and no interagency agreement has designated one "lead agency." (See below.) Cooperative and combined processing can also be used if many departments are reviewing the permit at the same time, most of the approvals can be obtained simultaneously, and only those departments with problems will require alterations and resubmittal.

◩ Lead agency agreements. The document *Cutting through the Red Tape-Together!* (See insert on page 4.5) suggests that permitting process efficiency would be enhanced by use of interagency agreements when more than one local agency has authority over a permit area. They would agree on which, and under what circumstances, one of them would become the "lead agency." In such cases, the "responsible" agencies use the environmental documents prepared by the other agency in their permitting processes. The agreement will describe performance standards, and conditions and criteria the agent must use on behalf of the other agencies. Appeal procedures should be clearly defined.

A QUANTITATIVE APPROACH TO COMPARING ALTERNATIVES

Example: Transmission Line Routing

Processes exist that can be used as a quantitative basis for California public agencies to compare alternative energy facility sites or routes for a linear facility. For example, the Z-score process is a statistical procedure to "normalize" and therefore put in perspective the data from different types of impacts. The process is a way of comparing the relative scale of important but unrelated impacts, such as a comparison between impacts from a facility to an endangered plant species versus the visual impacts of the facility to two thousand residents. The Z-score process can include weighting of impact categories based on perception of their relative value or importance.

The Z-score process was utilized for the City of Riverside in the selection of a route for the Orangecrest-Springs 69-kV electric power transmission line project. The first step in the route selection process was to develop a list of feasible route segment alternatives. Next, an objective process was developed for evaluating the route segments and thereby limiting the number of alternative routes for more detailed study. The City actively sought community input during this stage to ensure that community concerns were included in the selection process. Twelve evaluation factors were selected, each of which was given a numerical weighting score. Weights were developed that reflected the relative importance of the evaluation factors; the most important factors were given a high number and the least important were given a low number. Z-scores were used to determine the most and least favorable route segments. Route segments were then joined into entire routes, and the entire routes were scored using the Z-score process. Route Z-scores were presented at a Public Open House. After receiving public input, five routes were chosen for more detailed study as project alternatives.

For more information on the "Z-score" process, contact John Keene, Resource Management International, Inc., 3100 Zinfandel Drive, Suite 600, Sacramento, CA 95670, (916) 852-1300, FAX: (916) 852-1073.

PUBLIC INVOLVEMENT

Public involvement can be critical in its effect on the energy facility permitting process. An informed and involved public can make the process more efficient and less costly. The public can provide useful advice and support. Public involvement should occur early in the permitting process, continue throughout the process, and be a meaningful attempt to understand and resolve local issues. The process should not be seen as just a public education or coercion attempt. Identifying goals and stakeholders, holding frequent public workshops, utilizing technical advisory committees, and facilitating communication are ways that local governments can focus and improve public input.

◩ Identify goals and stakeholders. Once public involvement goals have been defined, key community leaders and any other citizens or groups that may have an interest in the success or failure of the facility permit should be identified and made part of the process. The stakeholders should be involved to the maximum extent possible and be kept informed of activities in which they do not participate. It is important for these stakeholders to be provided access to the permit agency and the developer.

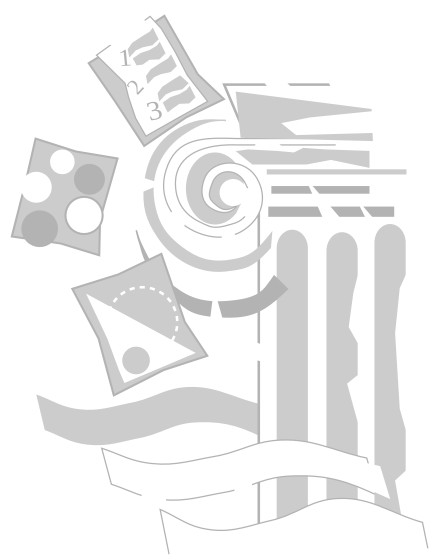
◩ Frequent public workshops. Public workshops early in the permitting process will provide meaningful opportunities for addressing community issues. Being less formal than public hearings, they provide an opportunity for creating a dialogue and facilitating important public input and support. Workshops are more effective at addressing public concerns when held early in the permit process, when changes are easy to make. Public hearings that come late in the process, after time and energy have been invested in a facility application, can be ineffective.

◩ Citizen advisory committees. Citizen advisory committees, composed of community representatives, can be organized to advise local governments of energy facility issues and serve as public representatives in the rulemaking process of a regulatory agency. Committee members should be integrated into the permitting process, with their concerns and suggestions being considered at all stages of the project. They can also be included in the rulemaking process, possibly reducing later conflicts on specific permits. See the box on page 4.8 entitled *Lake County Permitting Process* for an example.

◩ Communication facilitation. Several techniques are available to facilitate communication between the developer, the public and regulatory agencies. Design charrettes are one method. Charrettes are one to seven day intensive, collaborative efforts that bring together concerned citizens, stakeholders, and all the relevant information with a detailed plan as the product. The charrette process involves working interactively with design consultants who sketch and render basic design plans based on input from participants. A charrette can result in a more easily approvable project.

Computer simulations are another way to convey energy facility proposals in order to help the public visualize what a project will look like. Communities have also used weighted preference systems to involve the public in permitting decisions. See the box on the previous page entitled *A Quantitative Approach to Comparing Alternatives*.

An “Info Expo” is another way to inform the public and answer their questions on energy facility proposals. All the residents of the host community should be invited to a combination open house and science fair. Various experts can be located at information booths, and throughout an afternoon discuss the project with attendees, answering their questions, and in some cases, conducting impromptu debates. Unlike a hearing, the Info Expo creates the opportunity for real “give and take.”



MATRIX OF LOCAL GOVERNMENT REQUIREMENTS FOR WIND ENERGY CONVERSION SYSTEMS (WECS)

REQUIREMENTS	ALAMEDA CO.	CONTRA COSTA CO.	GLENN CO.	KERN CO.	MERCED CO.	MONTEREY CO.	RIVERSIDE CO.	SOLANO CO.	PALM SPRINGS
Setback: Structures (e.g. residences, businesses)	3X total WECS height[1] from residential or commercial zoning[2] (but in no case less than 500 ft)[3] 3X total WECS height from a Dwelling Unit[2] (but in no case less than 500 ft)[4]	A minimum of 1,000 ft from any existing off-site residences or residential areas All WECS, buildings, and structures shall be sited to minimize visual impact to residences within one mile	*Horizontal Axis WECS:* 2X total WECS height from structures and homes *Vertical Axis WECS:* At least 10 blade diameters from structures and homes	Minimum 4X total WECS height or 1,000 ft (whichever is greater) from any off-site residence on an adjacent parcel[6] Minimum 1.5X total WECS height from any on-site residence or accessory structure designed for human occupancy	NA	1.25X total WECS height from any habitable structure	*Setback information is for Commercial WECS only* 1.25X to 3X total WECS height from any building[7 8]	Minimum of 10 ft from any structure on the property	No WECS shall be closer than 1,200 ft from any residence, hotel, hospital, school, library, or convalescent home (may be reduced due to factors of topography or the characteristics of the proposed WECS project) 1.25X total WECS height from any off-site building[9]
Setback: Property lines	1.25X total WECS height from all property lines 3X total WECS height from a Building Site upon which a windfarm has not been approved[2] (but in no case less than 300 ft)[4]	3X total WECS height or 500 ft (whichever is greater) from exterior project boundaries	NA	4X total WECS height or 500 ft (whichever is greater) from exterior boundaries if project site is adjacent to parcels of less than 40 acres[6] 1.5X total WECS height from all exterior boundaries if project is adjacent to parcels of 40 acres or more (allowance for setback reduction)	1.25X total WECS height from any exterior property line	2X total WECS height from any property line	1.25X to 3X total WECS height from any lot line[7 8] (If WECS is located in the W-E or W-1 zone) 3X total WECS height from lot line of any lot containing a dwelling[8]	Minimum 1.25X total WECS height from any property line (Setbacks determined by height may be waived when appropriate easements are secured from adjacent property owners) 300 ft from any district which does not permit WECS	1.25X total WECS height from any lot line[9] Minimum 200 ft from any lot line of a lot containing a dwelling
Setback: Public roads, highways	3X total WECS height[2] (but in no case less than 500 ft)[3] 6X total WECS height from the travelled way of I-580[5] (but in no case less than 500 ft)	All WECS, buildings, and structures shall be sited to minimize visual impact to adjacent roadways, and County scenic routes	NA	Minimum 1.5X total WECS height	1.25X total WECS height	5X total WECS height from the right-of-way line of any public road or highway	1.25X to 3X total WECS height[7 8] Scenic setbacks required from various state highways	NA	1.25X total WECS height[9] Scenic setbacks required from various state highways and roads
Setback: Railroads	NA	NA	NA	Minimum 1.5X total WECS height	NA	NA	1.25X to 3X total WECS height[7 8]	NA	1.25X total WECS height[9]
Setback: Above Ground Transmission Lines (more than 12 kv)	NA	NA	NA	NA	NA	NA	1.25X total WECS height	NA	1.25X total WECS height

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1 Total WECS height is measured from grade to the uppermost extension of any blade, or the maximum height reached by any part of the windmill.
2 If the ground elevation of the windmill is 2 or more times the height of the windmill above the protected feature, the setback shall be 4X total height of the windmill.
3 A reduction may be granted if it is shown in a report prepared by a qualified professional, and verified by the County, that a lesser minimum setback is adequate, however, in no case shall a setback less than 300 ft ever be provided.
4 This setback may be reduced by a maximum of 50% if the written, notarized, and recorded agreement of the affected property owner is obtained.
5 Setback from the travelled way of I-580 shall be 8X the total height of the windmill if the ground elevation of the windmill is 2 or more times the height of the windmill above the travelled way of I-580.
6 The Planning Director may allow a reduction in this setback, not to exceed a minimum setback of 1.5X total WECS height, if a letter of consent from the owner of the adjacent parcel is filed with the Planning Department.
7 If WECS is located in the W-E zone or W-1 zone, the setback shall be 1.25X the total WECS height from the protected feature. If located in any other zone, the setback shall be 3X the total WECS height.
8 This setback shall be reduced to 1.25X total WECS height if WECS is certified as complying with safety standards or may be reduced to 1.25X total WECS height if the topography of the adjacent property eliminates or substantially reduces potential safety hazards.
9 This setback may be reduced to less than 1.25X total WECS height if Planning Commission determines that the topography of, or other conditions related to, the adjacent property or right-of-way eliminates or substantially reduces the potential safety hazards.

MATRIX OF LOCAL GOVERNMENT REQUIREMENTS FOR WIND ENERGY CONVERSION SYSTEMS (WECS) (CONT)

REQUIREMENTS	ALAMEDA CO.	CONTRA COSTA CO.	GLENN CO.	KERN CO.	MERCED CO.	MONTEREY CO.	RIVERSIDE CO.	SOLANO CO.	PALM SPRINGS
Noise Levels	Not closer than 1,000 ft in an upwind direction from any dwelling; nor closer than 300 ft in any other direction from any dwelling or Building Site; bonds required[10]	Not to exceed 65 dB(A) as measured at any lot line Cash deposit of $3,000 used in the investigation and evaluation of a noise complaint or permit violation	*Noncommercial WECS:* Not to exceed 65 dB, measured at nearest residential dwelling *Commercial WECS:* Not to exceed 65 dB, measured at nearest inhabited structure	Not to exceed 45 dB(A) for more than 5 minutes out of any hour; or to exceed 50 dB(A) for any period measured within 50 ft of home, school, hospital, church, or public library	Not to exceed 60 dB(A) CNEL from closest existing residence	In compliance with Noise Element of the General Plan	Not to exceed 65 dB(A); 60 dB(A) if point of measurement is adjacent to a lot used for residential, hospital, school, library, or nursing home purposes; Accessory WECS not to exceed 60 dB(A)	Not to exceed 50 dB(A) CNEL at any property line abutting a residential zone; 60 dB(A) CNEL at any other property line	Not to exceed 55 dB(A) at measurement point; limit reduced by 5 dB(A) if pure tone noise will be generated; setbacks[12]
Interference with Broadcast Signals/ Navigational Systems	NA	Shall be designed, installed, and operated so that no distrupting electromagnetic interference is caused	Shall not create electromagnetic interference that can disrupt local residents or businesses	NA	Wind turbines shall be filtered and/or shielded to prevent interference with broadcasting signals	No disrupting electromagnetic interference shall be caused	Shall comply with FAA regulations for siting structures near an airport or VORTAC station	Wind turbines shall be filtered and/or shielded to prevent interference with broadcasting signals	Shall comply with FAA regulations for siting structures near an airport or VORTAC station
Avian Injury/ Mortality	File reports; obtain veterinary care; pay monitoring fees[11]	NA	File reports; contact avian rehabilitation center	NA	NA	NA	Report all dead birds found within 500 ft of a WECS	File reports; annual fee to fund avian activity research (Limited term, now expired)	Report all dead birds found within 500 ft of a WECS
Distribution Lines/ Power Poles	Electrocution protection measures	NA	NA	All on-site electrical wires associated with WECS shall be installed under-ground	NA	NA	Electrical distribution lines on project site shall be undergrounded	Transmission lines under-grounded; raptor protection measures	Electrical distribution lines on project site shall be undergrounded; raptor protection
Soil Erosion/ Sedimentation Control Plan	Required prior to issuance of any building permits	NA	NA	Required prior to issuance of any building permits; surety bond to guarantee implementation	Erosion control plan required	NA	NA	Grading/erosion/ sedimentation control plan required	NA
Inoperable or Unsafe WECS/Site Reclamation	If a windfarm has not produced electricity in 1 year or more than 50% of the turbines are being removed or in disrepair, and there is no plan to restore production, the permittee shall restore site; or cash performance deposit is required.	Reclamation plan required; cash deposit required to insure completion of site reclamation	Not operational or not producing electricity, dismantle blades within 6 months; not operational for continous 2 year period, reclaim site to natural state	NA	Reclamation plan and bond required	Not operational for continous period of 1 year, required to be removed; permittee shall maintain a fund payable to County for the removal	Inoperable and unsafe WECS shall be repaired or removed by the owner; site shall be restored to its natural condition; a bond may be required	Surety bonds may be required to guanantee removal of any abandoned windmills	Not operational for continous 1 year period WECS shall be declared a public nuisance and must be repaired or removed; a bond may be required
Encountering Achaeological Resources	Halt work within 30 meter radius; retain archaeologist	NA	NA	NA	NA	NA	NA	Halt work; retain archaeologist	NA

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10 A cash bond in the amount of $2,000 to be used in the investigation of a noise complaint. A $10,000 performance bond which shall inure to the benefit of property owners or residents within one half mile of the windfarm who suffer damage as a result of a violation of the noise standard.

11 Fees shall be used by County to prepare a permanent compliance monitoring program to oversee compliance with existing and proposed mitigation measures, EIR, and General Plan.

12 Wind turbines prohibited within 200 ft of any property used for residential, hotel, hospital, school, library or convalescent home purposes. Acoustical report indicating compliance with noise level limits required for wind turbine development at a distance between 200 ft and 3,000 ft from previously stated land uses. At distances greater than 3,000 ft from previously stated land uses, development may be permitted without acoustical study.

MATRIX OF LOCAL GOVERNMENT REQUIREMENTS FOR WIND ENERGY CONVERSION SYSTEMS (WECS) (CONT)

REQUIREMENTS	ALAMEDA CO.	CONTRA COSTA CO.	GLENN CO.	KERN CO.	MERCED CO.	MONTEREY CO.	RIVERSIDE CO.	SOLANO CO.	PALM SPRINGS
Safety/Security	Maintain phone numbers of inhabitants of all adjacent properties in event of fire	Warning signs; manual and automatic controls to limit blade speed; tower access limitation	NA	Warning signs; fencing; fuel break	Braking system; blade pitch control; manual and auto overspeed controls	Fencing; warning signs; manual and auto controls to limit blade speed	Fencing; guy wires marked; warning signs; fire protection measures	Windmill equipped with breaking system; blade pitch control	Fencing; warning signs; fire protection
WECS Height	NA	NA	NA	Not to exceed maximum height allowed for antennae and towers by the district with which Wind Energy District is combined	NA	*Noncommercial WECS:* Not to exceed 50 ft; 100 ft if parcel WECS is located on is 10 acres or larger *Commercial WECS:* 200 ft maximum[13]	*Commercial WECS:* Comply with height limits of zone where located *Accessory WECS:* 80 ft or less in any zone	NA	Not to exceed 200 ft
Height of Blade Tip from Ground	NA	NA	NA	NA	No lower than 15 ft unless enclosed by 6 ft high fence	Lowest position of blade shall be at least 30 ft above the ground and 30 ft above highest existing structure or tree within a 250 ft radius	*Horizontial axis WECS:* No lower than 25 ft; *Vertical axis WECS:* If rotors are less than 15 ft from the ground, WECS shall be enclosed by a fence	Minimum 15 ft from ground unless enclosed by 6 ft high fence	*Horizontial axis WECS:* No lower than 25 ft; *Vertical axis WECS:* If rotors are less than 15 ft from the ground, WECS shall be enclosed by a fence
Density	NA	NA	1 turbine per 10 acres	Accordance with industry standards	NA	NA	NA	NA	NA
Color/Finish	Blend with surroundings	Nonreflective, unobtrusive color	NA	Nonreflective, unobtrusive color; nonreflective surface	Nonreflective, nongloss gray	Colors and surface treatment shall minimize disruption	Light environmental colors, or darker, fully-saturated colors; matte or galvanized finish	Neutral, nonreflective	Light environmental colors, or darker, fully-saturated colors; matte or galvanized finish
Project Identification Signs/Advertising/Logos	NA	No advertising sign or logo on any WECS; no more than 2 project identification signs, not to exceed 16 sq ft in area or 8 ft in height	NA	One project identification sign, not to exceed 32 sq ft in area	Brand names or advertising shall not be visible from any public access	NA	No advertising sign or logos on WECS; no more than 2 signs relating to the development allowed, not to exceed 15 sq ft in area or 8 ft in height	Brand names or advertising shall not be visible from any public access	One project idenification sign, not to exceed 50 sq ft or 8 ft in height; no advertising signs or logos on WECS
Status Report	Rated capacity, meteorological data, actual power generated	NA	NA	NA	NA	NA	Quarterly power production report to the Planning Department	Rated capacity, meteorological data, actual power generated	NA
Insurance Policy	Comprehensive General Liability in minimum of $1,000,000	NA	NA	NA	NA	Shall maintain an insurance policy to cover installation and operation of WECS	NA	General Liability and Workers' Compensation in minimum of $1,000,000	NA

Prepared 7/95

[13] WECS shall be equipped with air traffic warning lights and shall have prominent orange markings on the rotor blade tips if total height exceeds 175 ft or if any WECS exceeding 125 ft in total height is placed at an elevation over 200 ft.

STATE AND FEDERAL PREEMPTIONS FOR ENERGY PROJECTS

Characteristics of a project, including the facility type, size, location and project applicant all help to identify if the project is under a local agency's authority or if there is a state or federal preemption.

In terms of electric generating facilities, there are two types that trigger preemption of local authority regardless of project applicant. First, non-federal hydroelectric facilities (i.e., those not built by the federal government) are normally under the licensing authority of the Federal Energy Regulatory Commission (FERC). Exemptions from FERC's license are granted only if projects meet specific criteria (see the Guest Author article by Fred E. Springer at the end of this chapter). Exempted hydroelectric projects are subject to state environmental review.

Secondly, thermal power plants, 50 MW or greater, and their related facilities including transmission lines are normally under the authority of the Energy Commission. Among other things, the Energy Commission must review projects within its jurisdiction for compliance with local laws, ordinances, regulations, and standards. The Energy Commission strongly encourages local agencies to participate in its licensing process.

EXAMPLES OF NON-UTILITY APPLICANTS

- Chevron
- Gilroy Foods
- U.S. Generating Company
- Mission Energy
- San Francisco Energy Co.

In terms of applicants there are three general types: municipal or other publicly-owned utilities; investor-owned utilities; and non-utility private enterprises. The following preemptions apply if not preempted by FERC or the Commission as explained above.

◩ Publicly-Owned or Municipal Utilities. Some publicly-owned utility energy projects may be subject to local permitting requirements in their own jurisdictions, but the Legislature has granted some exemptions. For example, Government Code section 53091 generally exempts municipal utility facilities "for the production or generation of electrical energy" from the zoning and building codes of cities and counties.

◩ Investor-Owned Utilities. The CPUC asserts jurisdiction over investor-owned utilities for most energy projects and considers its authority preemptive of all local regulations. Under Public Utilities Code section 761, the CPUC is granted regulatory authority over the method and means of locating and constructing investor-owned utility equipment and facilities.

Although the CPUC has preemptive authority over most investor-owned utilities' projects, it does encourage the utilities to consult with local agencies. In particular, the CPUC requires an investor-owned utility to obtain nondiscretionary permits and approvals for certain substations and distribution power lines (< 50kV) when no CPUC permits are required. (CPUC D94-06-014)

CALIFORNIA'S MAJOR MUNICIPAL UTILITIES

- Los Angeles Department of Water & Power
- Sacramento Municipal Utility District
- Imperial Irrigation District
- Northern California Power Agency

◩ Non-Utility, Privately Owned Enterprises. All relevant local laws and regulations generally apply unless specifically preempted by state or federal law. Non-utility proponents of intrastate oil or gas pipelines are presumably subject to the requirements of local governments. However, the CPUC may assume jurisdiction if such pipelines interconnect with an investor-owned utility system. (Pub. Util. Code section 2811.) FERC through its discretion may also preempt local authority for certain interstate pipeline projects depending upon project characteristics.

UNDERSTANDING THE PERMITTING PROCESSES OF STATE AND FEDERAL AGENCIES

The charts beginning on page 4.16 generalize the major steps in permit application review and approval processes of several state and federal agencies for proposed or existing electrical generation and linear facilities in California. These charts highlight the points at which local governments and the public can participate in these processes.

The processes are presented by facility type and, in some cases, generating capacity, as follows:

- Thermal power plants 50 MW or greater
- Thermal power plants under 50 MW and non-thermal (except hydroelectric) power plants
- Hydroelectric generation facilities
- Linear Facilities (electricity transmission lines and natural gas pipelines)

Federal and state permit application review processes are charted separately with the exception of applications for thermal power plants, 50 MW and greater. Each agency's specific licensing or approval requirements are not shown. At the time of this writing, the only abbreviated or exemption application process characterized is the Energy Commission's Small Power Plant Exemption.

Each flow chart incorporates the major components of the environmental review process (NEPA or CEQA) with specific requirements of various agencies italicized. Federal agencies follow NEPA for environmental review purposes. NEPA does not set a time limit for completion of environmental assessments. The charts represent the events to be followed when an Environmental Impact Statement is required. State agencies follow CEQA with a specified time frame of 12 months. In addition to the 12 months, many agencies typically allow for a Data Adequacy period which the Permit Streamlining Act limits to 30 days (Gov. Code Section 65943). Also a three month extension can be granted under California's Permit Streamlining Act with the applicant's consent. The charts depict events to be followed when an Environmental Impact Report is required.

Finally, each chart contains at least four generalized review stages: discovery, analysis, hearings and decision. These terms are used to characterize the activities in each stage and are not necessarily used by the agencies discussed. In some processes, a Data Adequacy stage is also present. Whether formal or informal, most review processes have a "prefiling" stage which provides an opportunity for potential applicants, lead agencies and responsible agencies to clarify any ambiguities about a given process or requirement and to identify interested parties. For the most part, the greatest opportunity for local governments to become involved in these processes occurs during the discovery and hearing stages.

THERMAL POWER PLANTS

The California Energy Commission has jurisdiction for permitting all thermally based power plants producing 50 megawatts or greater. This grant of authority is preemptive of local regulation. A license from the Energy Commission, if granted, takes the place of all permits that otherwise would have been required by state and local entities. However, the statute which creates the Energy Commission's jurisdiction also directs the Energy Commission to consider whether a proposed project will conform to local laws and regulations (Pub. Resources Code 25523(d)(1)).

A project will conform to local laws and regulations only if the Energy Commission makes certain findings. To license such a project, the Energy Commission must find that the project is needed for the public convenience and necessity and that there is no more prudent and feasible means of meeting this need (Pub. Resources Code 25525). Of the more than 40 projects approved in its 20 year history, the Energy Commission has overridden local regulations only once.

The process before the Energy Commission includes an environmental review meeting the requirements of the California Environmental Quality Act (CEQA). The timing and form of documents produced during this review are somewhat different from those prepared pursuant to CEQA in most other proceedings. This is because the Energy Commission conducts a certified regulatory program that has been approved as fulfilling the requirements of CEQA in an alternative format (functionally equivalent).

It is important for local agencies wishing to participate in a power plant siting case to consult with the Energy Commission to ensure full awareness of the timing and significance of analytical documents and of all opportunities for input.

POWER PLANTS

THERMAL— 50MW or GREATER

• State Agencies •

• California Energy Commission

- The Commission's AFC process is functionally equivalent to an EIR process.
- Opportunities for local agency input are noted in bold.

Application for Certification (AFC) Process*:

Typical Time: 12 Months

Phase:	Data Adequacy	Discovery	Analysis	Hearing	Decision
Time: (Months)	-1.5 to 0	0 to 5	5 to 10	10 to 11.5	11.5 to 12
Activity:	• Applicant files Application for Certification (AFC). • **Local agencies are asked to review an application to determine if it adequately discusses the project's compliance with their laws, ordinances, regulations and standards.** • Applicants are requested to submit additional information necessary to deem application complete. • 30 days after filing, Executive Director must make recommendation to full Commission. Commission has up to 45 days to reach decision regarding acceptances of application from date of filing.	• Commission accepts AFC as complete at a publicly-noticed Business meeting. • **Commission staff in concert with local agencies request, as needed, additional information of applicant for analysis purposes and conducts, if necessary, publicly-noticed workshops.** • **Local agencies, interested parties and Commission staff identify issues and, if necessary, develop mitigation measures.** • **Local agencies can intervene in the Commission's process with full rights to participate, present witnesses and submit testimony.**	• Commission staff files Preliminary Staff Assessment (PSA) approximately 180 days after Commission acceptance of AFC. • **Publicly-noticed workshops are held with the applicant & other interested parties to discuss PSA, including the proposed Conditions of Certification.** • **Public Prehearing Conference held.** • **Approximately 60 days after filing the PSA and 14 days before Hearings begin, Commission staff files Final Staff Assessment (FSA). The FSA serves as staff's testimony for hearings.**	• Commission Committee issues Presiding Member's Proposed Decision (PMPD) after hearing(s) conclude based on testimony and hearing record. • **Applicant, intervenors & interested parties are provided a minimum of 30 days to review the PMPD and file comments.** • **Committee hearing on PMPD.**	• Commission Committee issues revised PMPD (not required in all cases). • Commission adopts PMPD in a publicly-noticed Business Meeting.

* Can include transmission lines, natural gas pipelines, and other related facilities.

POWER PLANTS

THERMAL— 50MW to 100MW

• State Agencies •

• California Energy Commission

• Opportunities for local agency input are noted in bold.

Small Power Plant Exemption (SPPE) Process:

Typical Time: 6 Months

Phase:	Discovery & Analysis	Hearing	Decision
Time: (Months)	0–4	4–5	5–6
Activity:	• Applicant files for a Small Power Plant Exemption (SPPE). • Commission staff and local agencies, as needed, request additional information of applicant for analysis purposes. • Public workshops are held. • Local agencies, interested parties and Commission staff identify issues and, if necessary, develop mitigation measures. • Local agencies can intervene in the Commission's process with full rights to participate, present witnesses and submit testimony. • Commission staff publishes draft Initial Study which contains an environmental analysis and serves as staff testimony.	• Commission Committee holds public hearing(s) on SPPE Application. • Committee issues proposed decision, which contains Initial Study, on whether to grant exemption.	• Commission decides whether or not to grant the exemption at a publicly noticed Business Meeting. • If Commission approves exemption, staff files Initial Study and Negative Declaration with State Clearinghouse. • Local agencies can base their subsequent permits on environmental findings contained in the Commission's Initial Study and Negative Declaration.

POWER PLANTS

THERMAL— UNDER 50MW and NON-THERMAL (EXCEPT HYDROELECTRIC)[1]

• State Agencies and Municipal Utilities •

- California Public Utility Commission (CPUC)- for all IOU proposed projects.
- Municipal Utilities- for all projects proposed by municipal utilities.
- State Lands Commission (SLC)- all projects on state lands.

> • This chart generally incorporates the CEQA EIR Process.
> • Possible lead agency specifics are noted in *italics.*
> • Opportunities for local agency input are noted in **bold**.

Typical Time: 12 Months[2]

Phase:	Data Adequacy	Discovery	Analysis	Public Review	Decision
Time: (Months)	←Variable→0	3	6	9	12
Activity:	• Applicant files application. • CPUC and SLC have 30 days to review application for completeness. Munis have no required time period. • Applicant has 60 days to correct deficiencies. • The lead agency has one year to approve or reject the project after completion of the application. (A 3-month extension is possible).	• Lead agency determines if EIR is required. (30 days) • Notice of Preparation of an EIR is filed. • **Interested parties review application to identify issues to be considered in Draft EIR (30 days).** • **At interested party's request, scoping and content meetings are held (30 days).**	• Lead agency prepares Draft EIR. *- The CPUC's "Certificate of Public Convenience and Necessity" also requires a Need and Alternatives analysis and an Engineering review.* *- The CPUC's "Permit to Construct" seeks to complete the CEQA process in 9 months.* *- The SLC's "Land Use Lease" requires review for compliance with CEQA and trust use under which state land is held.* • Notice of Completion of Draft EIR filed with Office of Planning and Research.	• **Lead agency notifies public of availablility of Draft EIR.** • **Lead agency consults with and requests comments from all agencies that exercise authority over resources which may be affected by the project.** • **Interested parties and agencies review Draft EIR and submit comments to the lead agency. (45 days)** • **Public hearings are encouraged under CEQA but not mandatory.**	• Lead agency responds to Draft EIR comments. • Lead agency prepares Final EIR. • **Lead agency may provide public review of Final EIR before making a decision, but it is not mandatory.** • Lead agency certifies Final EIR.

[1] See hydroelectric permit process charts which follow.

[2] Extensions beyond the required 12 month time frame must be agreeable to the lead agency and the applicant.

POWER PLANTS

THERMAL— UNDER 50MW and NON-THERMAL (EXCEPT HYDROELECTRIC)[1]

• Federal Agencies •

- United States Forest Service- for projects on USFS lands.
- Bureau of Land Management- for projects on BLM lands.

> • This chart generally incorporates the NEPA EIS Process.
> • Possible lead agency specifics are noted by *italics.*
> • Opportunities for local agency input are noted in **bold**.

Typical Time: Varied.

Phase:	Prefiling	Discovery	Analysis	Public Review	Decision
Time:	← Variable → 0				No time limit
Activity:	• *Applicant consults with USFS on data requirements for application.*	• Application is filed. • Lead agency determines whether EIS is necessary. • Notice of Intent to prepare an EIS is published in Federal Register. • Public scoping meetings are held. • Lead agency prepares scoping report of issues.	• **Draft EIS is prepared in coordination with other agencies including local government.** • Lead agency determines whether proposed use is compatible with federal lands. • Lead agency conducts legal review to determine facility compliance with applicable laws, regulations, and ordinances.	• Lead agency publishes and distributes Draft EIS. • **Lead agency holds public meetings and workshops.**	• **Lead agency receives, considers and responds to public comments.** • Lead agency prepares and publishes Final EIS. • Decision is made at least one month after Final EIS is published.

[1] See hydroelectric permit process charts which follow.

PERMITTING PROCESSES OF STATE AND FEDERAL AGENCIES

POWER PLANTS

HYDROELECTRIC FACILITIES

• State Agencies •

• State Water Resources Control Board (SWRCB)

> • This chart generally incorporates the CEQA EIR Process.
> • Possible lead agency specifics are noted by *italics.*
> • Opportunities for local agency input are noted in **bold**.

Water Quality Certification:[1]

Typical Time: 12 Months[2]

Phase:	Data Adequacy	Discovery	Analysis	Public Review	Decision
Time: (Months)	←Variable→ 0	0–3	3–6	6–9	9–12

Activity:

Data Adequacy
- Applicant files application.
- Lead agency has 30 days to review application for completeness.
- Applicant has 60 days to correct deficiencies.
- SWRCB engineers are available to help prepare applications.
- The lead agency has one year to approve or reject the project after completion of the application. (A 1 year extension is possible for EIRs, 6 months for NDs).

Discovery
- Lead agency[3] determines if EIR is required. (30 days)
- Notice of Preparation of an EIR is filed.
- Interested parties review application to identify issues to be considered in Draft EIR (30 days).
- At interested party's request, scoping and content meetings are held (30 days).
- Lead agency consults with and requests comments from all agencies that exercise authority over resources which may be affected by the project.

Analysis
- Lead agency prepares Draft EIR.
- SWRCB also reviews projects to determine if they use water resources to make sure they do not impair existing water quality.
- Notice of Completion of Draft EIR filed with Office of Planning and Research.

Public Review
- Lead agency notifies public of availablility of Draft EIR.
- Interested parties and agencies review Draft EIR and submit comments to the lead agency. (45 days)
- Public hearings are encouraged under CEQA but not mandatory. Parties may stipulate to a proceeding in lieu of a hearing.

Decision
- Lead agency responds to Draft EIR comments.
- Lead agency prepares Final EIR.
- Lead agency may provide public review of Final EIR before making a decision, but it is not mandatory.
- Lead agency certifies Final EIR.

[1] Contact the SWRCB, Division of Water Rights, regarding the Permit to Appropriate Water.

[2] Extensions beyond the required 12 month time frame must be agreeable to the lead agency and the applicant.

[3] For all projects requiring a FERC license, FERC is lead agency for purposes of environmental review. A CEQA document may be required for purposes of water quality certification.

POWER PLANTS

NONFEDERAL HYDROELECTRIC FACILITIES[1]

• Federal Agencies •

• Federal Energy Regulatory Commission (FERC)

> • This chart incorporates the NEPA EIS requirements.
> • Opportunities for local agency input are noted in bold.

Hydro Licensing and/or Re-Licensing Process:

Typical Time: Varied

Consultation Process			Licensing Process			
Stage 1	Stage 2	Stage 3	Data Adequacy	Discovery	Analysis	Decision
• Pre-filing consultation begins between project proponents, interested resource agencies[2] and FERC. • Potential applicant provides information as required to agencies. • Within 60 days of initiating pre-filing consultation, joint agency/ public meetings are held. • Resource agencies request environmental studies.	• Environmental studies conducted. • Potential applicant provides draft application to resource agencies. • Interested agencies have 90 days to review the Draft Application and submit comments to potential applicants. • Within 60 days after written comments of disagreeing agency, public meetings are held to resolve disagreements on the Draft Application. • Applicant files Section 401 Application with state certifying agency.	• Final Application is filed with FERC. • Applicant publishes public Notice of Filed Application within 14 days of submittal. • Interested public and resource agencies must submit requests for additional studies within 60 days of application filing.	• FERC staff reviews application. Staff submits a deficiency letter to and/or makes additional information request of applicant. • Applicant must file deficiency revisions within 90 days of request.	• FERC issues a public Notice of Accepted Application. • Protests and interventions must be filed by the public and resource agencies within 60 days of the public notice of accepted application.[3] • Additional information filed by applicant. • Public notice that the application is ready for environmental analysis. • Public and resource agencies submit comments to FERC. Agencies develop Terms and Conditions within 60 days of environmetal analysis notice.	• EA or EIS public scoping meetings held. • Public and resource agencies' comments submitted to FERC. A revised EIS scoping document is then issued. • Draft EIS issued. • Depending on size of the project and issues, public and agencies have 45-60 days to submit comments on Draft EIS. • Agencies issue revised Terms and Conditions. • 45 days after public comment deadline, FERC's staff makes clarification requests of agencies. • FERC staff issues Preliminary Inconsistency Determination. • Public and resource agencies have 45 days to comment on inconsistencies. • Public meeting to resolve inconsistencies.	• Final EA or EIS issued. • Order issuing or denying license.

[1] The Army Corps of Engineers or the Bureau of Reclamation licenses all federal hydroelectric facilities under a separate permitting process.

[2] Federal and State Resource Agencies.

[3] Only parties filing protests and interventions by this deadline can petition FERC for rehearings of project if decision is disputed.

PERMITTING PROCESSES OF STATE AND FEDERAL AGENCIES

LINEAR FACILITIES

TRANSMISSION LINES and PIPELINES

• State Agencies and Municipal Utilities •

- **California Public Utility Commission (CPUC)**- for all IOU proposed projects.
- **Municipal Utilities**- for all projects proposed by municipal utilities.
- **State Lands Commission (SLC)**- all projects on state lands.

> • This chart generally incorporates the CEQA EIR Process.
> • Possible lead agency specifics are noted by *italics.*
> • Opportunities for local agency input are noted in **bold**.

Typical Time: 12 Months[1]

Phase:	Data Adequacy	Discovery	Analysis	Public Review	Decision
Time: (Months)	←Variable→ 0	0 – 3	3 – 6	6 – 9	9 – 12
Activity:	• Applicant files application. • CPUC and SLC have 30 days to review application for completeness. Munis have no required time period. • Applicant has 60 days to correct deficiencies. • The lead agency has one year to approve or reject the project after completion of the application. (A 3 month extension is possible).	• Lead agency determines if EIR is required. (30 days) • Notice of Preparation of an EIR is filed. • **Interested parties review application to identify issues to be considered in Draft EIR (30 days).** • **At interested party's request, scoping and content meetings are held (30 days).**	• Lead agency prepares Draft EIR. *- The CPUC's "Certificate of Public Convenience and Necessity" also requires a Need and Alternatives analysis and an Engineering review.* *- The CPUC's "Permit to Construct" seeks to complete the CEQA process in 9 months.* *- The SLC's "Land Use Lease" also requires a review to determine project consistency with provisions of the Public Trust Doctrine under which state land is held and to assess rent.* • Notice of Completion of Draft EIR filed with Office of Planning and Research.	• **Lead agency notifies public of availablility of Draft EIR.** • **Lead agency consults with and requests comments from all agencies that exercise authority over resources which may be affected by the project.** • **Interested parties and agencies review Draft EIR and submit comments to the lead agency. (45 days)** • **Public hearings are encouraged under CEQA but not mandatory.**	• Lead agency responds to Draft EIR comments. • Lead agency prepares Final EIR. • **Lead agency may provide public review of Final EIR before making a decision, but it is not mandatory.**[2] • Lead agency certifies Final EIR and adopts required findings and Statement of Overriding Considerations (if required).

[1] Extensions beyond the 12 month required time frame must be agreeable to the lead agency and the applicant.

[2] This is a provision of the National Environmental Policy Act (NEPA) rather than CEQA.

LINEAR FACILITIES

TRANSMISSION LINES and PIPELINES

• Federal Agencies •

- Federal Energy Regulatory Commission (FERC)- for interstate projects.
- United State Forest Service- for projects on USFS lands.
- Bureau of Land Management- for projects on BLM lands.

> • This chart generally incorporates the NEPA EIS Process.
> • Possible lead agency specifics are noted by *italics.*
> • Opportunities for local agency input are noted in **bold**.

Typical Time: Varied.

Phase:	Prefiling	Discovery	Analysis	Public Review	Decision
Time:	← Variable → 0				No time limit
Activity:	• *Applicant consults with USFS on data requirements for application.*	• Application is filed. • Lead agency determines whether EIS is necessary. • Notice of Intent to prepare an EIS is published in Federal Register. • **Public scoping meetings are held.** • Lead agency prepares scoping report of issues.	• **Draft EIS is prepared in coordination with other agencies including local government.** • *USFS & BLM determine whether proposed use is compatible with federal lands.* • *USFS & BLM conduct legal review to determine facility compliance with applicable laws, regulations, and ordinances.* • *FERC considers alternative options provided by existing facilities, reviews the engineering design of the project and assesses potential market impacts.*	• Lead agency publishes and distributes Draft EIS. • **Lead agency holds public meetings and workshops.**	• **Lead agency receives, considers and responds to public comments.** • Lead agency prepares and publishes Final EIS. • Decision is made at least one month after Final EIS is published.

HOW TO DETERMINE THE LEAD AGENCY

Determining the lead agency for CEQA or NEPA purposes when more than one agency has jurisdiction is not always easy. As discussed in the previous section, some agencies have clear preemptive authority over specific energy projects giving them lead agency status for environmental review purposes. This section attempts to shed some light on the issue of lead agency status for environmental review of power plants, transmission lines and pipelines.

The six charts on the following pages identify the typical lead agencies for major energy facilities based on general type of permit applicant. For the three applicant types (investor-owned utilities, municipal utilities, and non-utility developers) the charts differentiate between generation and linear facilities (electricity transmission lines and natural gas pipelines) as follows:

Generation Facilities

- Thermal power plants 50 MW or greater
- Thermal power plants below 50 MW
- Hydroelectric power plants
- Other non-thermal power plants

Linear Facilities

- Electrical transmission lines or natural gas pipelines associated with a thermal power plant 50 MW or greater
- Other electrical transmission lines
- Other natural gas pipelines

The charts indicate the typical lead agencies when general conditions apply to a given project proposed by the specified applicant. Please note, when both federal and state permits are required, and both NEPA and CEQA apply, federal and state leads are needed for environmental review purposes. In such cases, the state and federal agencies involved may choose to coordinate their efforts producing a single environmental document. Consistent with the previous discussion of local authority, there are some general guidelines that can be followed to determine which agency will likely have primary authority over a given energy project in the state.

For example:

- The FERC Office of Hydropower Licensing is normally the federal lead agency for NEPA purposes on non-federal, (i.e., hydroelectric projects not built by the federal government) non-exempt hydroelectric projects.
- FERC is generally the NEPA lead agency for interstate electrical transmission and natural gas pipeline projects.
- The Energy Commission is the state lead agency for thermal power plants 50 MW or greater and their related facilities.
- The California Public Utilities Commission (CPUC) is the state lead agency for investor-owned utility energy projects such as non-thermal power plants, thermal power plants under 50 MW, transmission lines, and pipeline projects.
- Municipal utilities are normally the state lead agency for their own non-thermal or under 50 MW thermal power plants, intrastate transmission line or pipeline projects.

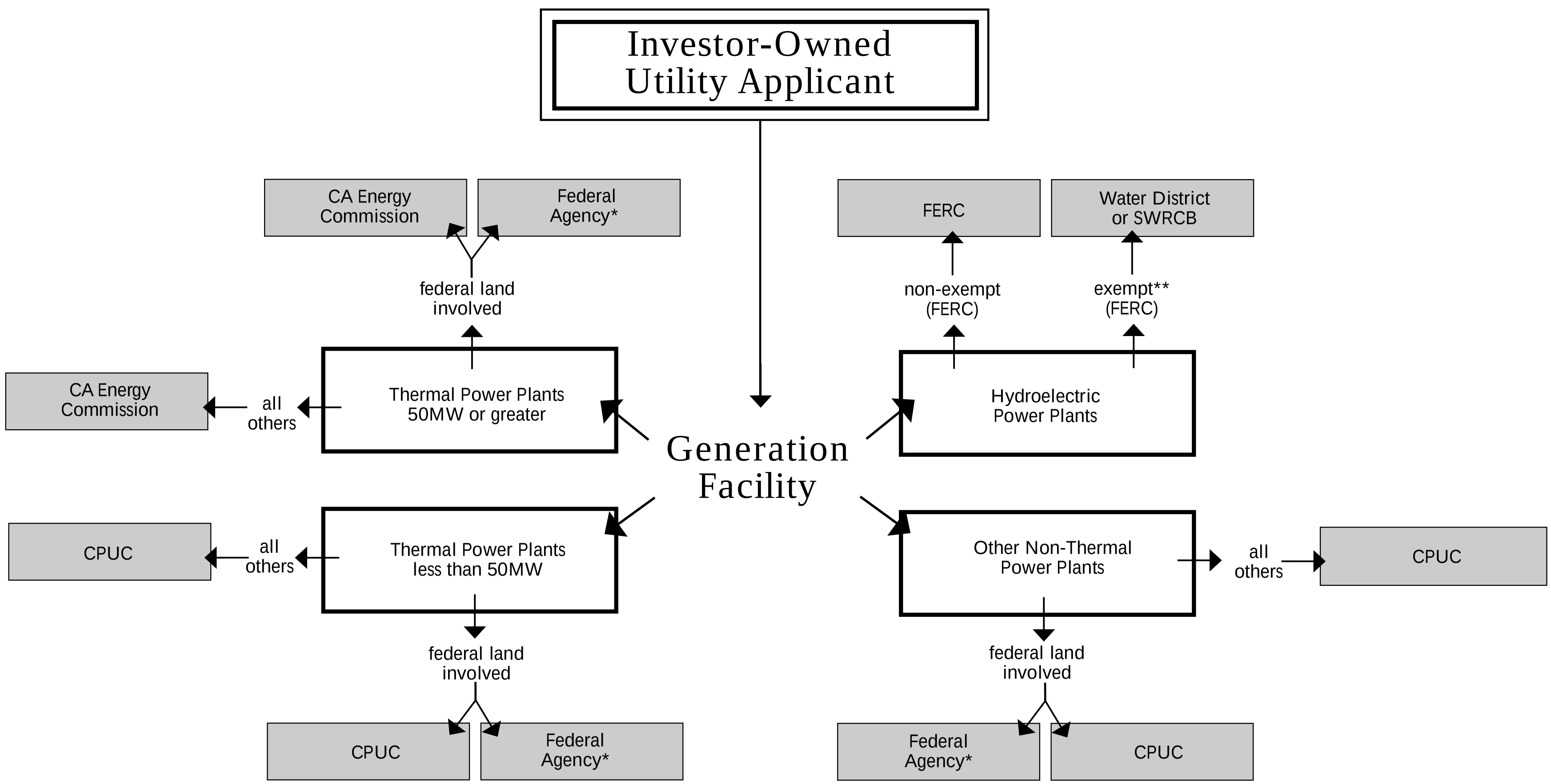
These are not absolutes by any means. Even within each of these rather certain conditions, there is some gray. This is particularly the case when a project involves significant amounts of public lands or resources under the jurisdiction of a state or federal agency. That agency may act as the lead agency for environmental review purposes. For instance, if a proposed interstate transmission line facility crosses substantial federal lands under the management of the U.S. Forest Service, the Forest Service may be the lead agency rather than FERC.

In situations where both NEPA and CEQA apply to a given project, joint environmental analysis and documentation is frequently done. In cases where no such arrangement has been made and separate analysis is being conducted, avoiding redundancy is encouraged. According to the *Guide to the California Environmental Quality Act,* if the NEPA process is completed first, the lead agency for the CEQA analysis should rely, whenever possible, on the NEPA documents instead of redoing the work. (Remy et al., 1994). When the CEQA analysis is started first, the state or local lead agency is encouraged to work early and closely with the federal lead agency.

Although not definitive, the following charts lay out a path one can use at least to narrow the field of potential lead authorities and identify those typically taking the lead role. When the choices are really muddied, another alternative is to consider the direction given in *Citizens Task Force on Sohio v. Board of Harbor Commissioners* section 1501 of the CEQA Guidelines where one criterion, for example, is that the agency that acts first is the lead when more than one jurisdictional body has clear authority. (Cal. Code Regs., tit. 14, section 1501 (L).) In addition, the Governor's Office of Planning and Research is available to and responsible for mediating lead agency disputes if they arise.

As illustrated in the following tables, "Local Agencies" are CEQA lead agencies when the proposed project involves a non-utility applicant filing projects which are either less than 50 MWs or non-thermal power plants which are not located on federal land. Furthermore, if a non-thermal power plant is proposed on federal land, the local agency may still be a CEQA lead agency.

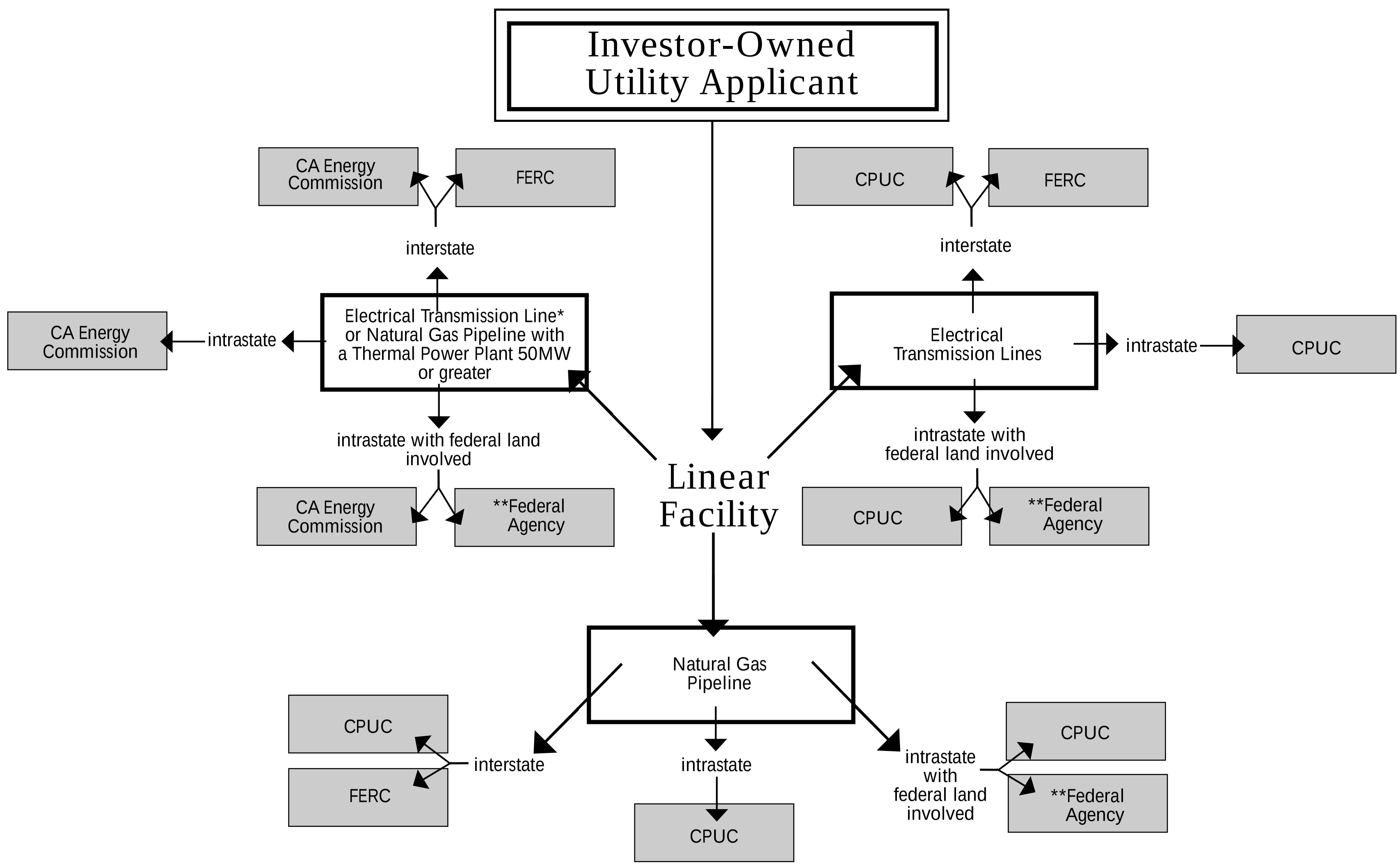
DETERMINATION OF LEAD AGENCIES FOR



* Federal Land Management Agencies such as the Bureau of Land Management and the U.S. Forest Service.

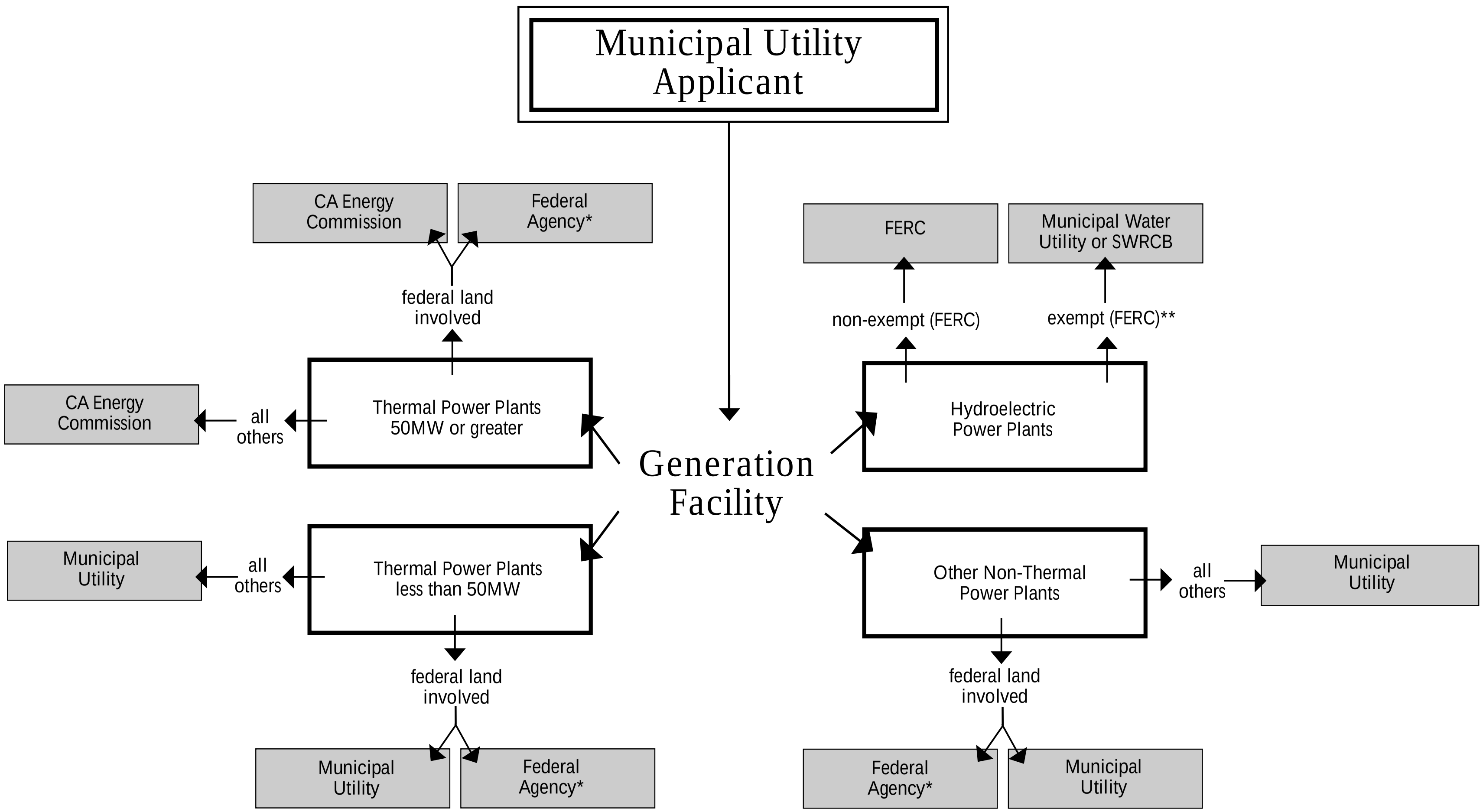
** Some small hydroelectic projects qualify for an exemption from FERC's licensing. Exempted projects are subject to state environmental review.

DETERMINATION OF LEAD AGENCIES FOR



* CA Energy Commission's juridiction over electric transmission lines from thermal power plants is limited to the first point of interconnection with the existing system.
** Federal Land Management Agencies such as the Bureau of Land Management and the U.S. Forest Service.

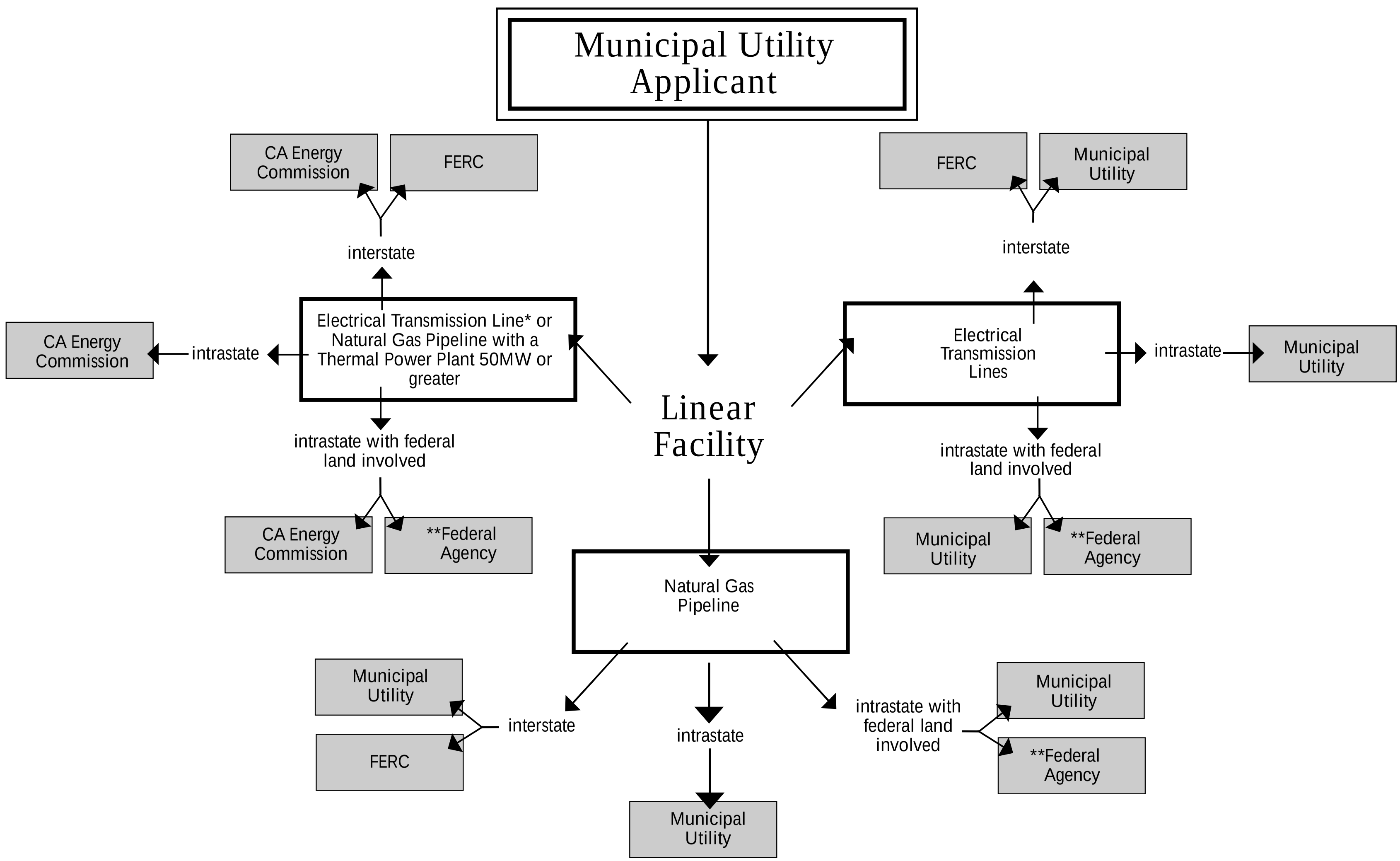
DETERMINATION OF LEAD AGENCIES FOR



* Federal Land Management Agencies such as the Bureau of Land Management and the U.S. Forest Service.

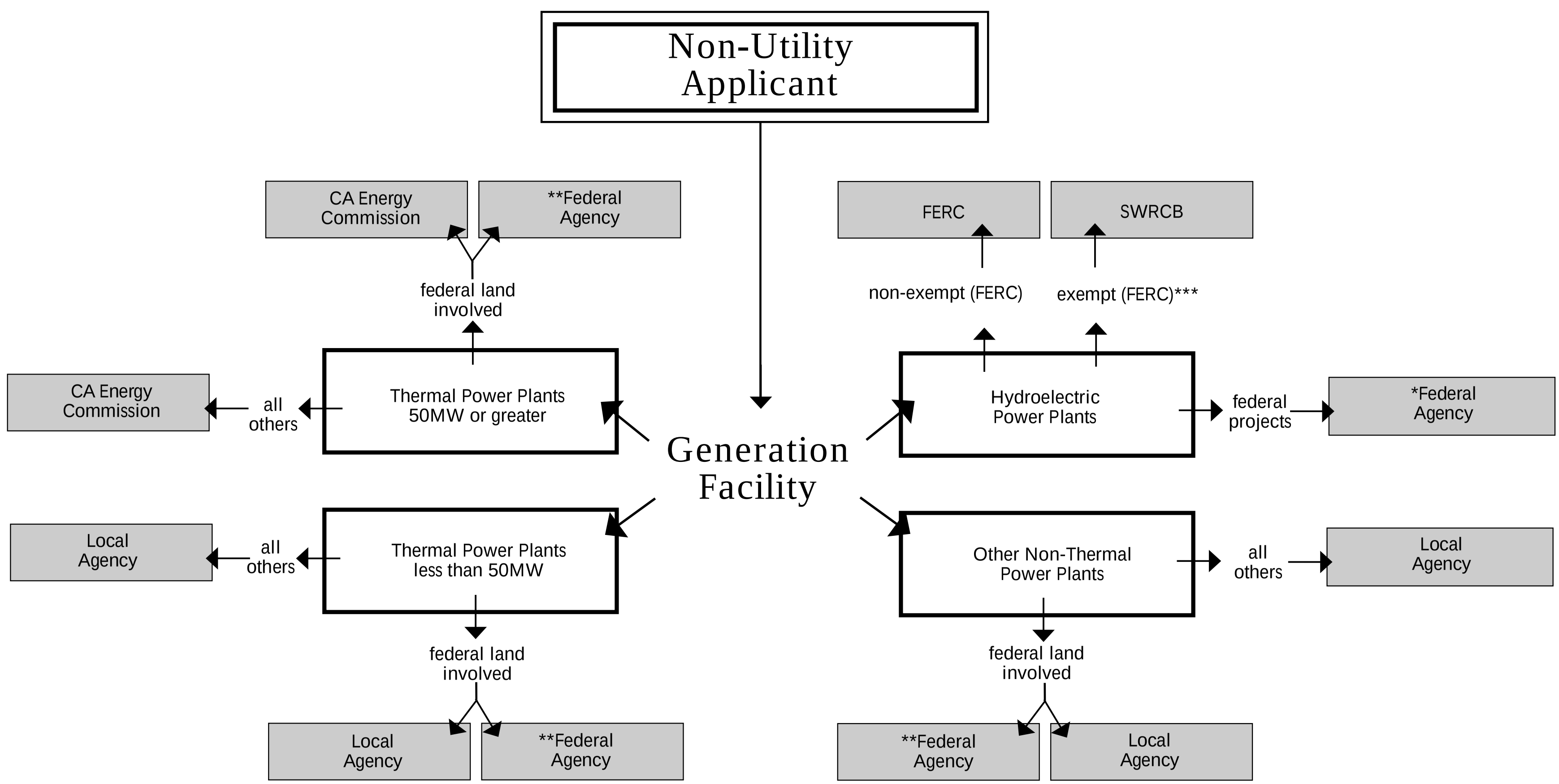
** Some small hydroelectric projects qualify for an exemption from FERC's licensing. Exempted projects are subject to state environmental review.

DETERMINATION OF LEAD AGENCIES FOR



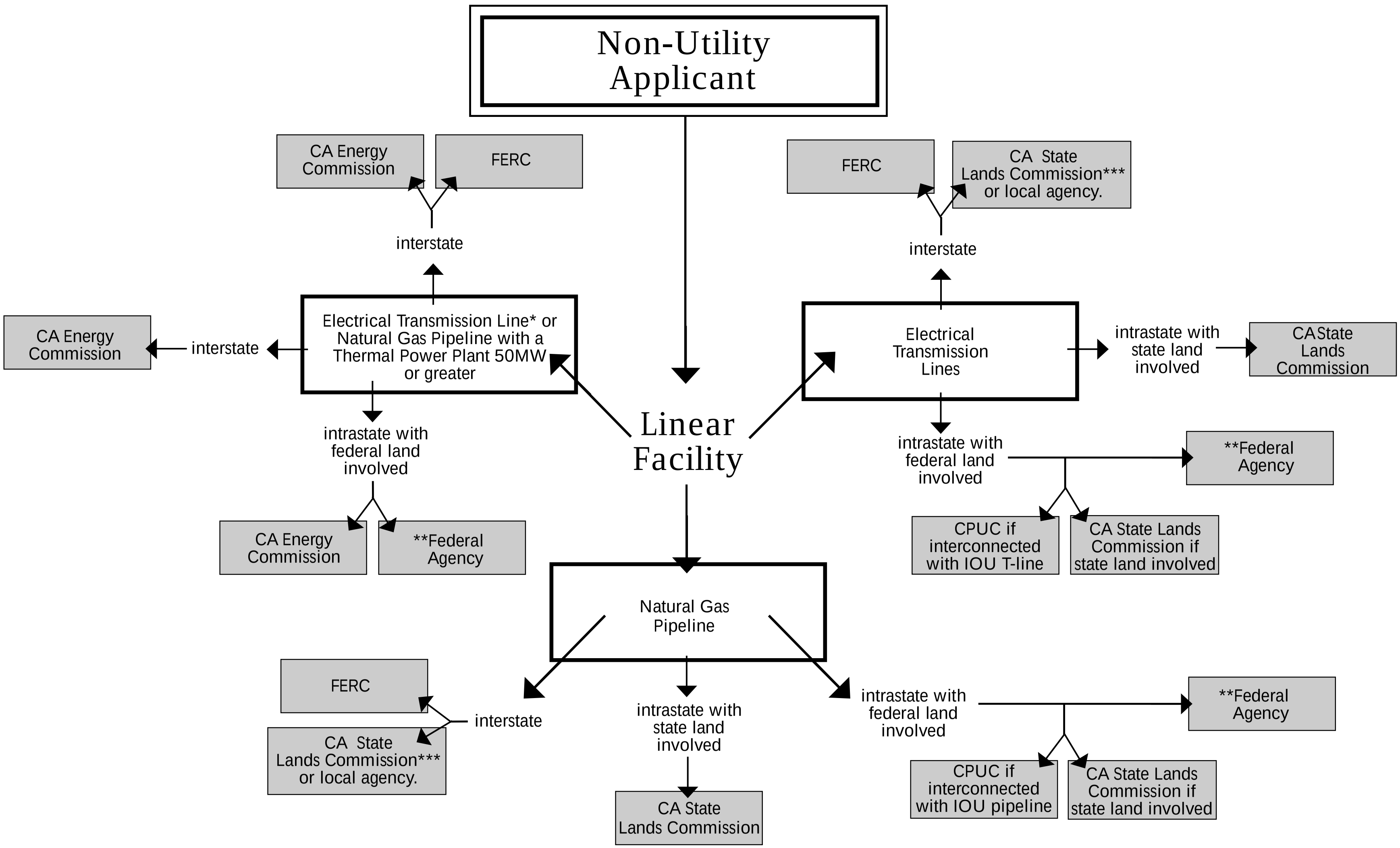
* CA Energy Commission's juridiction over electric transmission lines from thermal power plants is limited to the first point of interconnection with the existing system.
** Federal Land Management Agencies such as the Bureau of Land Management and the U.S. Forest Service.

DETERMINATION OF LEAD AGENCIES FOR



* Most Federal projects of Federally authorized projects are proposed by the Army Corp of Engineers or the Bureau of Reclamation.
** Federal Land Management Agencies such as the Bureau of Land Management and the U.S. Forest Service.
*** Some small hydroelectic projects qualify for an exemption from FERC's licensing. Exempted projects are subject to state environmental review.

DETERMINATION OF LEAD AGENCIES FOR



* CA Energy Commission's juridiction over electric transmission lines from thermal power plants is limited to the first point of interconnection with the existing system.

** Federal Land Management Agencies such as the Bureau of Land Management and the U.S. Forest Service.

*** When project crosses a navigable waterway or if State lands are involved. For a multi-county project, use of a state agency makes the process easier. The Office of Permit Assistance can assist.

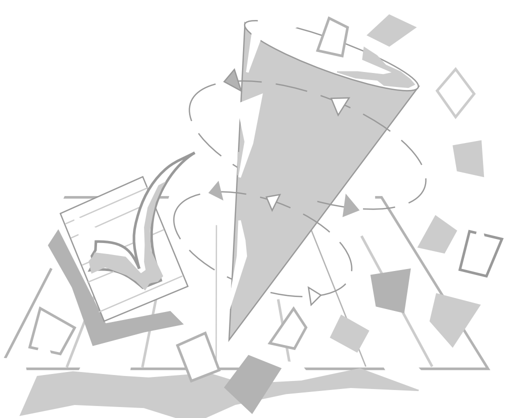
ADDITIONAL AGENCIES WITH PERMIT, LEASING OR REVIEW REQUIREMENTS

AGENCY	PERMIT/REVIEW	LEGAL AUTHORITY
FEDERAL		
Bureau of Indian Affairs	Right-of-Way Grants	Title 25, United States Code sections 323-328
Army Corps of Engineers	Dredging and Fill Permit	Rivers & Harbors Act Clean Water Act
US Fish and Wildlife Service	Biological Assessment Biological Opinion Jeopardy Opinion	Fish & Wildlife Coordination Act Endangered Species Act Federal Power Act Migratory Bird Treaty Act Eagle Protection Act
National Park Service	Right-of-Way Permit (for transmission lines)	Title 16, United States Code section 79
Bureau of Reclamation	Hydropower License Application Overhead Crossing Permit Lease of Power Privilege	Federal Power Act Reclamation Act
CALIFORNIA		
State Lands Commission	Land Use Lease (tidelands, submerged lands, beds of navigable rivers, school & other state lands) Geothermal Exploration or prospecting leasing (oil, gas & other minerals)	Public Resources Code section 6000 et seq.
Dept of Transportation	Encroachment Permit	Facilities that impact state highways
Dept of Conservation Div. of Oil, Gas & Geothermal Resource	Notice of Intention Oil, Gas or Geothermal Well Permit	Title 14, California Code of Regulations, Div 2
Dept of Water Resources, Div. of Safety of Dams	Plan Approval	Water Code, Div 3, Part 1 & 2
Integrated Waste Management Board	Solid Waste Facility Permit	Government Code sections 66796.32 Public Resources Code section 40000 et seq.
Dept of Toxic Substances Control	Permit to Operate	Health & Safety Code, Div 20, Ch 6.5
Coastal Commission	Development Permit	CA Coastal Act 1976, Public Resources Code section 30000 et seq.
Dept of Forestry & Fire Protection	Timber Operators License Timber Harvesting Plan Timberland Conversion Permit Fire Permit	Public Resources Code section 4511 et seq., 4521 et seq. Public Resources Code section 4100 et seq.
Dept of Parks & Recreation	Right-of-Way Permit	Public Resources Code section 5012
State Water Resources Control	Certification of Adequacy of Water Rights Permit to Appropriate Water Statement of Diversion and Use Clean Water Act Section 401 Certification	Public Utilities Code section 2821 Water Code, Div 1 & 2
Reclamation Board	Encroachment Permit	Water Code section 8590 et seq.
Dept of Fish & Game	Approval Stream or Lake Alteration Permit Dredging Permit	CA Endangered Species Act, Fish & Game Code section 2090 Fish & Game Code section 1600-7 5650-53.9, 5800, 11037

IDENTIFYING SECONDARY OR RESPONSIBLE AGENCIES

Secondary agencies are those that have some permitting or approval requirement over a project for which they are not the lead agency. CEQA defines these agencies to be "responsible" agencies, having responsibility for carrying out or approving a project in addition to those requirements of the lead agency. Over the years, the relationship between a "responsible agency" and the "lead" agency has been described in both statutes and case law. Important aspects of this relationship include:

- Lead agencies must consult with responsible agencies prior to the completion of an EIR.
- Responsible agencies will only comment on aspects of the project for which they have jurisdictional authority or expertise. The lead agency is required to respond to these comments prior to certifying the final EIR.
- A responsible agency is limited in the scope of environmental analysis it can prepare beyond that produced by the lead agency for a given project.



In cases of licensing programs which have been found to be functional equivalents to CEQA EIR processes, these principles hold true although the processes may vary slightly. The table on page 4.32, *Additional Agencies with Permit, Leasing or Review Requirements* identifies those agencies which may be considered secondary or responsible agencies for energy projects including power plants, transmission lines, storage facilities, natural gas or oil pipelines.

"Getting involved early in the process is key to providing greater influence and the efficient use of staff resources during the permitting process."

HOW TO INFLUENCE STATE, FEDERAL, AND MUNICIPAL UTILITY ENERGY PROJECT PERMITTING

◩ Understand your local legal authority and limitations. This knowledge allows the best use of local government resources by directing them where they can have the most influence. (See the previous section of this chapter, "Local Authority in Permitting Energy Projects" and Appendix C for other agency roles.)

◩ Know local resources/constraints in advance. Current, detailed information about local energy resources (e.g., natural gas, geothermal, hydro, etc.) and sensitive permitting issues (e.g., wetland habitats, endangered species, etc.) can provide early guidance to non-local lead agencies and improve the effectiveness of their processes. Having this information readily available will allow your staff to be more efficient when analyzing proposals, and avoiding the "false starts" of proposed developments in sensitive areas. (See Chapter 3.)

◩ Know how to participate effectively in different lead agencies' permitting processes. Appendix C and the permitting process flow charts starting on page 4.16 provide information on opportunities for local involvement in the permitting processes of individual agencies.

◩ Actively participate in other agencies' formal scoping and data gathering workshops. These opportunities are critical for effectively influencing lead agencies. Participation provides an opportunity for early input regarding local concerns, identified constraints, policies, and preferences. Scoping meetings and workshops are normally scheduled according to the amount of interest shown towards the proposed project. Therefore, your expressed interest at the beginning of the process will provide greater opportunities for input later. Early participation significantly increases your ability to influence other agencies and developers.

◩ Exert your influence through lead and responsible agencies. When not directly involved in the permitting of an energy facility, local governments can transmit their concerns to lead agencies and responsible agencies. The role of responsible agencies is narrowly defined by CEQA and may require working with more than one to adequately address local concerns. This can be especially useful if the lead agency does not officially consult with local agencies during the permitting process. It is important to communicate adequate information, particularly information developed during local planning processes (i.e., identification of local constraints, policies, standards, and preferences).

◪ Understand the potential permitting issues associated with particular types of energy facilities. Familiarity with various types of energy projects will alert you to potential impacts associated with them and the actions you may want to take during project permitting. (See the section of this chapter, "Identifying Secondary or Responsible Agencies" on page 4.33, Appendix B, and Chapter 5.) These actions are important since local governments may have key roles to play during facility development, monitoring, and closure and will have to live with the consequences of a project.

◪ Have in place easily accessible policies, ordinances, and standards regarding energy facilities. As discussed in the previous section on local legal authority and in Chapter 3, local government general plan policies can be helpful even when a state agency, federal agency, or municipal utility is the lead under CEQA or NEPA. Policies identify resources of interest and community criteria for development. Having a policy or ordinance in place strengthens the position of the community to mitigate potential impacts. In some cases, local governments will be able to require permits whether or not they are the lead agency.

◪ Keep your local elected officials informed of plans for energy facilities. Elected officials who are knowledgeable about different types of energy facilities, their potential impacts and plans for their development, are more likely to make balanced decisions related to energy projects in their community. Being informed, they can also participate in other agencies' permitting processes more effectively, enhancing local influence.

◪ Develop and maintain cooperative relationships with utilities and involved agencies. Cooperative relationships promote interagency coordination, through which information about planned activities can be exchanged. This can reduce "surprises" for the involved parties, resulting in a more effective and efficient permitting process. Early knowledge of energy projects provides more time for public and local agency involvement. Interagency coordination also facilitates work with responsible agencies in permitting processes.

ENSURING PERMIT COMPLIANCE-MITIGATION PLANNING AND MONITORING

CEQA gives decision makers an opportunity to avoid or substantially reduce potentially adverse environmental effects by requiring impact mitigation measures. However, researchers have often found that mitigation measures were either not implemented, or inadequately implemented. In an attempt to correct this deficiency, the California Legislature enacted Public Resources Code section 21081.6 in 1988.

The statute states that the approving entity (whether the lead agency or a responsible agency) must adopt a "reporting or monitoring" program which is "designed to ensure compliance during project implementation." The law applies to mitigation measures which are the result of a certified EIR or a mitigated Negative Declaration. The statute allows for substantial local flexibility in devising an appropriate mitigation monitoring program .

As a result, local agencies have generally viewed the statute as requiring both programmatic and project-specific implementation procedures. Some agencies have first developed overall implementation programs by ordinance or resolution, and then applied those programs to individual projects on a case-by-case basis. The commonalities of these programs are shown in the box on page 4.36, *CEQA Monitoring Requirements.*

ELEMENTS OF A SUCCESSFUL MITIGATION MONITORING PROGRAM

The three basic elements of a successful mitigation monitoring program are:

1) Well-written conditions specifying the required mitigation, timing, and methods for the project developer or operator to report to the responsible monitoring agency

2) Environmental expertise to verify compliance reporting and

3) a computerized tracking system

◪ Well-written Conditions. It is essential to develop well written conditions whose requirements are specific, measurable, agreed upon, realistic, time certain and enforceable. Without these elements and a follow-up program, success cannot be determined or measured. Vaguely worded mitigation requirements result in poor implementation.

The project developer or operator must submit reports on the level of implementation and ultimate success of the mitigation measures. As a start, well-designed and written mitigation measures with specific time frames make it easier for both parties to comply with the requirements. Occasional site visits complement compliance report submittals. Responsible agency involvement (e.g., Department of Fish and Game, or the local air district) is important for this element.

- Environmental Expertise. Environmental expertise is desirable to ensure that the developer's implementation of the mitigation measures is adequate. This monitoring is done using periodic reports from the developer and onsite inspections. If the responsible monitoring agency staff does not possess the necessary environmental expertise to evaluate the submitted reports, the agency can hire consultants and include consultant charges in its fee structure.

- Computerized Tracking. A computerized tracking system can provide needed institutional memory. Traditionally, two of the difficulties associated with mitigation monitoring are:

1) Tracking the status of various requirements and

2) Tracking when reports are due

Input to a computerized system can be extensive and detailed including a project description, the elements of each condition, project contact persons, key event lists (groundbreaking, operation commencement, etc.), staff transmittals, delegated agencies, and project condition amendments, updates and revisions. Computer programs can be customized to provide the necessary reports such as transmittal activity, condition status, due dates of developer and staff submittals, outstanding conditions or overdue staff responses, critical condition status (when work must stop if not in compliance), and status of ongoing conditions.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- To provide energy facility developers with guidance, the city/county can direct the planning, building and any other departments with energy facility permit or oversight authorities to develop preferences, codes, standards and siting criteria for potential future energy facility development.

- The city/county can compile all local energy facility legal and procedural requirements, including projected costs and time frames, into a public information manual for distribution to developers seeking local permits and interested public.

- The city/county can develop a one-stop permit center to consolidate local permit approval and information. Where possible, the center shall contain forms and information from other jurisdictions' agencies that share authority over energy facilities.

- The city/county can develop pre-application packages for energy facility development and encourage (or require) pre-application conferences with energy facility developers and all local, regional, state and federal agencies with permit approval or oversight authorities.

- To lessen the time involved in developing energy facility project Environmental Impact Reports, the city/county can encourage the development of Master Environmental Assessments or Program Level EIRs for locally-preferred energy facility technology types.

- The city/county can encourage staff to develop relationships with other local, regional, state and federal agencies with energy facility permit approval or oversight authority for the purpose of sharing energy facility development information and experiences.

- The city/county can encourage involvement of the public in the energy facility permitting and rulemaking processes.

◪ The city/county can require mitigation compliance monitoring for all energy facilities for which it issues permits.

◪ The city/county can direct the appropriate local agencies to develop mitigation compliance monitoring programs.

IMPLEMENTATION IDEAS

The following are suggested implementation ideas which can be applicable to energy facilities in general:

Developer Guidance

◪ Develop or update policies, codes, standards, ordinances and siting criteria for various types of energy facilities.

◪ Develop and maintain public information manuals which detail legal and procedural requirements, projected costs and time frames for energy facility permits, and which identify roles of other agencies and utilities.

Permit Streamlining

◪ Develop or update preapplication packages and hold preapplication conferences.

◪ Centralize and regularly update the provision of local permitting information into a one-stop permit center.

◪ Develop regulations that clearly specify requirements in a measureable, and time certain manner.

◪ Designate a single point-of-contact staff person.

◪ Train staff in the overall requirements of energy facility permitting so they better understand the entire process.

CEQA MONITORING REQUIREMENTS

Typical implementing Ordinance Provisions of a Monitoring Program:

- State purpose of and need for the program.
- Designate a monitoring program manager.
- Assign responsibilities to various departments within the agency (e.g., planning, public works, etc.).
- Develop cooperative agreements with other agencies (APCD, RWQCB, Fish and Game, Energy Commission, etc.).
- Identify the project applicant's role.
- Establish an equitable fee structure to cover monitoring expenses.
- Establish enforcement procedures and penalties. Create conflict resolution and appeal provisions.
- Design reporting forms.
- Specify the review process for reporting monitoring results.
- Provide for quarterly and/or annual monitoring reports that summarize the results of the program and allow feedback to staff and decision makers.

Program Application on Specific Projects:

- Require greater specificity in mitigation measures, i.e., to include measurable performance standards.
- Prepare a master mitigation checklist for each project.
- Assign project-specific monitoring responsibilities to agency staff or other entity for each category of mitigation measure.
- Develop a project-specific monitoring schedule for each mitigation measure category.
- Establish specific reporting requirements, including both agency monitoring reports and applicant field verification reports.

◪ Develop and use a Master Environmental Assessment or program level EIR.

Interagency Coordination

◪ Develop contacts with other local jurisdictions, especially those with previous energy facility experience.

◪ Participate in joint review panels.

◪ Ensure consistent policy/standards among agencies with jurisdictional overlap.

◪ Eliminate duplicate permit approvals where feasible.

◪ Direct all departments to review all local policies and ordinances to check for consistency and to rewrite those that conflict, are confusing, or often result in the submittal of incomplete or incorrect permit applications.

◪ Pursue interagency agreements to clarify local lead agency designation.

◪ Review local policies and ordinances for consistency, making changes as appropriate.

- Establish parallel processing when possible.

Public Involvement

- Hold public workshops at the various stages of the permit process.
- Integrate technical advisory committees into the permitting process.
- Encourage public participation in the rulemaking process.
- Use computer simulations or design charrettes to communicate issues.
- Conduct an "Info Expo."
- Develop and implement a mitigation monitoring program based on CEQA monitoring requirements. The monitoring program should include well-written conditions with specific timing and method requirements.
- Ensure that appropriate environmental expertise is available to review mitigation monitoring efforts. If such expertise is not available with city/county personnel, the project developer/operator can pay for the costs of outside consultants.
- Develop a computerized mitigation monitoring tracking system.

CASE STUDIES

- Air quality mitigation for the ACE Cogeneration Project. The 100 MW Argus Cogeneration Expansion (ACE) project in Trona, northern San Bernardino county, uses a coal-fired fluidized bed boiler to cogenerate electricity and process steam. During the licensing process, all parties agreed that all ACE project criteria air pollutant emissions would be fully offset by in-kind emission reductions created by modifications to two existing process steam boilers located at the adjacent chemical plant. However, the two boilers were operating under an ongoing permit variance, often exceeding their existing permit levels by 50 percent.

"SMARTE" PRINCIPLES

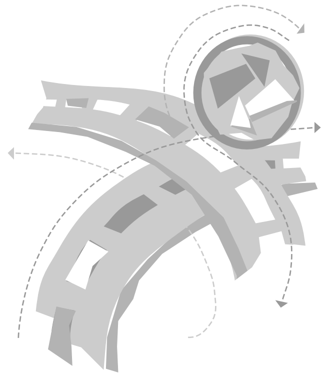
The SMARTE principles are used by the Energy Commission for compliance condition writing and enforcement.

Specific	Provide clear direction so that all parties understand what, and in some cases how, mitigation or other required activities need to be done. Being specific can lead to inflexibility. If flexibility is required to avoid future amendments include terms such as "...or equivalent as approved by..."
Measurable	Provide an objective standard for measuring (determining) whether a condition has been met. Avoid setting up future subjective debates.
Agreed Upon	Strive for agreement with the project owner, other agencies, and interested parties on the condition requirements.
Realistic	Strive for the simplest, most direct, and least-costly condition requirements that will achieve the required or desired goal. Is the required condition reasonable considering what is being required and the timeframe in which it is to be done?
Time Framed	Provide clear, realistic time frames for compliance with each condition. Dates can be stated as a specific number of days before or after a key event for the construction or operation of the project. This principle is closely tied with ensuring that compliance conditions are measurable.
Enforceable	Provide a practical method for verifying that the required activities have been done in the specified time frames.

The Commission's permit only credited the project with those emissions reductions below permitted emissions levels, not the full amount between the permitted levels and the actual emissions levels under the variance. This mitigation strategy allowed the local air district to ensure that the two boilers operated in compliance with their permits, thereby reducing air pollution emissions, as well as to permit a new source without a net increase in emissions. The effectiveness of the mitigation is shown by the fact that the NOx emissions from the two process boilers prior to the ACE project were 800 lbs. per hour, and now net NOx emissions from the two boilers and the ACE project together are now less than 500 lbs. per hour.

Contact: Dale Edwards, California Energy Commission, Energy Facilities Siting and Environmental Protection Division, Siting Office, 1516 Ninth Street, Sacramento, CA 95814, (916) 654-5100.

◪ Gas pipeline conditions of certification use experts for verification. The 120 MW American I cogeneration project in Monterey County, which was under the Energy Commission's jurisdiction, required the construction of a 38 mile natural gas pipeline. The pipeline traverses areas of steep terrain which are highly susceptible to erosion. Conditions of certification for the pipeline included revegetation for erosion control along the length of the pipeline. Without revegetation there could have been significant erosion impacts resulting in reduced productivity of grass rangeland, degradation of stream water quality, excessive siltation of stream beds which could result in later flooding hazards, and habitat loss.



A staff biologist and soil specialist from the Energy Commission conducted periodic field visits for two years following completion of construction to verify that the revegetation was effective.

Contact: Dale Edwards, California Energy Commission, Energy Facilities Siting and Environmental Protection Division, Siting Office, 1516 Ninth Street, Sacramento, CA 95814, (916) 654-5100.

INFORMATION RESOURCES

The University of California, Davis Extension program conducts a variety of courses on CEQA, environmental regulation and land use issues. For example, it conducts a workshop entitled "Mitigation Measure Development and Monitoring". Jones & Stokes, a Sacramento-based environmental consulting firm, has developed the course materials. The course covers state and federal requirements for mitigation, including California Environmental Quality Act, National Environmental Policy Act, and Clean Water Act requirements. Information on mitigation measure monitoring and examples of programs in operation are included.
Contact: U.C. Davis Extension, 1-(800)-752-0881.

The Governor's Office of Planning and Research (OPR) has a CEQA Advisory Series booklet entitled *Tracking CEQA Mitigation Measures Under AB 3180* which provides an in-depth discussion of the mitigation monitoring/reporting requirements and methods of compliance. It is available from OPR for $9.00.
Contact: Governor's Office of Planning and Research, 1400 Tenth Street, Sacramento, CA 95814, (916) 322-7798.

The Office of Permit Assistance (OPA), in the California Trade and Commerce Agency, mediates between state and federal agencies when conflicts arise, coordinates all non-Cal-EPA state departments' permit requirements, and will help when there is a problem determining the lead agency on a project. The developer, city, county, state agency, legislator or governor, can request OPA's assistance. It is suggested that projects with multi-jurisdictional approvals involve OPA from the start. The Office has been successful in bringing together players to resolve conflicts. OPA has developed a booklet, *Local Government Permit Streamlining Strategies,* which contains case studies, information on CEQA streamlining, one-stop shops, expedited permit issuance and development review, developing a single permit coordinator, and computerized permit tracking. The Office also publishes the *California Permit Handbook,* a guide containing the most often required permits, plus guides to help launch a successful and environmentally sound project.
Contact: Office of Permit Assistance, 801 "K" Street, Suite 1700, Sacramento, CA 95814, (916) 322-4245.

GUEST AUTHOR: THOMAS SPARKS

Manager of Government Relations and Utility Affairs, Geothermal Operations, UNOCAL

DEVELOPING ENERGY PROJECTS IN A GIVEN COMMUNITY

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.

California has been a leader in developing a diversified mix of electric generation resources. As the California economy grows, it is important to maintain this diversity when adding or replacing power plants. This policy will lead to the development of large and small power plants using a variety of fuel sources and power generation technologies near many California communities.

When looking to site a power project in or near a given community, the project developer must rely on a vast array of information. Site selection must follow a thorough evaluation of preliminary information. Failure to obtain reliable information in the preliminary project stages can result in cost overruns or costly project failure. Conversely, success in obtaining this information early and accurately can lead to successful project siting.

Power plant siting is an activity where no one likes surprises. Local residents need to know what is being planned at the site selection stage. Developers need to know that the proposed project has reasonable community acceptance prior to making large investments of time and money.

> *"In summary, good communication and reliable information are the critical elements in successful power plant siting."*

For example, a few years ago, Unocal successfully located a geothermal plant in Imperial County. This success can be attributed to a variety of factors, most important of which was the cooperation and assistance we received from the local community and government leaders. The siting process went very smoothly for us, with no surprises, simply because we received good information "up front".

Also important to our success in siting the Imperial County powerplant were the advantages unique to geothermal development which make it attractive to local officials and community leaders. The project brought jobs and royalty income to the local area. The advantage common to all power plant development is that it brings jobs and employment stability, which is especially attractive to local communities given today's economic climate. In our experience, this factor was crucial in local officials' willingness to assist us with project development.

From the beginning of the process, when we first filed for our Conditional Use Permit and began work on the necessary environmental documents, local authorities were willing to provide the information we needed and to identify any opposition or other difficulties we might face. An especially critical first step was having someone available to walk us through the process at the local level, and introduce us to the policy leaders in the community.

This first contact can be accomplished in a variety of ways. For example, the applicant can contact the local Chamber of Commerce for assistance or attend meetings of local business organizations. Alternatively, the applicant can rely on assistance from governmental agencies whose job it is to attract business to locate in a community, such as the Community Redevelopment Agency. It is to the applicant's advantage if this local contact is also willing to act as a mediator.

The next critical step in the power plant siting process is for the applicant to hold community meetings. This needs to occur early on in the process, even before regulatory proceedings begin. These meetings should be relatively small in size, and specific to particular communities. In other words, one or two large meetings for the combined residents of several different localities are really too cumbersome to encourage questions and meaningful discussion. In a smaller forum, participants are frequently more relaxed and responsive, and willing to dive into the details of the proposal. In these meetings the applicant should identify any areas of disagreement. Local authorities can help facilitate these meetings by identifying the participants and what is or is not known about their perspectives.

From these initial community meetings, the local lead agency and the applicant should jointly sponsor advisory groups. These groups, comprised of local residents and public authorities, can assist the applicant in further identifying areas of controversy and ways to resolve outstanding issues. These groups improve communication between the applicant and the public, as an open dialogue with local residents builds credibility for the applicant.

Even though different energy technologies raise different issues, people react to industrial development in similar ways. Most critical for the applicant is to identify local concerns. Once these concerns are known, accommodations can often be made. It is important to remember that these concerns are often based on perceptions, which may or may not be accurate. It is therefore important for the applicant to be able to identify misperceptions, which then can be cleared up with further explanation. This is most successfully accomplished with the assistance of local leaders.

The following are some specific examples of an applicant's information needs that can be met by local authorities.

1) Community Attitude. Community acceptance of the proposed project is critical. Project developers should ask local officials for answers to the following questions:

• What are the attitudes of the entities who will be affected by the project, during both construction and operation?

• What are the land uses surrounding the project?

• What are the environmental conditions?

• Will the project be supported by community leaders?

• Will the project create controversy in the community?

• Is the local area in a "no growth" mode or is there a favorable development climate?

• Are there ways that the project can meet some of the community's needs?

A wise developer will get official and unofficial answers to such questions.

2) Community Resources. The availability of community resources is also critical. Project developers need to know the following:

• What is the availability of workers with construction and operation skills? (This information may be important in remote areas.)

• What are the prevailing wages for the skills needed? (This is also especially important in remote areas.)

• What is the cost of services and supplies?

• For fossil-fueled power projects, what is the availability and cost of water?

• If the project requires transportation of fuel to the site, then what are the available transportation modes, costs and reliability?

• If the local community is served by a municipal utility or irrigation district, do the affected agencies prefer some form of joint participation? (If so, the project developer should know this early in the site selection process.)

• Are there any tax incentives for locating in a particular area?

• Does the community sponsor any enterprise zones to stimulate industrial development?

3) Local Regulations. Early knowledge of local regulations is also critical. To gain this information, project developers should begin to consult with permitting and regulatory agencies prior to site selection. Local agencies can assist the project developer in the following ways:

• Obtaining public participation in the site selection process.

• Jointly sponsoring public meetings moderated by community leaders. This can greatly facilitate interaction and reduce false rumors about the project.

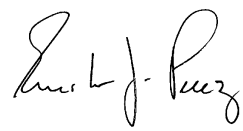
• Providing information such as area master plans or master environmental impact reports, and disclosing any changes to master plans or any local opposition to master plan elements.

In summary, good communication and reliable information are the critical elements in successful power plant siting. Of paramount importance to this success is the willingness of local authorities to work with the project developer to provide the necessary information and facilitate community participation in the planning process. Strong cooperation at the local level can make or break an applicant's project.

Attorney
Former California Energy Commission Public Advisor

PARTICIPATING IN LICENSING: OPPORTUNITIES AND ADVANTAGES

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.



In its 16 year history, the California Energy Commission has never been preempted or excluded from asserting its siting jurisdiction over any power plant it was interested in. That history includes battling with PG&E all the way up to the U.S. - Supreme Court to enforce the agency's authority over nuclear power in California. Its jurisdiction has been imposed even on projects sited at military bases.

At first glance, given express statutory language indicating preemption of local and regional laws, ordinances, standards and regulations, it would be reasonable to assume that when this state agency comes to town, locals are out of business. However, the Energy Commission has only overridden local standards against the will of the local agencies once in 16 years.

By law and practice, the Energy Commission bends over backwards to integrate all relevant substantive local standards into its decision making process. Through public notices, workshops, and hearings, the Energy Commission attempts to fully include local participation. In addition, much of the Commission's process defers substantively to existing local and regional substantive standards. For example, if a local agency has a general plan element regarding land use that prescribes certain activities, the Energy Commission will not approve a project at that location without extensive consultation and consideration of a significant override procedure.

> *"The opportunity to participate in someone else's process can be refreshing and advantageous."*

Based on this record, and considering that the Energy Commission's jurisdictional mandate is as strong, if not stronger, than any other state agency (including the Public Utilities Commission, the State Water Resources Control Board, and the State Lands Commission), when faced with the question of whether one of these agencies totally preempts effective local government participation in its proceedings, the answer is probably not.

For example, investor-owned utility transmission lines may be the primary jurisdictional interest of the California Public Utilities Commission (CPUC). That does not mean that local government cannot directly participate in the CPUC's licensing process to address local concerns. Similarly, when the State Lands Commission issues a lease for commercial recreational activities on property within its charge, local government can participate.

The opportunity to participate in someone else's process can be refreshing and advantageous. Instead of carrying the administrative responsibilities of a lead or permitting agency, local government can participate in a state or federal proceeding as an "intervenor" or participant. That change in roles alone means greatly reduced administrative, professional and legal expense in making projects adopt desirable characteristics.

The second question, then, is why should local government participate in state agency proceedings.

Again the example of the Energy Commission is illuminating. State agencies generally lack substantive standards directly related to local impacts of projects over which they may have jurisdiction. In many ways, CEQA impacts become the starting point for the state agency's development of standards to protect public health and safety. Prepared local agencies presenting either already prepared local standards (from, for example, general plans, specific plans, ordinances, zoning, etc.), or participating in the state agency proceeding to advocate the imposition of such standards can be extremely successful.

Various counties and cities have participated with generally successful results in Energy Commission proceedings. Lake and Sonoma Counties, home to substantial geothermal resources, have succeeded in obtaining "socio-economic" mitigation measures to compensate them for impacts to their school districts, loss of taxes, coordination of construction and operation schedules to avoid school buses, etc. Colusa County, after fighting proposed transmission lines, developed a General Plan Transmission Line Element to identify preferred corridors for future development. In virtually all licensing cases, local standards have been integrated almost routinely into the state license; and in many cases, local government has benefited financially or environmentally from participating.

Local government can and should participate in all state and federal licensing proceedings to protect public health and safety. Apparently preemptive state and federal proceedings should be seen largely as procedural mechanisms for coordinating multi-jurisdictional processes.

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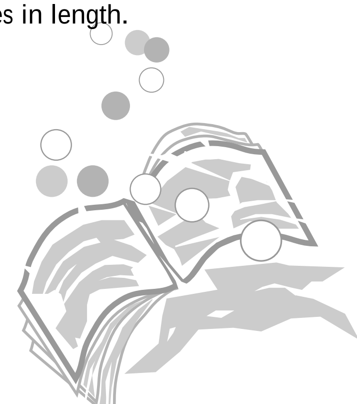
SITING POWERLINES & SUBSTATION FACILITIES
AN INVESTOR OWNED UTILITY'S APPROACH

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.

M. M. Hertel

The siting of electric utility facilities is taking place in an increasingly uncertain regulatory and business environment. The passage of and pending revisions to the California Public Utilities Commission (CPUC) General Order (G.O.) 131D extended active CPUC regulation of investor owned utility projects to include 50 to 200 kV powerlines and substation facilities. Projects that will be operational in 1996 will require a Permit to Construct, if they do not meet a number of exemption criteria. Because of the wide range of project types and project sensitivities which are normally encountered in facilities covered by G.O. 131D, the siting process has to be very flexible.

Annually, Southern California Edison (Edison) expects to have at least 150 projects which are subject to G.O. 131D. While the vast majority are small exempt projects with minor sensitivities, the remaining projects may be larger with more significant sensitivities. For example, non-exempt projects can range from existing line relocations of greater than 2,000 feet to the construction of a new distribution substation and associated powerlines, which may be many miles in length.



In January 1994, Edison began to document existing siting practices and develop procedures to meet G.O. 131D requirements. The result was a flexible, integrated process adaptable to different project types and sensitivities. An overview of the "Integrated Facility Siting Process" is provided in the accompanying figure.

> *"The Integrated Facility Siting Process includes procedures to incorporate community values and concerns in the evaluation of alternative sites/routes."*

PROCESS DEVELOPMENT

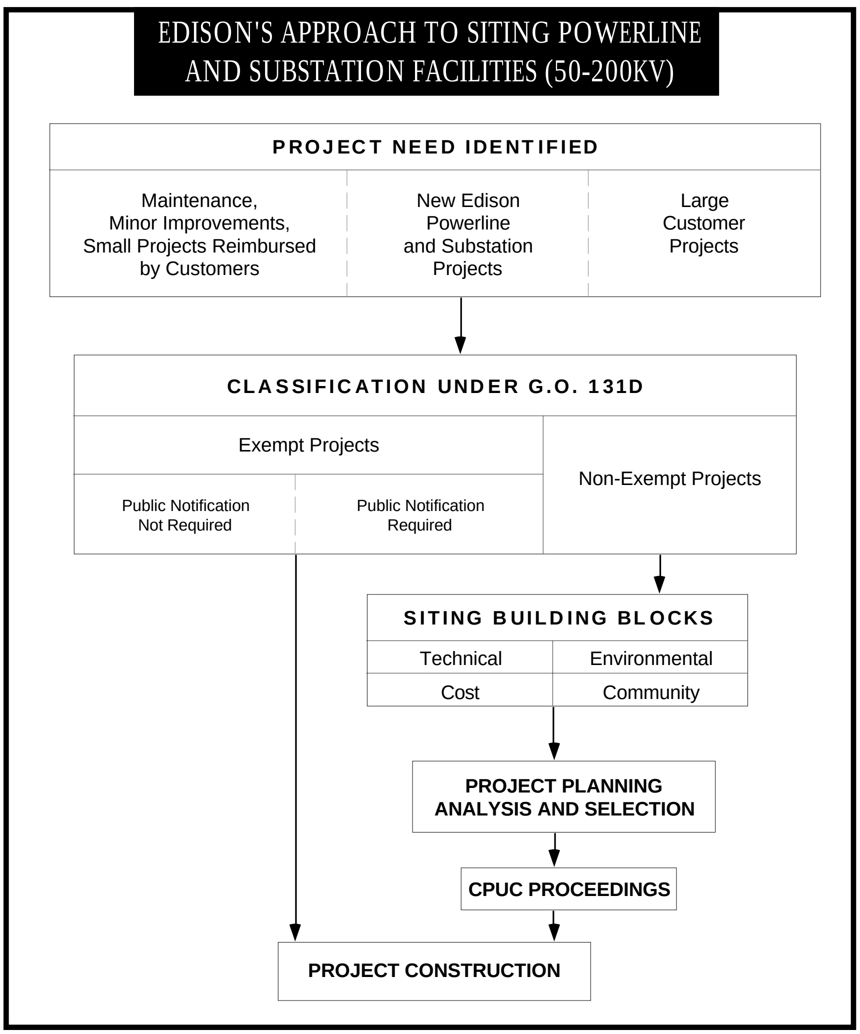
Our approach to siting process development was to establish a core team which was responsible for identifying key Edison stakeholders and determining process goals and requirements. Based on the stakeholder interviews, we established an interdisciplinary team representing all Edison organizations with significant involvement in facility siting. The siting process was then developed based on process goals and requirements, key building blocks, and major steps identified by the team.

G.O. 131D provided the basic requirements for process development. It defined which project types would require an application for a Permit to Construct and which would be exempt. An early project screening/classification step was included for definition of project scope and efficient development of necessary project program plans.

The Integrated Facility Siting Process includes procedures to incorporate community values and concerns in the evaluation of alternative sites/routes. The resulting process is applicable to all types of facilities (not just the 50 to 200 kV powerlines and substation facilities covered by G.O. 131D). The emphasis on process rather than details ensures flexibility and applicability to a wide range of project types.

DIMENSIONS OF THE SITING ISSUE

Classification under G.O. 131D- To classify and track the projects, Edison developed a regulatory clearinghouse which has responsibility for final project classification, documentation, and CPUC interface. The regulatory clearinghouse will determine exemption status and public noticing requirements under G.O. 131D. Exempt projects do not require extensive and detailed environmental assessments. However, certain classes of exempt projects may still require public noticing and those with significant sensitivities will be treated as non-exempt.



◩ Project Types. Edison has three distinct types of projects in the 50200 kV range.

1) Edison maintenance and minor improvement projects, and small projects requested and paid for by customers, constitute the vast majority of 50-200 kV projects. The projects requested by customers typically involve relocation or extension of existing 50-200 kV powerline facilities. Most will be exempt under G.O. 131D.

2) New Edison powerlines and substations to improve the reliability of the system and serve new load will typically require a Permit to Construct under G.O. 131D.

3) Large customer requests for a new substation and subtransmission connections may either be exempt or require a permit, depending on the type of project, location, and sensitivities.

◩ Process Building Blocks. Four building blocks are central to the siting process developed by Edison: technical considerations, cost, environmental values and concerns, and community values and concerns. Technical and cost considerations are essential to the development of a reliable and efficient electrical system. Studies of alternative siting solutions that reflect environmental constraints and opportunities and the development of mitigation strategies are critical to the siting process. Integration of local communities into the siting process is accomplished by identifying all steps in which information is either needed from the public or should be provided to the public by Edison, determining how best to involve the public in this information exchange, and identifying where public values should be considered in the decision process.

PARTNERS IN CHANGE

The process of siting electrical facilities involves many partners—community leaders, the general public, interest groups, local governments, and regulatory and resource agencies, among others. All these organizations have a stake in the shape of the southern California community and landscape. Change in communities and landscapes challenges the most rigorous siting process.

Regulations change to accommodate new contingencies. Technical solutions to electrical problems are in constant review. Costs are increasingly scrutinized. Environmental concerns are heightened by urban encroachment and new discoveries. And communities and their various constituencies are increasingly vocal about their concerns. Only through partnership can these four building blocks be integrated to produce better siting decisions.

Edison's siting process, completed in December 1994, will be revised as necessary to comply with revisions to G.O. 131D (originally adopted in June 1994) and inputs from our internal users and external partners.

GUEST AUTHOR: FRED E. SPRINGER

Director, Office of Hydropower Licensing
Federal Energy Regulatory Commission

AUTHORIZATION OF HYDROELECTRIC FACILITIES — GUIDELINES AND ISSUES

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.

The Federal Energy Regulatory Commission (Commission) regulates the construction and operation of nonfederal hydropower projects. Our jurisdiction and authority comes from the Federal Power Act (FPA), as amended in 1986 by the Electric Consumers Protection Act (ECPA). We currently regulate 273 projects (10,058 megawatts) in California. There are also 19 applications for original licenses and relicenses pending at this time.

State and federal agencies, Indian tribes, local governments, and the public have several opportunities to participate in our hydropower licensing program. Active, timely, responsible, and cooperative participation by these entities is essential to the success of our program. With it, we can assure the efficient use of the nation's renewable hydropower resources while protecting the environment.

COMMISSION AUTHORIZATIONS

Under Section 23(b) of the FPA, the Commission regulates hydro projects that:

1) are on navigable waters;

2) are on non-navigable waters over which Congress has commerce clause jurisdiction, were constructed after 1935, and affect interstate or foreign commerce;

3) are on public lands or reservations of the U.S.; or

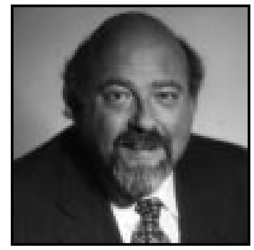
4) use surplus water or water power from a federal dam.

The Commission issues three forms of authorization: preliminary permits, licenses, and exemptions from licensing. The Commission has issued two handbooks, which give a detailed explanation of the licensing and relicensing procedures. They are available from the Commission upon request.

"...assure the efficient use of the nation's renewable hydropower resources while protecting the environment."

A) Preliminary Permits

Preliminary permits are issued for up to 3 years. Their purpose is to maintain the permittee's priority of application for license while the permittee studies the site and prepares a license application. A permit doesn't authorize construction. It isn't a prerequisite to apply for or receive a license, and it doesn't obligate its holder to apply for a license.



B) Licenses

The Commission issues licenses for terms of up to 50 years. When a license expires, the federal government can take over the project (with equitable compensation) or the Commission can issue a new license, either to the existing licensee or to a new licensee.

The Commission issues licenses only for projects best adapted to a comprehensive plan for improving or developing a waterway for beneficial public purposes. This standard requires the Commission to explore all issues relevant to the public interest. Typical (and sometimes competing) uses for a waterway are power generation, irrigation, flood control, navigation, fish and wildlife, recreation, cultural resources, and aesthetics. ECPA requires the Commission to give "equal consideration" to developmental and non-developmental values and to consider to what extent a project is consistent with any federal or state comprehensive plans for a waterway affected by the project.

Section 404 of the CWA also requires a permit for the placement of dredged or fill material in navigable waters. A Section 404 permit (issued by the Corps of Engineers) may be required for various activities associated with the construction or operation of a project.

The Coastal Zone Management Act requires an applicant for a project affecting land or water in a coastal zone to certify that the proposed project is consistent with the state's approved coastal management program. A copy of the self-certification must be furnished to the state, which has six months to notify the Commission that it concurs or objects to the certification. If the state fails to act within six months, its concurrence is conclusively presumed.

The Commission's licensing process also includes analyses of the need for power, the design and safety of the project, the project's economic benefits and financial feasibility, and an environmental analysis.

◩ Consultation. The licensing process involves substantial participation by state and federal agencies, Indian tribes, local governments, and the public. Altogether, depending on the complexity of the case, from seven to nine specifically defined opportunities are provided for state and local agencies to submit comments and recommendations. This participation occurs both before and after an application has been filed.

Prefiling consultation with agencies, tribes, and the public usually leads to detailed economic, engineering, and environmental studies. Local governments are encouraged to be active at the prefiling stage.

Study Requests - Agencies, tribes, and the public help develop the record to evaluate the merits of a particular project. Traditionally, the Commission staff's participation at the prefiling stage was minimal, principally involving dispute resolution. However, in recent years we have begun to participate more actively. This considerably increases the opportunity for early resolution of study request issues and identification of issues and alternatives. When the application is filed, the Commission issues newspaper and Federal Register notices, and additional study requests.

"The Commission must strike a balance between developmental and non-developmental resources in determining the public interest."

Interventions - When the application is accepted for processing, the Commission publishes a second public notice in the Federal Register and a local newspaper soliciting further comments and interventions. Copies are also sent directly to the local governments, land owners, and federal and state agencies involved. All timely comments received become a part of the record on which a decision is made. Intervenors receive documents in the record and can participate in any hearings or meetings where Commission staff and outside parties discuss project merits. They also have the right to appeal any order issued on the application.

Scoping - We also have a public-scoping process in connection with the environmental analysis. This includes local meetings and site visits, to ensure that the environmental document is thorough, balanced, and considers all issues of concern.

◩ Environmental review comments. After staff gets all the information it needs to complete its analysis, the Commission issues a third public notice. This notice states that the application is ready for environmental analysis and gives federal, state, and local agencies, as well as tribes and the public, an opportunity to recommend specific environmental mitigation measures, and to explain their opposition to or support for the proposed project. Certain federal agencies may also submit mandatory conditions to protect the environment.

◩ NEPA compliance document. The staff then prepares a Draft Environmental Assessment or a Draft EIS according to NEPA guidelines. The agency, public, and tribal recommendations are discussed in the Draft EA or Draft EIS. The draft is followed by a comment period and, often, another public meeting. The environmental document, along with the Safety and Design Assessment, are part of the record supporting the Commission's decision.

The Commission must strike a balance between developmental and non-developmental resources in determining the public interest. This balancing uses both dollar values and nondollar values (qualitative and descriptive values) for the resources. This balancing is thoroughly discussed in the environmental document.

Section 10(j) of FPA - Fish and Wildlife Issue Resolution Process - If the staff finds any recommended terms and conditions of a fish and wildlife agency inconsistent with the FPA or other laws, it will attempt to resolve the inconsistency through negotiations.

C) Exemptions from licensing

Some small hydroelectric projects qualify for an exemption from licensing. The application process is simpler than for licenses. The Commission issues exemptions for two types of projects:

1) Small conduit hydroelectric projects (a Conduit Exemption)—installed capacity of 15 MW or less for non-municipal applicants and 40 MW or less for municipalities, and

2) Small hydroelectric projects of 5 MW or less.

Generally, applying for an exemption is the same as filing for a license, except that the recommendations of the fish and wildlife agencies are mandatory and the 10(j) dispute resolution process doesn't apply to exemptions. Prefiling consultation is required.

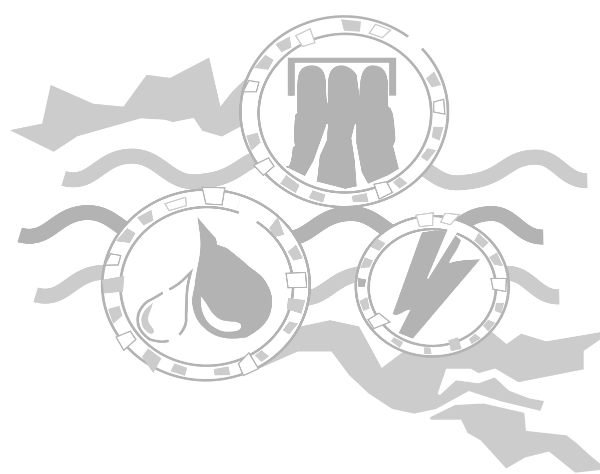
Summary and conclusions. The licensing process may appear complicated and lengthy on paper. Often it is in practice, as well. However, I am confident that in the end it fully and fairly balances the legitimate concerns of local agencies and all other interested parties - to ensure that hydropower development is beneficial for the nation.

Available Resources:

1) *Hydroelectric Project Licensing Handbook* (December 1991), and

2) *Hydroelectric Project Relicensing Handbook* (April 1990), Federal Energy Regulatory Commission.

For copies of the latter handbook, contact FERC's Public Reference Section, Room 3104, 941 North Capitol Street, NE, Washington, DC 20426; (202) 208-1371.



GUEST AUTHOR: STEPHEN D. PADULA

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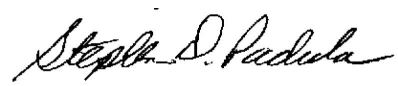
EFFECTIVE LOCAL INVOLVMENT IN THE LICENSING OF HYDROELECTRIC PROJECTS

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.



Most of the current activity related to hydroelectric development in California, and the nation as a whole, involves the evaluation of existing hydroelectric projects which must receive new licenses in order to continue operations beyond the term of their expiring licenses. Effective public involvement in the "relicensing" of these projects requires an understanding of the Federal Energy Regulatory Commission's (FERC) licensing process and how FERC is organized to process applications for new licenses. Non-federal hydroelectric projects located on navigable waterways and affecting interstate commerce generally are under the jurisdiction of FERC.

FERC's Division of Project Review (DPR) is responsible for coordinating and managing all aspects of hydropower application processing, including the evaluation of the project in the context of the technical, engineering and environmental requirements of the governing federal legislation. DPR analyzes alternatives to the proposed hydroelectric project. It examines the need for a potential project's power, the project's economic feasibility and environmental effects. Ultimately DPA must determine what project configuration is best adapted to the comprehensive development of the waterway. DPR is also responsible for providing guidance to prospective applicants, to interested federal and state agencies, and to members of the public with respect to the FERC regulatory process.

Of the existing projects in California with FERC licenses, many have licenses expiring between the years 2000 and 2015. Relicensing consultation (the initial steps in the licensing process) on some of these projects will be initiated within the next few years. It is possible that in unique instances, the relicensing process will determine that instead of issuing a new operating license, FERC should either issue a non-power license to the applicant or recommend to Congress that the federal government "take over" the project from the applicant. In cases of "takeover" the federal government compensates the licensee for the lost project value. The ultimate fate of the project could theoretically include decommissioning of the power generating facilities or partial/complete project removal.

> *"A license must be issued with conditions to ensure that the hydroelectric development is best adapted to a comprehensive plan for improving and developing the waterway for beneficial public uses."*

The official FERC licensing process is not particularly user friendly to local governments and the general public. The process is very complex, potentially intimidating, and the issues very technical. The formal opportunities for involvement and input to the decision-making process are few, and come relatively late in the formal consultation process. In evaluating public involvement in the so-called Class of '93, (approximately 160 relicensing applications for projects with license expiration dates at the end of 1993, that were filed with FERC in 1991) the track record was rather poor. Setting aside organized, special interest, nongovernmental organizations (NGO's), there was relatively little actual public involvement in relicensing consultation. Attendance was low at most public meetings, and very little use was made of the extensive public information libraries that FERC required licensees to create.

Why the lack of public involvement? Was it an actual lack of interest or did the process appear to be inaccessible? While the causes are uncertain and subject to debate, there is no debate regarding the lack of actual opportunities for public involvement. During the typical three to five years of consultation and application preparation activities, FERC's regulations require only one formal opportunity for public involvement. This occurs when the licensee initiates the formal consultation process. Unfortunately, most of the formal participation opportunities come after license applications are filed with FERC, during FERC's adequacy review and environmental assessment processes. By this time most of the information on which the final decisions are made has been gathered and the positions of the various participants have been set.

This has not gone unrecognized by FERC which in the last several years has initiated an Outreach Program to assist members of the public in their participation in the relicensing process. Licensees starting relicensing today are also attempting to provide additional opportunities for public involvement earlier in the consultation process. These measures include voluntary meetings with the more traditional participants in the process along with local government officials and the general public to solicit input to their relicensing planning efforts. Licensees are also attempting to convey better information about their projects.

The goal is simple. A better informed public will more likely have a better understanding of the resource values; economics and trade-offs inherent in hydroelectric energy production; and in alternative sources of energy that would be required if existing hydroelectric generation capacity or flexibility is reduced in relicensing. Unfortunately however, the relicensing process remains very much the realm of federal and state resource agencies, Indian tribes, and NGO's. It is a daunting arena for local citizens.

To be effective in the licensing process, local governments and members of the public at large must first of all not rely on other participants in the consultation process to represent their interests. Federal and state agencies are typically guided by their own directives and NGOs typically have their own narrow special interests which they will promote. Active participation in the process is the best way for local governments and the general public to see that their interests and values are given proper consideration during the decision making process.

Being informed of the licensing process and the potential issues that may surround a particular licensing action will enhance the effectiveness of local involvement. For projects in California, contact should be made with FERC Division of Project Review West Branch (DPR-WB) representatives to obtain information on projects with upcoming expiring licenses and FERC's plans for processing the relicense applications.

Local interests can also contact the owner of the hydroelectric project located in their community to obtain information on the license expiration date and the licensee's plans for initiating the consultation process required prior to filing an application with FERC for a new license.

Additionally, federal and state resource agencies with jurisdiction over land or resources potentially affected by the project can be contacted. Through these agencies, one can obtain copies of relevant resource management plans for the land or waters influenced by the project. Such plans may be periodically updated. Local officials and the public can request that they be notified so that they can participate in the revision of agency plans which will influence FERC as it makes its licensing decision.

In contacting FERC, other agencies or the project owner, local officials or members of the public should at the very least know the project name and FERC number. Be as specific as possible about the particular area of interest or concern you may have. Interested parties should request that they be placed on mailing lists for receiving information from resource agencies on management plan activities and from the owner on planned licensing activity.

Success by local government officials and local citizens in affecting the licensing outcome will depend most heavily on taking advantage of additional opportunities to provide input to licensees prior to the filing of the license application, and indeed, prior to the start of formal consultation. Many licensees are starting much earlier to prepare for formal consultation, including earlier evaluation of existing environmental conditions and of opportunities for upgrading existing generating capabilities. Some licensees are also providing information earlier to potentially interested parties in hopes that fewer surprises will occur for all participants once the formal process starts.

Given that the opportunities to officially participate in the licensing process are so limited, it is essential that none of the opportunities be wasted. In particular, involvement in the first official scoping meeting during the first stage of consultation is essential. At this meeting, local officials and the public can officially register their interests or concerns and request that they be kept informed of planned studies by the project owner. This should ensure that they get the opportunity to review and offer the "local" perspective on the owner's draft and final proposals. They will also be able to participate in FERC's NEPA activities after the application for a new license has been filed. Participation in person, where possible, is most effective. Providing formal comments in writing is also essential given the formal nature of the licensing process.

The licensing of hydroelectric facilities by FERC can be an intimidating process. However, with some early research and effort to engage the major participants in the process, local officials and members of the public should be able to effectively represent the important local interests as only they can. New licenses currently being issued by FERC will govern the operation of existing hydroelectric facilities in California for the next 30 to 50 years. Conditions in these licenses will affect such important issues as public access, recreational development and restrictions on development surrounding the project.

Regardless of which side of the particular issues local government officials and their constituents may find themselves, many of these issues have the potential for significant local effects. Local officials should do what they can to ensure that decisions on these issues are not made based solely on the agendas of resource agencies and NGOs, but also on the very important and unique perspective of those in the local community.

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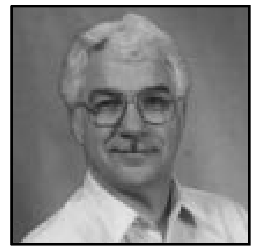
BIOMASS & LOCAL GOVERNMENT: CHALLENGES & OPPORTUNITIES

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.



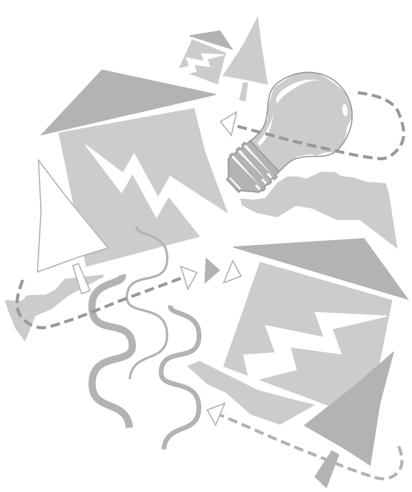
BIOMASS AND YOUR TOWN

Today, municipalities throughout California are being challenged by both problems associated with waste materials and opportunities to utilize biomass as a source of energy. Some are painfully aware, others seemingly ignorant. Over sixty facilities in California convert agricultural, forest and urban wood waste materials into fuel and then into electricity. Collectively they provide just under 2 percent of the state's electricity supply. Yet, few even know that these plants exist or that technologies are available for the utilization of biomass wastes. The challenges are how to preserve this important option and how to take advantage of similar situations and opportunities in other areas.

At stake are thousands of jobs in mostly rural areas, millions of dollars in taxes paid to local communities and, perhaps most importantly, the ability to dispose of waste materials in a manner that contributes to the improvement of the environment in the places where we live, work and play.

Biomass (the organic materials which are available in forest residues, agricultural crops and wastes, wood and wood wastes, animal wastes and municipal wastes) can be utilized for many purposes. These include production of electricity to heat, light and power our homes and businesses; production of ethanol as a transportation fuel or as a fuel additive to help reduce air emissions and clean the air we breathe; and feedstock for the production of chemicals that are an integral part of our lives.

> *"...biomass-to-energy applications hold the promise of bringing us one step closer to a more efficient utilization of all our resources..."*



The great part about biomass use is that while accomplishing the above we can solve some of our community headaches. Use of urban wood wastes recovered from municipal waste streams helps reduce input to landfills, prolongs their life and helps reduce waste disposal costs. The use of agricultural wastes utilizes materials that would have been open-field burned or landfilled and helps to clean our air. The use of forest and mill waste helps reduce the hazards of wild fires, and recovers and utilizes waste materials as a source of renewable fuel. Biomass is a fuel that doesn't spend our dollars overseas. It doesn't need to be shipped half way around the world and we don't have to send our sons and daughters to defend its source.

Biomass fuels are here now. Many of them are in waste streams, and we live with and pay for the problems they cause -air pollution, unnecessary landfilling and wasted resources, to name a few. Some will say (especially those in communities whose biomass facilities are facing serious economic challenges due to decreases in the price of natural gas) that biomass power costs are not as cheap as power utilizing natural gas. That's true, at least in conventional accounting systems.

But what about the price we pay for those problems that plague our communities. Inadequate landfill space, air pollution from waste burning, the increasing threat of wild fires due to fuels not removed from our forests, and of course, the price we paid or may have yet to pay for Desert Storm or our next endeavor to protect foreign sources of fuel. These costs can, in part, be offset through use of biomass fuels and feedstocks.

Fuel is fuel. It's all used to create heat and to supply the sources of energy that support our economies. We have the technologies and ability to use biomass that is currently being wasted and in waste streams creating serious and expensive problems for cities and towns across the state. They're renewable and sustainable. Their successful application requires careful integration and efficient utilization. My mother used to say . . ."if you get a lemon make lemonade." It is my hope that my daughter will learn to say "if you get a lemon, use the skin for zest, the pulp for pie, plant the seed for new trees, and make lemonade."

We must make more efficient use of all our resources. We must examine both our existing problems and our future opportunities creatively, not just one problem at a time. We must work toward resolution of meeting the needs of our communities and solving the problems they face by integrating our efforts in resource utilization. Today, biomass-to-energy applications hold the promise of bringing us one step closer to a more efficient utilization of all our resources, and in a sustainable, environmentally acceptable manner.

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CRITICAL PERMITTING ISSUES

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CHAPTER 5

ENERGY AWARE
PLANNING GUIDE: *ENERGY FACILITIES*

CHAPTER 5.0: CRITICAL PERMITTING

CRITICAL PERMITTING ISSUES/AN OVERVIEW

INTRODUCTION

Most energy facilities have potentially significant permitting issues, as shown in Table B-ii of Appendix B. This Chapter addresses energy facility permitting issues which we feel exhibit most, if not all, of the following factors:

- Unique — to power plants and transmission lines
- Show-stopper — could seriously delay or stop projects
- Controversial — including public concerns and fears
- Confusing — difficult to work through all opinions

In addition, the permitting issues addressed are linked to some of California's broader growth-related concerns such as air quality, public health and rare/endangered species.

There are separate chapters for the following issues:

- 5.1 Air Quality
- 5.2 Biological Resources
- 5.3 Hazardous Materials Handling and Storage
- 5.4 Water Use and Quality
- 5.5 Visual and Noise Impacts
- 5.6 Public Concerns about Electric and Magnetic Fields
- 5.7 Energy Facility Closure/ Abandonment

These chapters provide background information; policy, implementation and mitigation ideas; and case studies to facilitate local government and developer resolution of energy project permitting issues. These chapters share how some jurisdictions have addressed these issues.

In addition, Energy Commission staff routinely evaluate potential energy development in the following, usually less critical issue areas: traffic and transportation, socioeconomics, geological hazards, soil resources, energy facility waste management, and cultural and paleological resources.

Local governments will find that the permitting process will be most effective and efficient if all parties who may be affected by these issues be included early in the planning and permitting processes as discussed in more detail in Chapters 3 and 4, respectively.

An energy project permitting challenge many local governments face is balancing concerns for health and safety and other potential environmental impacts, while providing for California's increase in population and prosperity. This challenge is compounded by difficult budgetary constraints.

Since an adequate energy supply is important to the future of California, and increased energy efficiency will not meet all future needs, it is important to balance this need for energy production and distribution with a reduction of potential impacts as much as possible.

GUEST AUTHOR ARTICLE

The Guest Author article cited below is found at the end of this chapter. The article contains opinions of the author which do not necessarily reflect the views of the Energy Commission or its staff.

Siting Transmission Facilities: Environmental Issues and Routing Opportunities by John Keene, Supervising Environmental Consultant, Resource Management International, Inc.

THE ENERGY COMMISSION CAN ASSIST LOCAL GOVERNMENTS

This chapter includes information on how the staff of the Energy Commission evaluate power plant and transmission projects within its jurisdiction. Energy Commission staff is available to assist local governments and energy project developers in addressing their concerns, whether they are issues covered in this Guide or other issues.

SEEKING 'WIN-WIN' SITUATIONS

We are seeking 'win-win' situations in which maintaining a healthy environment is accompanied by sound and sustainable economics. Areas of high "quality of life" attract people and business development. An important part of that quality of life includes the protection of air and water quality and the natural resources which can benefit people for the long-term. In addition, health and safety and freedom from public nuisances are important considerations. When the quality of life in an area declines, people and businesses are likely to relocate.

KEY LOCAL ACTIONS TO ADDRESS PERMITTING ISSUES

In general, key actions local governments can take to address specific permitting issues include:

- Conduct advance planning, e.g. up-to-date general plan elements, resource inventories and coordination with utilities (as addressed in Chapter 3)
- Develop energy facility guidelines or standards and mitigation measures
- Involve early the potential developer, all relevant agencies and utilities, and the public
- Seek information/assistance from other agencies
- Consider alternatives to the project or project location

COSTS TO LOCAL GOVERNMENTS

Local governments can incur high costs to review energy project applications, and for monitoring and enforcing regulations. There are options available to local governments to recoup at least some of the costs. First, the permit fees collected by a local agency can and should reflect the costs that are commonly associated with their review and approval, including the costs of outside consultants. Second, any ongoing monitoring costs can be part of the yearly permit fee structure.

> *"Local government agencies with an interest in the air quality impacts of energy facilities should work closely with their local districts to ensure that their input will be recognized ..."*

REDUCING THE WORKLOAD

Designating adequate industrial land away from other sensitive land uses, such as schools and hospitals, will eliminate many potential future conflicts. However, not all energy facilities create significant impacts that require such separation. For example, small cogeneration facilities using natural gas-fired turbines or fuel cells have been successfully located in non-industrial areas of cities without adversely impacting the surrounding community.

Potential conflicts and hence workload can be reduced when there is advance planning and early involvement with local utilities, potential developers, relevant agencies, and the public. In addition, conflicts can be reduced when local permitting processes are developed in concert with general plans. In determining overall community goals with the land use plan, consideration should be given to what energy requirements will be created and how these might be met. This could significantly reduce conflicts between the community planning and specific facility permitting processes.

IMPLEMENTATION IDEAS

The following are suggestions for implementation ideas which can be applicable to energy facilities in general:

- Develop mitigation requirements that reflect accurate pre-construction estimates of impacts to enhance mitigation effectiveness.
- Establish cost recovery ordinances. Include the cost of application evaluation, as well as monitoring services as part of the permit fee structure.
- Participate in regional programs related to energy facility planning and permiffing. Develop relationships with neighboring jurisdictions to share information, policies and programs, and to seek input on projects that have impacts that may affect other jurisdictions.

Work with other jurisdictions to develop and implement uniform standards throughout the region. Coordinate with other jurisdictions to ensure a level playing field for all jurisdictions in the region. Develop procedures to notify all affected jurisdictions and agencies for input on projects that may affect them.

- Schedule a pre-application meeting with the energy project proponent and all interested local, state and federal agencies. The purpose of the meeting is to provide the developer with early feedback on the proposals, including the possible issues that may need to be addressed and mitigation measures that may be required. Providing developers with all local, state and federal permit requirements and local policies in advance of submittal of the project application will allow them to design-in the necessary measures from the start. Proper early design of handling and storage areas can facilitate permitting by eliminating costly and time-consuming design revisions.

- Designate adequate industrial land in areas down-wind and well separated from sensitive uses. Protect vacant industrial sites from encroachment by residential or other sensitive uses. Designating industrial land is a benefit to developers and the community alike by not locating incompatible uses adjacent to each other.

INFORMATION RESOURCES

The Energy Commission staff can provide information on siting procedures, significance criteria, data requirements, conditions of certification, and the applicable laws, ordinances, regulations and standards for determination of environmental issues, engineering requirements, determination of need, facility closure, and demonstration projects. Commission staff has experience working with project developers and developing consensus among all parties.

For energy facilities over which the Energy Commission has jurisdiction, power plant siting regulations are found in *Rules of Practice and Procedure and Power Plant Site Certification Regulations.*
Contact: Siting Office, California Energy Commission, 1516 Ninth Street, Sacramento, CA 95814, (916) 654-3928.

The Office of Planning and Research, has written *General Plan Guidelines* to help local governments write their General Plans, including all required and optional elements.
Contact: Governor's Office of Planning and Research, 1400 10th Street, Sacramento, CA 95814, (916) 445-4831.

The Association of Bay Area Governments (ABAG) has written *Small But Powerful — A Review Guide to Small Alternative Energy Projects for California's Local Decision Makers.* The guide includes a description of small, nontraditional energy facilities including wind, biomass and waste-to-energy, solar, hydroelectric, and cogeneration, and a discussion of critical issues and the permitting and regulatory review for each type of energy facility.
Contact: Association of Bay Area Governments, P.O. Box 2050, Oakland, CA 94604, (510) 464-7900.

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SITING TRANSMISSION FACILITIES: ENVIRONMENTAL ISSUES & ROUTING OPPORTUNITIES

Opinions of the author do not necessarily reflect the views of the Energy Commission or its staff.

Today, more than ever, the success of new and upgraded electricity transmission projects begins with a thorough understanding of real and perceived environmental issues, including electromagnetic field (EMF) effects, avian collisions and electrocutions, aesthetics, and land use compatibility. Decision makers must strive for a balance between infrastructure needs and the sensitivities and constraints of the environment.

Public agencies and developers both are beginning to recognize the value of early identification of key environmental issues, routing opportunities and options, and early agency and public involvement. Understanding the issues and taking action early to address those issues are key to a successful process.

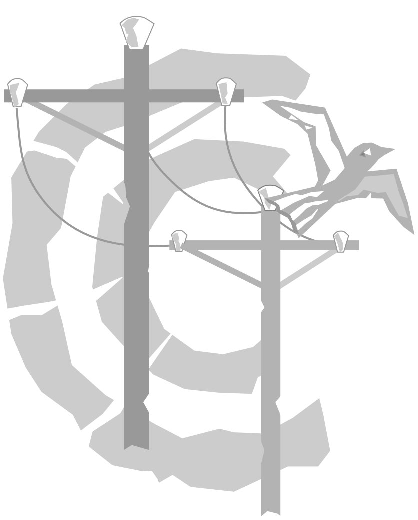
EMF EFFECTS

EMF has become a very frequently discussed concern, but the human health risks of EMF are still widely disputed and uncertain. However, there are actions that can be taken in transmission facility and switchyard location and design which can reduce potential electric and magnetic fields. Design considerations include changing the structure height, altering the conductor configuration and spacing, and reordering the phase sequence. Early communication and factual treatment of EMF issues can make new facilities more understandable to the public and compatible with existing land uses.

> *"Decision makers must strive for a balance between infrastructure needs and the sensitivities and constraints of the environment."*

AVIAN COLLISIONS AND ELECTROCUTIONS

Bird electrocutions on powerlines and collisions with transmission line structures are often a concern with resource agencies (e.g., California Department of Fish and Game and U.S. Fish and Wildlife Service), utilities, and the public. In the past, public concern was related to electrocution of birds, specifically raptors; however, advances in engineering design and modifications to powerlines and substations have significantly reduced these problems. Currently, the primary concern is direct avian mortality due to accidental collision with the transmission line structures, especially the static line (the static line is the non-conducting wire on a transmission line placed above conductors to minimize outages from lightning strikes). Static lines are thinner than the conductor and more difficult for birds to detect, especially during inclement weather. There are a number of methods for reducing bird collisions with transmission lines, including not installing the static lines, use of marking devices (e.g., orange aviation markers) to increase the visibility of the static line, and constructing the new line in existing corridors to increase visibility.



AESTHETICS

The public generally considers transmission lines in the landscape to be aesthetically adverse, especially when they are in close range view from private residences, public recreational facilities, or major roadways where similar features (transmission lines) are not already present. There are several siting opportunities and options which, when feasible, can significantly reduce visual impacts, including upgrading an existing line, paralleling an existing line, paralleling an existing linear feature (e.g., a gas pipeline, road, railroad, or canal), or constructing an underground line (technically feasible for lower voltage lines).

LAND USE COMPATIBILITY

The public is often concerned that a new transmission line will affect prime agricultural land by impairing agricultural production, and in residential land use areas, concerns tend to focus on the potential for acquisition/relocation of residences in the transmission line right-of-way.) There will likely be other land use concerns (e.g., traffic or noise) related to the construction of a new transmission line; however, as with the above issues, their early indemnification will assist in the evaluation of routing opportunities.

LOCAL AGENCY ACTIONS

What can an agency do to ensure a successful project? There are no guarantees to the success of a project, but there are steps which can reduce financial, environmental and regulatory risks, including:

- Environmental Assessments
- Early Agency Consultation
- Public Participation Plans

Environmental Assessments

Early reconnaissance-level environmental assessments are often used to evaluate alternative corridors for transmission lines. The assessment study provides a preliminary evaluation of potential environmental impacts, including potentially significant environmental impacts which could result in public opposition, project denial, withdrawal, or costly redesigns. Early assessments can take the form of initial studies, fatal flaw analyses, and environmental feasibility reviews.

Early Agency Consultation

Early consultation with permitting and regulatory agencies gives the lead agency and project applicant the opportunity to describe the proposed project and alternatives, identify the issues and concerns of the agencies, determine what permits/approvals are required, determine what information is needed to process the permits, establish time lines for submitting information, and identify the agencies' contact persons for the project. In addition, early consultation provides the agencies with an opportunity to suggest alternatives and mitigation measures early in the planning and siting process.

Public Participation Plan

An effective public participation program can build public understanding, help establish an organization's credibility, and identify issues that may have been overlooked in early project planning. To be effective the program should:

- Educate and clearly explain the need for the project
- Provide a vehicle for the public to express their concerns and share information
- Demonstrate that public input is being considered and addressed in the decision making process

In addition to meetings, public involvement programs can also include: citizen advisory and focus groups, media coordination, and newsletters, flyers, and brochures.

The key to an agency's success in siting a new transmission line includes understanding and addressing the key environmental issues, and identifying opportunities to mitigate these issues. Effective agency and public participation helps to accomplish these objectives and make the environmental regulatory process a success.

NOTES NOTES NOTES

CHAPTER 5.1: AIR QUALITY

INTRODUCTION

Air pollution problems from ozone formation or particulate matter buildup in the atmosphere are common throughout California. The majority of emissions which create these problems come from mobile sources, like trucks, cars, busses, trains and airplanes. Lesser amounts come from stationary sources, such as refineries, powerplants and industrial manufacturing; and area sources such as residential fireplaces, gas water and space heaters, dry cleaners and gas stations.

Power plant emissions represent less than 5 percent of state-wide air emissions. Nevertheless, due to their relatively large size, citizen concerns about the potential public health impacts of air pollutants emitted by individual energy facilities are often the greatest source of public opposition to construction and operation of such facilities. Recognizing these concerns, and identifying potential air quality impacts and mitigation measures early in the permitting process, will increase the efficiency and effectiveness of the process, thus reducing the costs and concerns of everyone.

Energy facilities produce air pollutant emissions during construction, and during the handling, storage, and combustion of fuels, and from the use of chemicals. Air pollutant emissions and the resulting level of public exposure may produce adverse health impacts, property damage, and damage to agriculture, or be a public nuisance. The federal and state governments have set ambient air quality standards to protect public health and welfare. California standards are often stricter than the national standards. Local air districts develop and enforce rules for attaining and maintaining these national and state standards, and are the primary agencies responsible for regulating air pollutant emissions from stationary sources, including energy facilities.

> *"Local government agencies with an interest in the air quality impacts of energy facilities should work closely with their local air districts ..."*

Local government agencies should work closely with their air district to ensure that their input will be recognized during the rulemaking and permit-approving activities of the district. While local agencies other than air districts do not regulate the emissions from energy facilities, they can take steps to avoid or minimize air quality impacts on surrounding uses. Cities and counties can influence, through their zoning laws, policy preferences, use permit processes, where energy facilities are located, and how they operate. (See Chapters 3 & 4 for more information.)

WHAT ENERGY FACILITY CHARACTERISTICS ARE ASSOCIATED WITH AIR EMISSIONS?

The types and quantities of air pollutants emitted from an energy facility are usually dependent upon the type of fuel used and the combustion process (see the insert *Typical Energy Facility Emissions).* Other emissions sources include cooling towers, pollution control equipment and chemicals, auxiliary power systems, and fugitive emissions sources such as leaking valves, graded construction areas, unpaved roads and parking areas, and storage piles.

Energy facility projects may also have transportation emissions which will need to be included in the analysis of project emissions.

Examples include emissions from frequent truck traffic or coal trains.

Some energy facilities, such as wind turbines, hydroelectric, solar photovoltaic, nuclear, fuel cells, and small scale solar thermal, produce few, if any, air pollutant emissions during operation.

Some electricity generating facilities are designed to run nearly constantly at full capacity to meet the base load demand for electricity. Some facilities operate only during peak demand periods, such as hot summer afternoons, when air conditioning is widely used. Other facilities function somewhere in between, operating at partial load for much of the time, but then increasing operation to meet electricity demand whenever necessary.

Start-ups, shutdowns and transitions from partial to full load operation can increase air emissions, since many emissions control systems are temperature or flow-dependent. Since most ambient air quality standards are short-term (from 1 to 24 hours), the daily operating profile of an energy facility is important when assessing the significance of its emissions. Due to their operating profiles, intermediate and peak load facilities may have an impact on short-term ambient air quality conditions more than do baseload facilities using the same technology. Understanding when intermediate and peak load facilities may be operating to meet demand on a daily, weekly, and seasonal basis, helps determine the significance of their air quality impacts.

TYPICAL† ENERGY FACILITY EMISSIONS

Facility Type	Typical Emissions
Natural gas-fired	NO_x, CO_2, CO, VOC, PM10, SO_2
Oil or coal-fired	NO_x, CO_2, CO, VOC, PM10, SO_2, and fuel trace elements.
Geothermal	H_2S, SO_2, CO_2, ammonia, methane, mercury, radon, boron and trace metals.
Waste-to-energy	
Municipal solid waste	NO_x, CO, VOC, CO_2, PM10, and other chemicals (e.g., chlorides) present in the MSW.
Biomass	NO_x, CO, VOC, CO_2, PM10, and possibly trace organics, pesticides, fungicides. Rice straw burning emits silicon-dioxide fibers similar to asbestos.
Landfill/sewage gas	NO_x, SO_2, CO, VOC:, CO_2, PM10, and some ammonia chlorides.
Solar Thermal	NO_x, SO_2, CO, VOC, CO_2, PM10. Utility-scale solar usually has natural gas-fired assist/back-up, releasing additional emissions as listed above.
Solar central receiver, Photovoltaic array, or Wind turbine farms	PM10 from the disturbance of large tracts of land for large-scale facilities.

† These emissions are typical for the fuel types, regardless of energy facility size. The relative significance of the emissions depends on project parameters, such as type of combustion technology, fuel composition, and local ambient concentrations of pollutants.

WHAT ARE THE AIR POLLUTANT & EMISSIONS ASSOCIATED WITH ENERGY FACILITIES?

Emissions from power plants and related facilities usually include nitrogen oxides (NO_x), sulfur compounds, volatile organic compounds (VOCs), particulate matter 10 microns or less in diameter (PM10), carbon monoxide (CO), carbon dioxide (CO_2) and heavy metals.

- Nitrogen oxides (NO_x) consist mostly of nitrous oxide (NO) and nitrogen dioxide (NO_2). These compounds are primarily formed during combustion processes as nitrogen is oxidized. The higher the combustion temperature, the greater the rate of NO_x creation. Gaseous NO_x can react with VOCs to form ozone and can form suspended particulate matter.

Efforts to minimize NO_x emissions with urea injection or ammonia injection and selective catalytic reduction can lead to ammonia

AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	National Standard	California Standard
Ozone (O_3)	1 Hour	0.12 ppm*	0.09 ppm
Carbon Monoxide (CO)	8 Hour 1 Hour	9 ppm 35 ppm	9 ppm 20 ppm
Nitrogen Dioxide (NO_2)	Annual Average 1 Hour	.053 ppm - - -	- - - .25 ppm
Sulfur Dioxide (SO_2)	Annual Average 24 Hour 3 Hour 1 Hour	.03 ppm .14 ppm .50 ppm - - -	- - - .04 ppm - - - .25 ppm
Suspended Particulate (PM10)	Annual Geometric Mean 24 Hour Annual Arithmetic Mean	- - - 150 µg/m^3 50 µg/m^3	30 µg/m^3*** 50 µg/m^3 - - -
Sulfates	24 Hour (SO_4)	- - -	25 µg/m^3
Lead	30 Day Average Calendar Quarter	- - - 1.5 µg/m^3	1.5 µg/m^3 - - -
Hydrogen Sulfide	1 Hour (H_2S)	- - -	.03 ppm
Vinyl Chloride	24 Hour	- - -	.01 ppm
Visibility Reducing Particulates	1 Observation	- - -	Sufficient amount to produce an extinction coefficient of .023 per kilometer due to particulates when the relative humidity is < 70%

* ppm = parts per million
** Secondary Standard
*** µg/m^3 = micro grams per cubic meter

emissions. Such gaseous ammonia (NH_3) can react to form suspended particulate matter. (Refer to Chapter 5.3 *Hazardous Materials Handling and Storage* for a discussion of anhydrous and aqueous ammonia used with selective catalytic reduction systems.)

- The sulfur concentration in the fuel directly relates to the potential sulfur dioxide (SO_2) emissions, as elemental sulfur is readily oxidized. Coal and oil generally have a higher percentage of sulfur, by weight, than natural gas. Hydrogen sulfide (H_2S) and organic sulfides are often present in sewage treatment gases, landfill gases, and geothermal steam and brine, and can be emitted if the energy facility uses any one of these as a fuel or as thermal energy sources. Gaseous sulfur compounds can react to form suspended particulate matter in the atmosphere.

- Volatile organic compounds (VOCs) can be emitted from the incomplete combustion of fuels, and during the processing, handling, drying and storage of organic fuels (e.g., coal, oil, natural gas, wood, agricultural wastes, landfill gas). The lower the combustion temperature, the higher the production rate of VOCs. Gaseous VOCs can react with NO_x to form ozone and some types of VOCs can form suspended particulate matter.

- Particulate matter emissions result from the incomplete combustion of fuel (e.g., soot and smoke), ash by-products, and fugitive dust. Fugitive dust from fuel handling, processing, drying, and storage can add to the particulate emissions from fuel combustion. Generally, the greatest concern is with particulate matter less than 10 microns in diameter (PM10), as these smaller particles are more likely to remain suspended in the atmosphere and cause visibility and respiratory problems.

(Federal regulators are considering adopting PM2.5 standards to augment and/or replace existing PM10 standards. These potential standards could change the attainment status and the plan for various air basins, and the air pollutant emission control strategies and technologies being proposed and used.)

> *"Even though an energy facility's contribution to overall air quality may be small in terms of the percentage of the total air quality picture, it should not be assumed that its contribution is always insignificant."*

- The construction of an energy facility may cause significant short-term air quality impacts due primarily to fugitive dust if proper controls are not exercised. Fugitive dust is created from grading and other soil disturbances. The equipment involved (e.g., graders, cranes, trucks, and generators) also creates engine emissions including particulate emissions. These construction emissions are short-term unavoidable impacts that should be mitigated to the extent feasible.

- Fuels such as coal, oil, and natural gas also produce carbon monoxide (CO) and carbon dioxide (CO_2). CO is the result of incomplete combustion of carbon. The lower the combustion temperature, the higher the production rate of CO. CO_2 is an air quality concern because it is one of the pollutants which is believed to contribute to the greenhouse effect.

- Heavy metal compounds can be emitted from facilities burning oil and coal, depending on whether these elements are present in the fuel. They can also result from biomass, municipal solid waste, and geothermal facilities.

- The collection of landfill gas and sewage treatment gas may actually serve as a waste facility emissions control device and as a fuel source for electric generation and alternative fuel vehicles. (See the *Sonoma County Landfill Gas Project* box on page 5.1.8.) However, when the gas is collected and burned, air pollutants including heavy metals may be released. "Waste" gas fuels (gaseous or solid) also often contain ammonia, chloride, and organic compounds that can be emitted when burned. Precombustion treatment of the gases, careful sorting of wastes, hazardous materials extraction, and proper emissions control measures can reduce these emissions.

WHAT ARE CRITERIA POLLUTANTS?

Criteria air pollutants are those for which the United States Environmental Protection Agency (US-EPA) or the California Air Resources Board (CARB) has set standards based on public health, crop, and material damage criteria. These

THE REGULATORY ENVIRONMENT FOR AIR QUALITY

Federal	
• US-EPA sets national ambient air quality standards and hazardous air pollutant emission standards; identifies Best Available Control Technologies (BACTs) for criteria pollutants, Maximum Achievable Control Technologies (MACTs) for hazardous air emissions, Lowest Achievable Emissions Rates (LAERs), and oversees State programs (Clean Air Act)	Title 42, United States Code, section 7401 et seq.
State	
• CEQA guidelines for significant impacts: Violation of any ambient air quality standard, contributes substantially to an existing or projected air quality standard violation, or exposes sensitive receptors to substantial pollutant concentrations	Title 14, United States Code of Regulations, section 15064 Appendix G (x)
• CARB sets ambient air quality standards	Health & Safety Code section 39606
• CARB (with Dept. of Health Services) sets safe exposure limits for toxic air pollutants and identifies Best Available Control Technologies for Toxics (TBACT)	Health & Safety Code sections 39650-74
• CA Energy Commission requires identification of offsets in permits	Public Resources Code section 25523 (d)(2)
• Local air district must issue Determination of Compliance for projects subject to CA Energy Commission siting process	Title 20, California Code of Regulations, section 1744.5
• Permits prohibited for facilities that prevent or interfere with attainment or maintenance of any applicable air quality standard	Health & Safety Code sections 42300 & 42301
• No net increase in non-attainment pollutants for districts with moderate, serious or severe air pollution, BACT trigger levels for each category	Health & Safety Code sections 40918, 40919 & 40920
• Reporting requirements for facilities emitting criteria pollutants or any toxic contaminant	Health & Safety Code section 44360 et seq.
• Requirements of health risk assessments	Health & Safety Code section 44360 et seq.
• Health risk assessment required for any project that burns municipal waste or refuse-derived fuel	Health & Safety Code section 42315
• Emission control requirement for upwind areas	Title 17, California Code of Regulations, section 70600
• Offsets from avoided open burning allowed	Health & Safety Code section 41605.5
• Rice Straw Burning Reduction Act, emissions reduction credits	Health & Safety Code section 41865
• Offsets for biomass facilities that use agricultural waste, forest and other organics	Health & Safety Code section 42314.5

THE REGULATORY ENVIRONMENT FOR AIR QUALITY (Cont.)

State and Local	
General limitation on discharge from a source that causes nuisance to any considerable number of persons	Health & Safety Code section 41700 Local air district rules
Local	
Nuisance action to abate damages; public nuisance	Civil Procedure Code section 731
Local air districts have the primary responsibility for control of air pollution from all sources other than emissions from motor vehicles	Health & Safety Code section 40000
Full disclosure by facilities to local air district of hazardous emissions	Health & Safety Code section 44340 et seq.
Air Districts set: Emission limitation rules New source review rules Prevention of significant deterioration rules	Health & Safety Code section 42301

"criteria" pollutants are shown in the insert *Ambient Air Quality Standards* on page 5.1.3.

The shorter duration standards (hours and days) were set to protect the most susceptible populations from acute health problems (e.g., asthma sufferers, the elderly and very young children) and to protect agricultural crops. The longer standards (annual) are designed to address chronic health effects and the corrosion and soiling of materials.

Most of the criteria pollutants are directly emitted from the combustion process. These primary pollutants can affect public health and damage crops and materials directly. They can also form secondary pollutants, which also affect public health and damage crops and materials. For instance, secondary PM10 may result from VOCs, SO_2, NH_3, and NO_x primary emissions. Ozone (O_3), is formed from NO_x and VOC emissions reacting in sunlight.

WHAT ARE NON-CRITERIA AIR POLLUTANTS AND THEIR POTENTIAL EFFECTS?

Non-criteria pollutants are those for which the US-EPA, the CARB, and local air districts have not set ambient standards. Examples of energy facility-related non-criteria emissions can include ammonia, arsenic, benzene, beryllium, cadmium, chromium, formaldehyde, nickel, and selenium. The primary source of non-criteria air pollutants is from trace amounts of elements and compounds associated with fossil fuels. These can result in trace emissions (non-criteria air pollutants) and combinations of trace emissions which can have a public health effect.

One effective way to control non-criteria air pollutant emissions is to limit a facility's number of operating hours per year using certain fuels. The restricted use of the fuel, and, therefore, its non-criteria pollutant emissions, is based on a designated safe level of the long-term, average annual exposure of the most sensitive persons over a seventy year period. Natural gas, which is being increasingly used as the fuel of choice in energy facilities (due to its current abundance and low price), contains minimal levels of non-criteria pollutants which can result in the emission of non-criteria pollutants. Some non-criteria pollutants have been identified as toxic air contaminants. Although no ambient air quality standards have been adopted for these pollutants, specific emission control requirements may exist. For a list of toxic air contaminants, contact CARB or the California or U.S. Environmental Protection Agency.

WHAT ARE SOURCES OF ODORS FROM ENERGY FACILITIES?

Energy facilities may also produce odorous emissions due to the handling, storage, and combustion of fuels, and the use of process and emissions control chemicals. Industrial facilities associated with cogeneration energy facilities may also produce odors that the public will attribute to the energy facility. These odorous emissions are usually not strong enough to result in public nuisance complaints during normal operations. Upset conditions can lead to nuisance odor exposures and public complaints. Nuisance odors from normal and upset operating conditions do not normally constitute public health concerns.

Odors convey information about their sources and produce a wide variety of emotional and physical responses. Odors are characterized by detectability (or threshold), intensity, character, and desirability (hedonic tone). While we can describe the color, texture, feel, and shape of an object, an object's odor can help us decide if we want to be near it or away from it. The perception of, and sensitivity to, odors is highly subjective and varies widely among individuals. Some individuals become readily desensitized (odor fatigue) while others become physically ill when exposed to the same odors.

The relationships between the intensity or duration of the exposure to odors and the magnitude of the symptoms have not been established. Although the relationship between odor and health risk is not clear; some believe that if it smells bad, it must be bad.

WHAT CRITERIA CAN BE USED TO DETERMINE IF IMPACTS ARE SIGNIFICANT UNDER CEQA?

For those projects which are subject to CEQA, a significant adverse effect on air quality would require preparation of an EIR.

Under the California Environmental Quality Act (CEQA), a lead agency may consider a project's impact on air quality to be significant if it:

- Creates a potential health hazard
- Violates any ambient air quality standard
- Contributes substantially to an existing or projected ambient air quality standard violation
- Exposes sensitive receptors to substantial pollution concentrations

Some air districts may allow project-specific emission increases of non-attainment pollutants or their precursors. However, the districts' attainment plans, which consider all sources of emissions, should ensure that such project-specific emission increases do not interfere with the attainment or maintenance of ambient air quality standards.

Notwithstanding project compliance with air district rules and regulations, if other information is presented suggesting that the emissions may cause a significant effect, the city or county, if it is the lead agency, will need to evaluate the effect and decide whether it may be significant. Even though an energy facility's contribution to overall ambient air pollution levels may be small in terms of the percentage of the total air quality picture, it should not be assumed that its contribution is always insignificant. Although no individual source usually contributes a large percentage to air pollution, the sum of all emissions can be very significant. The spatial and temporal nature of such emissions, as well as their magnitude, need to be considered along with the severity of the existing nonattainment problem, to determine the significance of such emissions impacts.

The direct, indirect and cumulative impacts of a proposed energy facility should be considered. Direct air quality impacts can result from air pollutant emissions during the construction and/or operation of a facility. Indirect air quality impacts result from ancillary activities, such as fuel delivery on trucks, trains, barges, etc., and fuel production, either on-site or off-site.

A facility's cumulative impacts can be evaluated in concert with other nearby projects with potential air quality impacts. Projects that should be included in the analysis are similar past projects, those that are under construction, in the permitting process, or reasonably expected to be approved in the near future. If the total emissions of these projects, added to the background air pollution levels, exceed any ambient air quality standard based on an air dispersion modeling analysis, mitigation may be required. For air emissions which can result in regional impacts, the entire air basin may need to be considered in determining the extent of cumulative impacts. (Kings County Farm Bureau v. City of Hanford [1990] 221 Cal.App.3d 692, 270 Cal.Rptr. 650) Future development that is likely to result as a consequence of the project should also be considered.

WHAT IS THE RELEVANT FEDERAL AND STATE LEGISLATION?

FEDERAL

The Federal Clean Air Act (1970, amended 1977, 1990) required the adoption of national ambient air quality standards for all areas of the United States. The US-EPA implements the Federal Clean Air Act. For non-attainment areas, i.e., areas for which the National Ambient Air Quality Standards are exceeded, a classification system is in place based on the degree of non-attainment. The classes are moderate, serious, and severe. The US-EPA requires that each state develop a State Implementation Plan (SIP) to attain, by a deadline, or maintain the ambient air quality standards of the federal act. If the SIP is deemed not adequate to meet federal standards by the deadline, the US-EPA may prepare and implement its own Federal Implementation Plan (FIP) to do so.

STATE

California has enacted its own, more restrictive, Clean Air Act (1988, amended 1992). In California, the US-EPA has delegated the authority to implement portions of the Federal Clean Air Act to the Air Resources Board, which has authorized local air districts to implement rules for attaining the national and state air quality standards.

WHAT IS THE AIR DISTRICT'S ROLE?

Air districts have been set up to control all non-mobile air pollution sources. They have responsibility for adopting and enforcing rules and regulations to ensure that they meet state and federal ambient air quality standards. Local air districts are free to enact stricter rules and regulations than the state or federal rules and regulations. In California, the air districts are required to write air quality management plans to reduce the ambient levels of non-attainment pollutants. The districts' plans together constitute California's State Implementation Plan. With the passage of the 1992 amendments to the California Clean Air Act, air districts are now also responsible for implementing transportation and area source control measures to improve air quality.

Local air districts implement and enforce emission limitation rules, and in most cases, New Source Review (NSR) rules and Prevention of Significant Deterioration (PSD) rules. Emission limitation rules apply to both new and existing emission sources and specify maximum emission levels for various emission source categories. NSR rules establish criteria for siting new sources of nonattainment pollutants. The basic NSR requirements include:

SONOMA COUNTY LANDFILL GAS PROJECT

Landfill operators are required to control landfill gas emissions. Sonoma county was flaring off landfill methane as a control measure. The County decided not to waste this resource but to capture it and create electricity from it. By doing so, the County found an efficient solution to meeting a regulatory mandate that is able to pay for itself.

Currently, the County generates 3 MW with excess gas flared off. Part of what is generated is used on-site to power a composting project, and the remainder, about enough to power one Sonoma County town, is sold to PG&E. With the current Standard Offer #1 contract with PG&E, the County expects a payback period of 8-9 years. Current landfill capacity is projected until 2003 with adjacent land available for another 12-15 years of landfill life. Methane projection is expected for 20 years past closure. AB 939 diversion requirements may affect the gas generating capacity of landfills, however the effect is not yet known.

One issue that has accompanied this landfill gas project is air quality control. The County's permit with the Bay Area Air Quality Management District allows for flaring of landfill gas as an abatement control device. Power generation at this site is considered a new source of emissions and as such is under stricter emission control requirements, requiring offsets for the NO_X that is generated in the process. The County is working to secure these offsets.

Contact: Ken Wells, Sonoma County Department of Public Works, 575 Administration Drive, Room 117, Santa Rosa, CA 95403, (707) 527-2231.

A TYPICAL PROCESS TO DETERMINE AIR QUALITY IMPACTS and the EFFECTIVENESS OF MITIGATION MEASURES

- Identify the potential air pollutant emissions from the energy facility. Evaluate the type of fuel, its composition, the operating profiles, and emission data from facilities using similar fuels and processes. Identify worst case, average, and annual emissions based on whether the facility is baseload (operating continually), intermediate load (operating at partial capacity most of the time but increasing capacity to meet peak requirements), or peak load (operating only during peak need times, and therefore, involving many start-ups).

- Define the existing and future ambient air quality. In order to determine if the addition of emissions from the facility will cause an ambient air quality standard violation or increase the severity of an existing violation, existing and future ambient air quality should be evaluated. Information on spatial and temporal variations in ambient pollution concentrations is important for this purpose.

- Analyze the pollutant dispersion into the air. US-EPA, CARB and some local air districts have designated approved dispersion models for primary pollutants. The modeling can be done for regular operating and upset conditions using ambient air quality and meteorology data available from the local air district. Ozone and secondary PM10 are generally the result of many region-wide sources and are difficult to model. Therefore, evaluation of these indirect pollutant impacts generally requires consideration of the regional sources of the precursors of ozone and PM10, regional variations in ambient concentrations, and the facility's contribution to regional air quality.

- Consider the magnitude of the emission increases from the facility. All individual emissions in an air basin are small when compared with the total emission inventory, the sum of all emission sources. However, the degree to which a facility's emissions contribute to existing and future air quality problems in an air basin should be examined.

For non-criteria pollutants (those pollutants for which no standards have been set), it is often necessary to do the following to determine the significance of the impact, after the potential air pollutant emissions have been identified:

- Identify the potential health hazards of each toxic pollutant. Potential sensitive receptors can be located and the level of possible exposure from the facility emissions can be determined and compared to the acceptable exposure level. Potential human exposure can occur through inhalation and ingestion. Ingestion can occur, for example through eating crops, livestock, or fish, or by drinking milk, surface water, groundwater, or maternal milk.

Mitigation measures can then be developed to reduce or eliminate the adverse impacts of the project.

- Mitigation measures can be developed to eliminate or reduce significant impacts. Where feasible, mitigation measures can be matched spatially and temporally with the expected adverse air impacts. That is, an emission violating a standard or creating an adverse health impact in one location is best balanced by an emissions reduction in reasonable proximity to the violation, and short-term standard violations (hourly, daily) are best mitigated with emissions reductions of the same magnitude over the same time frame (hourly, daily).

- The use of offsets

- Compliance with the lowest achievable emission rate

- Certification by the proponent that other operations owned by them located in California currently comply with all air quality laws

In areas that already meet national ambient air quality standards, PSD rules establish criteria for new emission sources. Their purpose in part is to:

- Allow economic growth in a manner consistent with the preservation of existing clean air resources

- Protect public health and welfare

- Protect national parks and wilderness areas from visibility impacts

WHAT IS THE ROLE OF CITIES AND COUNTIES?

While air districts are responsible for controlling emissions from stationary sources, including power plants, other local government agencies, including cities and counties, can help to effectively mitigate project air pollutant emissions impacts under certain circumstances. They may do this by controlling the location, construction, and operation of the energy facilities themselves through general plan documents, specific area plans, zoning ordinances, special or conditional use permits, and any environmental impact reports required by the above processes. They can also influence the rulemaking and permit approval processes of their air districts through direct participation. (For more information on these topics, please refer to Chapters 3 and 4.)

The analyses performed for air district permits, when the district is not the lead agency, may not always address the broad range of issues required under the California Environmental Quality Act (CEQA). CEQA requires decision makers to document and consider the environmental implications of their actions, and ways to mitigate or otherwise lessen any resulting impacts. (See box on the previous page entitled *A Typical Process to Determine Air Quality Impacts and the Effectiveness of Mitigation Measures*.)

Local government agencies, in their issuance of other permits (e.g., special or conditional use permits) within their jurisdiction, may identify potential environmental air pollutant emission impacts from a project and mitigation measures, which may be in addition to those required by the air district permit.

WHAT IS THE CITY/COUNTY ROLE REGARDING ODOR IMPACTS?

Air districts in California adopt and enforce public nuisance rules to control odors from stationary sources. While air districts are responsible for controlling nuisance odors from stationary sources, city and county planning departments control the location and construction of some energy facilities themselves through general plan documents, specific area plans, zoning ordinances, and special or conditional use permits. These local government agencies, in their approvals of land use permits, may require stricter mitigation measures as a result of a CEQA analysis. Local governments also have the right to control nuisances, including odors.

If there are public complaints about odors or the perception by the public that an odor nuisance will result from the construction, operation or upset conditions associated with energy facilities, the local government permit authority may wish to pursue an odor impact determination and recommend mitigation. (See insert on the previous page entitled *A Typical Process to Determine Air Quality Impacts and the Effectiveness of Mitigation Measures.*) Odorous air emissions impacts can be determined by air dispersion modeling and compared to odor thresholds to estimate the potential for nuisance odors. Odor mitigation effectiveness can be evaluated similarly.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can locate air pollution sensitive land uses away from existing developed and undeveloped industrial sites. The city/county can require land developers, who propose projects that involve sensitive receptors (schools, hospitals, convalescent facilities), to provide buffer zones to separate them from industrial sites. The city/county can likewise require new energy facilities with adverse air quality impacts to be located an adequate distance from residential areas and sensitive receptors.

◩ The city/county can encourage energy facility developers to propose innovative measures to reduce air quality impacts. These can include new low-NO_X burners for reducing stack emissions and other new emissions control. The city/county can also encourage development of alternate energy technologies that improve air quality.

IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

◩ Participate in the local air district's rule development process. The rules set by the air district include emission limitations, new source review, and prevention of significant deterioration rules.

◩ Participate in the public hearing process of federal, state and regional agencies on issues relevant to local air quality. Participate in the Energy Commission's licensing process for energy facility projects with potential air quality impacts within the boundaries of the city/county.

◩ Participate in developing procedures for performing air quality impact analyses. Support the development and use of air basin-wide air quality impact assessment guidelines. Participate in regional programs affecting air quality. Develop relationships with neighboring jurisdictions to share air quality information, policies, and programs, and to seek input on projects that have air quality impacts that affect other jurisdictions. Coordinate with other jurisdictions in the air basin to ensure a level playing field for all jurisdictions in the basin. Develop procedures to notify all affected jurisdictions and agencies for input on projects that may affect their air quality.

◩ Coordinate with other jurisdictions in the air basin to request comments from them and affected agencies during review of energy facility applications for facilities with the potential to impact air quality in their jurisdictions. Request notification of, and an opportunity to provide input for, energy facility development in neighboring jurisdictions that potentially will adversely impact local air quality.

◩ Consult with the local air district during CEQA review for all energy facility projects. Work with the local air district to ensure that all air quality impacts identified during CEQA review are consistently and adequately mitigated.

◩ Consult with the local air district to identify sources of toxic emissions and plot them on land use and zoning maps. Consult with project proponents during pre-application review to avoid inappropriate uses at affected sites.

◩ Designate adequate industrial land in areas downwind and well separated from sensitive uses. Protect vacant industrial sites from encroachment by residential or other sensitive uses. Designating industrial land benefits developers and the community alike by not locating incompatible uses adjacent to each other.

◩ Conduct a pre-application review with the project developer, local air district, and other affected agencies to identify air quality issues that may require redesign of the project and allow all interested parties to have their concerns addressed in the early stages of an energy facility's development. Review the air quality impact analysis provided by the applicant to ensure accuracy of the information.

◩ Consider requiring projects to prepare health risk screening assessments as part of an environmental review when the proposed industrial process or emissions are known. The health risk screening assessment will provide the permitting agency with the necessary information to determine if the project will have significant adverse health impacts, and to determine if a detailed health risk assessment is needed.

◩ Consider requiring mitigation to control fugitive dust, including site watering, speed limits, tire washing for vehicles that leave the site, parking area treatments, such as paving, and stabilizing temporary dirt piles.

◩ Develop monitoring procedures to ensure that mitigation measures are in force, and to evaluate their effectiveness.

◩ Provide incentives for energy facility project developers that propose innovative measures to reduce air quality impacts, or that use cleaner, alternate energy technologies. The incentives may include expedited permitting, and reduced permit or operating fees. Positive incentives encourage creative ideas that may provide better air quality improvements than would otherwise occur with standard mitigation measures.

◩ Develop an Odor Complaint Resolution Plan to identify the source of a nuisance odor and to correct the problem. This can reduce or eliminate nuisance odors and the public's perception of odor problems. The odor complaint resolution plan can be a project-specific plan to respond to and resolve odor complaints. Or the plan can be an educational program for the area near a proposed energy facility focusing on the scope and use of the local air district's nuisance rules, or the city/county nuisance abatement programs, if appropriate.

CASE STUDIES

The City of Pleasanton has adopted an air quality element as part of its general plan. The element includes policies and programs related to protecting and monitoring air quality, review of facility proposals, buffer zones between sensitive land uses and potential point sources of air pollution, and coordination with local, regional and state agencies, including the local air district and neighboring jurisdictions.
Contact: Planning Department, City of Pleasanton, P.O. Box 520, Pleasanton, CA 94566, (510) 484-8311.

The Lake County Geothermal Element requires that geothermal operations be planned and carried out using the best available air pollution control technology consistent with the requirements of the Lake County Air Quality Management District. Appropriate operating practices are required to reduce emissions and prevent nuisance odors.
Contact: Mark Dellinger, Energy and Resource Manager, Lake County Special Districts, 255 N. Forbes Street, Lakeport, CA 95453, (707) 263-2273.

INFORMATION RESOURCES

The California Air Resources Board (CARB) has developed the *CEQA Review Handbook for Local Air Pollution Control Agencies.* The handbook provides valuable information on the use and content of required CEQA documents and related time limits; on evaluating stationary sources, development projects, land use projects, and transportation plans; on determining cumulative impacts; and on how to incorporate CEQA into district rules. The handbook also includes an extensive list of sources for further information.
Contact: Stationary Source Division, California Air Resources Board, 2020 L Street, Sacramento, CA 95814, (916) 322-6020.

CARB has also developed the *California Emission Inventory Development and Reporting System* (CEIDARS) as a "living inventory" of emissions data for the state. Each January, the previous year's inventory is projected to represent emissions for the current year. As updates are made to this working database throughout the year, projections are replaced with actual data. The most recent data, as well as "snapshots" of specific time periods, are available via personal computer to local air districts. Each district has access to all of its own data, and to non-confidential data from other districts.
Contact: Dennis Goodenow, California Air Resources Board, 2020 L Street, Sacramento, CA 95814, (916) 445-4292.

CARB has also implemented a program that utilizes a Geographic Information System (GIS) to perform spatial analyses of emission inventory data. GIS will allow a pictorial representation of relationships among data that have traditionally been maintained only as tabular files. With GIS, the relationships can be presented as statistical reports, graphs, and maps. A study of Sacramento County has been completed. The process is currently being extended to the rest of the state.
Contact: Skip Campbell, California Air Resources Board, 2020 L Street, Sacramento, CA 95814, (916) 327-0301.

South Coast Air Quality Management District has developed the *CEQA Air Quality Handbook* to help local government agencies to develop CEQA documents. It includes chapters on air quality background information, the initial consultation, the initial study and determination of significance, document preparation, project review, and monitoring and reporting. The appendices include detailed guidance information, such as calculation procedures and quantification formulas.
Contact: South Coast Air Quality Management District, 21865 E. Copiey Drive, Diamond Bar, CA 91765, (909) 3963600.

The Association of Bay Area Governments (ABAG) and the Bay Area Air Quality Management District (BAAQMD) have prepared a guidebook for city and county governments called *Improving Air Quality Through Local Plans and*

Programs. The guidebook explains why local governments must be part of the air quality solution. It informs local policy makers and planners about air quality issues and opportunities relevant to local jurisdictions, and suggests key ideas for incorporating air quality beneficial policies and programs in local planning and decision-making. A set of appendices is also available to assist local planners in developing local air quality management strategies.
Contact: ABAG Publications, P.O. Box 2050, Oakland, CA 94604, (510) 4647900.

The San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) has developed a guidebook called *Air Quality Guidelines for General Plans.* This guidance document was developed as a resource for the cities and counties in the San Joaquin Valley to use in implementing local air quality programs in their general plans. However, the ideas in it are relevant to other jurisdictions. The objective of the guidelines is to facilitate the successful implementation of local air quality programs that will reduce pollutant emissions in the Valley. The guidebook is available for $10.00. SJVUAPCD also has a rules and regulations manual, emissions inventory criteria and guidelines, and facility risk assessment guidelines. Contact the District for a complete list of materials and order form.
Contact: David Mitchell, San Joaquin Valley Unified Air Pollution Control District, 1999 Tuolumne Street, Suite 200, Fresno, CA 93721, (209) 497-1075, FAX: (209) 233-0140.

The Local Government Commission, under contract to the California Department of Toxic Substances Control, has written a guidebook called *Reducing Industrial and Commercial Toxic Air Emissions by Minimizing Waste: The Role of Air Districts.* This guidebook will help air districts implement programs to reduce toxic air emissions through educational, technical assistance, and regulatory programs. It includes a model resolution for cities, counties and air districts to establish a program to reduce hazardous air emissions by promoting waste minimization.
Contact: Local Government Commission, 1414 K Street, #250, Sacramento, CA 95814, (916) 448-1198.

The City of San Francisco, Department of Public Works, has created an Odor Project to respond to odor complaints from the public. While geared to resolve odor complaints originating from the transport and treatment of sewage, it is also intended to be a data base, or institutional memory, of information about causes of, and solutions to, odor complaints for any odor source. The database will be used to solve odor complaints quickly by avoiding redundant investigations into the source of an odor, and provide a ready solution to the complaints.
Contact: Sam Murray, Odor Project, Public Affairs, Department of Public Works, City of San Francisco, 1550 Evans Avenue, San Francisco, California 94124, (415) 431-9430, Ext. 267.

RELATED CHAPTERS/ISSUES

- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)
- Hazardous Materials Handling and Storage (Chapter 5.3)
- Appendix F: Power Plant Generating Efficiency

NOTES NOTES NOTES

CHAPTER 5.2
BIOLOGICAL RESOURCES

INTRODUCTION

There is the potential for energy facilities and related facilities such as service roads, to impact biological resources during construction and/or operation. Construction activities may directly eliminate habitat or individuals of a species, or degrade important habitat as a result of additional noise, soil erosion, emissions and human activity. Facility operational impacts can include air emissions such as nitrous oxides, waste water discharges, and increased noise, lights, and human activity.

Local governments can be responsive and consistent when they provide energy project development guidance to prospective developers. Working with and providing advance guidance to developers will result in a more efficient, effective, and expeditious permitting process which will benefit both the local community and the developer/applicant.

WHAT ARE SENSITIVE SPECIES?

The term "sensitive species" as used in this document is intended to cover those species which have been provided various forms of legal protection under state and/or federal law (or are potentially eligible for such protection) and include:

- Species listed under the state and/or federal endangered species acts
- Species considered as candidate species for listing under the state and/or federal endangered species acts
- Species that meet the criteria of “rare” or “endangered” under the California Environmental Quality Act Guidelines
- Species identified by legislative acts as requiring protection
- Other species identified as being of special concern by state, federal, or local agencies that have the authority to so designate
- Species of interest or concern to educational institutions, museums, biological societies, or other organizations that have specific knowledge of the biological resources in the project area

WHAT ARE THE MAJOR POTENTIAL BIOLOGICAL RESOURCE IMPACTS FROM ENERGY FACILITIES?

◩ Direct impacts on biological resources include habitat loss disturbances and disruptions, and direct kills. The most significant impact that energy facilities have on biological resources is habitat loss. The size of an energy facility will dictate how much habitat is lost directly, that is, a large energy facility will impact more acres than a small one. But there are other factors to consider as well. For example, construction during inactive times of the year for sensitive species, such as during hibernation, will have a smaller chance of disturbing the local population. (See the box on the next page on *Energy Facilities with Potential Biological Resource Issues.*)

Linear, as well as nonlinear facilities can cause habitat disturbances and disruptions to species.

- Long, linear facilities can disturb many acres of habitat. The actual space needed for pipeline installation may include two lanes for traffic (one in and one out for the machinery doing the digging), an area to store the excavated dirt until the trench is covered, as well as an area in which the backhoe or bulldozer maneuvers when refilling the trench. A pipeline only a few inches in diameter may disrupt an area 75 or more feet wide for the pipeline’s entire length.

Public use can also disrupt biological resources where facility maintenance roads provide access.

• Nonlinear facilities, whether they are compact or large, can disturb sensitive biological areas, such as nesting or foraging areas, during construction or operation. Bright lights and loud noises can disrupt the habits of animals and interfere with mating and other essential activities. Facilities that emit air or water pollutants can affect biological resources either directly or by degrading habitat over an extended time period.

Facilities that discharge water into an adjacent water body can alter the temperature of the receiving waters and adversely affect associated wildlife and vegetation. Groundwater draw-down can lower the local or regional water table to a level where water supplies for animals and plants are eliminated. Such a draw-down may occur by direct facility pumping and/or from pumping by an off-site water provider. Energy facilities that use surface water for such things as cooling may draw in and destroy small fish and plankton.

"Cumulative impacts may be significant even when individual impacts are not."

Energy facilities that use holding or evaporation ponds containing chemicals that can adversely affect sensitive biological resources have resulted in wildlife deaths for individuals that came in contact with the toxic materials. Collisions of protected birds of prey, such as the golden eagle, with wind turbines are another example of direct species loss.

- Cumulative impacts refers to two or more individual effects or impacts which, when considered together, are considerable or which compound or increase other environmental impacts. The individual impacts may be changes resulting from a single project or a number of separate, closely related past, present, and reasonably foreseeable future projects. (Title 14, California Code of Regulations, section 15355). For example, noise, lights, and additional traffic in the vicinity of a facility or more than one facility can have a considerable cumulative impact of disturbance to sensitive species. Cumulative impacts may be significant even when individual project impacts are not.

- Indirect impacts may occur due to future development as a consequence of a project. For example, a project that provides economic incentives to further develop an area may cause the human population of the area to increase, requiring new houses, schools, and shopping facilities resulting in the loss of additional habitat.

The Swainson's hawk and the desert tortoise are examples of sensitive species affected by both cumulative and indirect impacts. The Swainson's hawk is a state listed threatened species in California. Five to ten acres of foraging habitat (grasslands and agricultural fields) may be lost to a typical power plant. It is hard to argue that the loss of these specific acres is a significant loss for the species, unless a breeding nest is involved. However, many projects together,

ENERGY FACILITIES WITH POTENTIAL BIOLOGICAL RESOURCE ISSUES

• Wind Turbine Farms - Bird collisions and death, noise and vibration disruption to species, loss of habitat

• Large Solar Facilities - Loss of habitat

• Electric Transmission Lines - Bird collisions and electrocution of large bird species, loss of habitat

• Oil & Gas Pipelines - Barrier to migration if above ground, possible spill contamination above or below ground

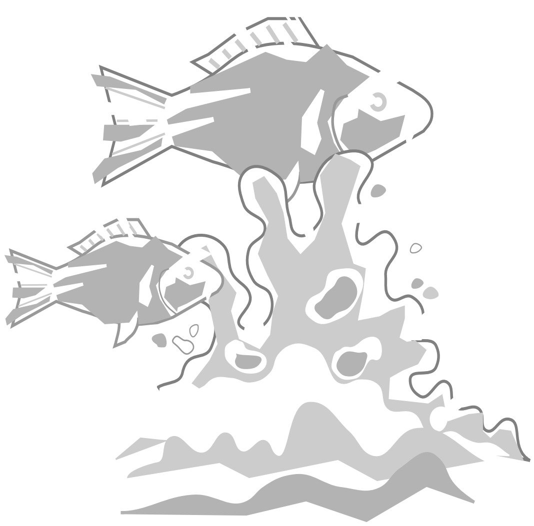
• Forest Waste Biomass Facilities - Traffic in forest, loss of habitat for some species, additional road kills on forest roads

• Hydroelectric Facilities - Habitat loss and barrier to migration for land and water species not just energy facilities, can have a huge impact on the amount of foraging acreage lost to all development over an extended time period.

The same is true for the desert tortoise, a state and federally listed threatened species found in the Mojave Desert area of California. Deserts are also suitable for utility-scale solar facilities, and sometimes utility-scale wind facilities, both of which require large tracts of land. In this case it may again be difficult to prove that the specific acreage impacted by the energy facility will directly threaten the survival of the desert tortoise; however, when a number of developments occur in the desert as a result of the energy development, there may be significant indirect and cumulative impacts to the species.

HOW ARE POTENTIAL IMPACTS DETERMINED?

A biological resource analysis should be performed for energy facility projects when there is the potential to adversely impact biological resources. Small projects in urban areas may require only a brief discussion of biological impacts, unless sensitive species are known to exist there, since impacts to the resources may already have resulted from existing development. Projects on undeveloped habitat, however, will obviously require a much more detailed analysis.



> *"Protection of these species...is important to local governments and the public, especially if the species has commercial and recreational values upon which the local community depends."*

Under current law state or federally listed or sensitive species need not actually be seen within a proposed project area to conclude that there may be a direct impact on the species. If the appropriate habitat/natural community is present and the project falls within the species' range, the species could inhabit the area in the future if the project-related disturbance does not occur. The box on the following page on *Conducting a Biological Resources Analysis of Potential Impacts* provides a basic framework for determining impacts associated with the development of an energy facility.

CEQA GUIDELINES HELP DETERMINE THE SIGNIFICANCE OF IMPACTS

Any activity that threatens the survival of a state or federally listed species is considered significant. In addition, the California Environmental Quality Act (CEQA) guidelines consider a project to have potentially significant impacts to biological resources if it will cause any of the following to occur:

- A fish or wildlife population drops below a self-sustaining level.
- A plant or animal community is eliminated.
- The habitat for fish, wildlife or plants is substantially reduced.
- The number or range of rare, or endangered species is substantially affected, reduced or restricted.
- The movement of any resident or migratory fish or wildlife species is interfered with substantially.
- The diversity or number of species of plants or animals is changed.
- A new species of plant or animal or other barrier to the normal replenishment of existing species is introduced.
- An existing fish or wildlife habitat deteriorates.
- Materials that pose a hazard to plant or animal populations are used, produced or disposed of.

CONDUCTING A BIOLOGICAL RESOURCES ANALYSIS OF POTENTIAL IMPACTS

Consult information resources

California has several excellent information sources to help identify possible biological resource issues prior to field surveys at the facility site. (See Information Resources at the end of this chapter). This information, however, cannot replace field work. If these information resources do not indicate any listed or sensitive plants, animals, and/or rare natural communities for the proposed project area, it should not be concluded that these biological resources do not occur on the site. One can only conclude that there is a lack of information for that particular area.

Contact state/federal agencies

The California Department of Fish and Game (CDFG) and/or the United States Fish and Wildlife Service (USFWS) should be contacted, prior to beginning any field work, to ensure that acceptable survey methods are used.

Do field work for a biological resources analysis

A biological resources analysis includes:

- An inventory of plant and wildlife species and habitat types at the site, at associated facilities and in the surrounding vicinity.

  Biological resource inventories must be completed at the correct time of year to ascertain whether or not sensitive species are present on the project site or in the area. If sensitive species and/or their habitats are known to occur in the project area and depending upon the species/habitats involved, the inventory may need to be conducted over a period of not less than one year in order to include all seasonal variations, migratory species and life cycle activities. For areas that are already highly developed, less than one year may be adequate. Use of a biologist familiar with the species and habitats of the area will probably increase the accuracy of the inventory. Emphasis is placed on biologically sensitive species known to be in the region, or known to occur in habitats similar to those existing at the site, and on areas of critical environmental concern.

- A description of how an area will be altered, for how long, and its potential effects

  Impacts can include direct habitat loss; air emissions; water discharges; noise that disturbs sensitive, breeding or aggregating wildlife; non-native landscaping that is detrimental to native species; lighting that attracts, deters or confuses birds or other animals; tall structures with which birds may collide; hazardous chemical spills; road kills of sensitive species; and human activity that interferes with sensitive species. Direct habitat loss may be due to the facility site, transmission lines, pipelines, parking lots, access roads, temporary construction staging areas and/or other facilities.

Determine direct, indirect & cumulative impacts

The biological resource survey results, together with the environmental impact discussion, can be used to determine the direct, indirect and cumulative impacts to a project.

Suggest mitigation measures (Refer to box on *Potential Mitigation Measures* on page 5.2.6.)

THE REGULATORY ENVIRONMENT FOR BIOLOGICAL RESOURCES

The purpose of the Federal Endangered Species Act of 1973 is to protect biodiversity by providing a program for the conservation of endangered and threatened species and their habitat. California has its own Endangered Species Act that lists species in addition to those on the federal list. Impacts to biological resources are also addressed by CEQA. Local governments, through policies and ordinances, may also designate local biological resources of concern, if they meet the criteria for “rare”, “threatened” or “endangered” under CEQA, even though they are not recognized as such on the state or federal lists. Species of local concern must then be addressed in the CEQA review for a project. Pertinent laws and regulations are listed below.

Federal	
• U.S. Fish & Wildlife Service (USFWS) designates & provides protection for species and habitat (Endangered Species Act)	Title 50, Code of Federal Regulations, section 17.1
• Consultation with USFWS is required when listed species may be jeopardized (Fish & Wildlife Coordination Act)	Title 50, Code of Federal Regulations, section 17
California	
• California’s Endangered Species Act protects the state’s rare, threatened and endangered species	Fish & Game Code sections 2050-2098
• Consultation and Memorandum of Understanding with Department of Fish & Game is required when rare, threatened or endangered species may be affected	Fish & Game Code sections 2081 & 2090
• Designation of protected plants (Native Plant Protection Act)	Fish & Game Code section 1900
• Designation of fully protected birds	Fish & Game Code section 3511
• Designation of fully protected mammals	Fish & Game Code section 4700
• Designation of fully protected reptiles & amphibians	Fish & Game Code section 5050
• Designation of fully protected fish	Fish & Game Code section 5515
• Siting energy facilities in state or local parks, estuaries or areas of critical environmental concern for biological resources is prohibited unless stringent criteria are met	Public Resources Code section 25527
Local	
• Species that meet the CEQA Guideline definition of "rare" or "endangered," but are not listed as such by the state or federal government.	Title 14, California Code of Regulations, section 15380

WHAT ARE AREAS OF CRITICAL ENVIRONMENTAL CONCERN?

Areas of critical environmental concern include rare natural communities and areas of high biodiversity. If possible, these areas should be avoided when siting any development, including energy facilities. Some areas have been identified by legislative acts as requiring protection, such as riparian areas and wetlands.

Examples of areas of critical environmental concern include:

- Vernal pools, riparian areas, and coastal estuaries, which are particularly important because so much of these natural communities have already been lost and they often harbor state and federally listed species.

- Wildlife refuges, ecological reserves and unique or irreplaceable habitats of scientific or educational value.

POTENTIAL MITIGATION MEASURES

(See page 5.2.8 for other ideas.)

- Avoidance. Select an alternative site that lacks sensitive biological resources.

- On-site habitat improvements. Remove trash, remove and reseed unused roads and storage areas; reduce activity and noise levels near sensitive habitat areas; revegetate disturbed areas; allow construction only during certain times of the year to avoid disturbing sensitive species during critical life history stages.

- On-site environmental awareness program. Train personnel on the importance of avoiding disturbance to the sensitive species and their habitat.

- On-site active enhancement and management of appropriate areas. Improve the amount and quality of water, food, cover used by wildlife; increase and protect important areas by providing fencing, signing and other measures to reduce disturbance and intrusion into breeding and rearing areas; and remove intrusive exotic weedy species competing with native plant species.

- Off-site habitat compensation. Acquisition and perpetual protection of suitable replacement habitat.

- Off-site habitat compensation by account. This requires compensation funds to be deposited for use in acquiring off-site mitigation habitat when such areas cannot be acquired prior to construction.

- Off-site habitat compensation endowment fund for the long-term maintenance and management of compensation acreage. The fund must be large enough to do some or all of the following depending on the situation:

  a) Develop habitat management plan(s)
  b) Implement habitat enhancement program(s)
  c) Develop species and ecosystem research programs to develop monitoring and management plans
  d) Develop species monitoring programs
  e) Perform analyses of population viability/sustainability to ensure protection of adequate area and species numbers has occurred
  f) Cover management/administrative personnel salaries
  g) Pay for office space rent and equipment purchases
  h) Coordinate and cooperate with other agencies and programs
  i) Pay for investment management of the endowment fund
  j) Provide detailed accountability for all funds
  k) Provide educational programs

HANDLING FACILITY DISCHARGES

National Pollutant Discharge Elimination System standards may not be adequate to protect all sensitive species. If the expected discharges from an energy facility may alter the quality of surface waters and adversely affect sensitive biological resources, the developer can be required to mitigate any impacts. Mitigation may include providing additional pre-treatment before release of discharges to surface waters or to a publicly owned treatment work (POTW). The developer may also provide funds to the POTW to upgrade its system to reduce the impacts of the facility's discharge to an acceptable level.

ECONOMIC CONSIDERATIONS

Protecting sensitive species and their habitat may increase the cost of an energy facility. Protection of these species, however, is important to local government and the public, especially if the species has commercial and recreational values upon which the local community depends. An example is the native salmon fishery. In extreme cases, the cost of on- and off-site mitigation, seasonal limits on construction and/or operation, or other mitigation measures (even if the sensitive species are of little commercial, tourist and/or recreational value) may be high enough to cause the energy developer to choose an alternate location.

Costs to the developer to implement mitigation measures will vary. Costs to local governments for participating in or conducting studies to understand the effects of energy facility development on sensitive biological resources can be included in the cost of operating permits.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can require developers of energy facilities to consult with the California Department of Fish and Game and/or the United States Fish and Wildlife Service to develop approved biological resources plans. The plans can address pre-construction surveys, monitoring and mitigation for biological resources in the areas that may be affected. The mitigation plan measures should reduce the impacts of the development to an acceptable level. A Memorandum of Understanding between the project proponent and the California Department of Fish and Game may be required if the proposed project has the potential to affect state-listed species.

- In order to protect significant local biological resources, the city/county can inventory existing habitat within its jurisdictional boundaries to determine what, if any, species should be designated to be of local concern.

- The city/county can work with the California Department of Fish and Game and/or the United States Fish and Wildlife Service to develop regional plans (e.g. a Habitat Conservation Plan) to identify a strategy for species recovery in the context of existing and planned development projects. As a result, land may be designated for protection from development as habitat for rare, threatened, or endangered species of local, state or national interest. Likewise, development areas may also be identified.

WIND TURBINES AND AVIAN MORTALITY

Wind farms are often located in windy mountain passes. Birds of prey, including golden eagles, may use these same areas. Collisions between these birds and wind turbines continue to happen in some areas, and although many studies have been done and more are in progress, developers cannot yet ensure that future collisions will be avoided. Mitigation measures being tested include paint schemes on turbine blades, redesign of turbine towers and shutting operation of specific turbines during high bird activity times. So far, the only foolproof mitigation is to avoid siting wind farms in the migration routes or hunting areas of birds.

- The city/county can prohibit energy facilities over which it has jurisdiction that will interfere with the migration of species of local, state or national interest unless appropriate mitigation is implemented. In other facilities, such interference of migration should be avoided.

TYPES OF MITIGATION MEASURES TO REDUCE IMPACTS

The three primary mitigation choices are avoidance by alternative site selection, on-site mitigation, and off-site mitigation.

- Avoidance or alternative site selection usually means locating the energy facility in an area that does not include areas of critical environmental concern or sensitive species habitat, but can also mean changing the facility footprint.

- On-site mitigation may include employee environmental awareness training, protection of on-site habitats, revegetation with native species, and facility or transmission line reconfiguration to reduce impacts.

- Off-site mitigation usually entails purchase of replacement habitat when avoidance and/or on-site mitigation is not sufficient. When off-site habitat is directly purchased, an adequate endowment is required to properly manage the replacement habitat in perpetuity. The amount of replacement habitat and the size of the endowment required will vary depending on the species affected and the specific habitat lost.

Examples of specific mitigation measures are provided in the box on page 5.2.6.

ADDITIONAL IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Ensure that the developer consults with the California Department of Fish and Game and/or United States Fish and Wildlife Service for all projects that may impact sensitive biological resources to help to determine which mitigation measures are recommended.

- Schedule construction to the time of year that is least disruptive to sensitive biological resources in the area.

- Use as a permit condition that a hydroelectric facility temporarily cease or reduce operations that could disrupt the migration of threatened, or endangered species, or economically important species. Consideration of migration routes during the planning phase for facility location can eliminate the need for this.

- Consider requiring the burial of pipelines in known migration routes of biologically sensitive, or commercially or recreationally important land species.

- Consider requiring that electric distribution lines, over which the local government has legal jurisdiction in areas known to have large birds of prey, be buried or built to specifications that eliminate the risk of electrocution. Bury the distribution lines up to the substation may be another feasible option.

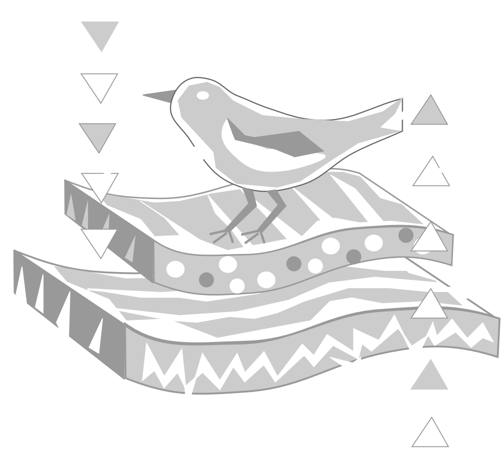
- In sensitive biological resource areas, consider requiring the use of helicopters for construction and maintenance of facilities that do not require frequent access.

- Implement a program to block access to and revegetate, or remove, temporary construction roads, and gate and lock permanent access roads.

- Prohibit the storage and handling of hazardous materials within a designated safe distance from sensitive species habitat, or other areas of critical environmental concern.

- Consider requiring that energy facility discharges that meet the requirements of National Pollutant Discharge Elimination System (NPDES) permits do not adversely affect biological resources.

- Develop a native plant revegetation program in areas where natural revegetation may be too slow to prevent adverse impacts. Consultation with a knowledgeable restoration ecologist may be necessary to develop and implement a program to ensure that an area disturbed by an energy facility is revegetated with appropriate species using the best available techniques to maximize success.



- Ensure that the project is provided an adequate source of water that does not adversely impact biological resources located in the area of the water supply.

- Consider requiring a specific plan to mitigate impacts to vernal pools, wetlands, and other areas of critical environmental concern if total avoidance is not possible. Mitigation may include the purchase and/or construction of compensation habitat. (See box on *Handling Facility Discharges* on the page 5.2.7.)

- Develop a specific mitigation monitoring plan when avoidance of the habitat of sensitive species is not feasible. The plan should identify how existing habitat will be protected, how and where new habitat will be provided to mitigate impacts to the existing habitat, how selected species will be encouraged to use the alternate habitat, a description of monitoring methods and frequency, and a definition of the criteria for successful mitigation. The plan should also describe the remedial measures to be implemented if any of the mitigation measures are deemed unsuccessful.

CASE STUDIES

Colusa County's *Transmission Line Element* includes policies for the protection of sensitive species and habitat. The element includes policies to:

- Avoid areas with soil and water conditions favorable for the sustenance of rare and endangered species.
- Avoid corridors which disrupt the nests of birds of prey and which create the potential for power line/bird electrocutions (if avoiding these corridors is not possible, provide perching sites on some of the power line towers).
- Map and inventory the habitat for sensitive species in the county to ensure their protection.
- Use helicopters to construct towers, string conductors, and perform maintenance activities in areas of extreme slopes and erosion hazards to minimize habitat disturbance.
- Require implementation of revegetation plans using species native to the site.
- Restrict public access to temporary and permanent roads serving transmission lines.
- Remove access roads where possible.

Contact: Colusa County Planning and Building Department, 220 12th Street, Colusa, CA 95932, (916) 458-8877.

Lassen County has included in its 1993 *Energy Element* a policy requiring consultation with and consideration of biological recommendations made by resource protection agencies, including the California Department of Fish and Game and the United States Fish and Wildlife Service. The element also includes policies and implementation measures regarding the use of native plant species during revegetation and a program to determine the success of revegetation efforts.
Contact: Lassen County Department of Community Development, 707 Nevada Street, Susanville, CA 96130, (916) 251-8269, FAX: (916) 251-8373.

Mono County's *Conservation/Open Space Element* contains policies related to the migration of deer, a recreationally important species. The element requires a site-specific deer study performed by a recognized deer biologist for projects with the potential to impact identified deer habitats, including migration corridors and winter range. Based upon deer study results, projects may be required to be modified or redesigned. The element also limits development in riparian areas and wetland zones. The county levies a developer mitigation fee to be used to enhance habitat elsewhere when mitigation measures on the site cannot reduce impacts to an acceptable level.
Contact: Scott Burns, Mono County Planning Department, P.O. Box 8, Bridgeport, CA 93517, (619) 932-5217, FAX: (619) 932-7145.

Alameda County has participated with Solano and Contra Costa Counties in the "Tri-County Wind Energy Mitigation Compliance Monitoring Program," funded in part with a $30 per wind turbine per year developer compliance fee. The purpose of this program is to revise land use policies to coordinate and supplement existing county plans, ordinances, and use permit conditions to protect endangered species and reduce or avoid other environmental impacts of wind farm development.

The county conducts ongoing five year reviews of all wind development operating permits, and imposes new conditions as its experience develops with the technology. Site restoration is required for wind farms that do not produce electricity for one year, or where more than 50 percent of the turbines are actively being removed or in disrepair, and that do not have a demonstrated plan to restore the equipment to a productive operat-

ing condition. Part of the developer compliance fee is used for an escrow account for abandoned wind generators.
Contact: Steve Richards, Zoning Administrator, Alameda County Planning Department, 399 Elmhurst Street, Hayward, CA 94544, (510) 670-5400, FAX: (510) 785-8793.

INFORMATION RESOURCES

The California Department of Fish and Game (CDFG) has developed the "California Natural Diversity Data Base." It is a sophisticated statewide geographic information system with current, very specific location and ecological information for California's rarest and most endangered species and rare natural communities. Hard copy data base reports and map overlays (any scale) are available. A menu-driven data base version called *Rarefind* is also available.
Contact: California Natural Diversity Data Base Information Services Coordinator, California Department of Fish and Game, 1220 "S" Street, Sacramento, CA 95814, (916) 327-5960.

CDFG has also developed the Wildlife Relationships Program which offers a great deal of life history, distribution and habitat information on California's endangered and common wildlife species. This information is available from a menu-driven data base, and a three volume set of books entitled *California's Wildlife.*
Contact: Wildlife Habitat Relationships Program Coordinator, California Department of Fish and Game, 1701 Nimbus Road, Suite D, Rancho Cordova, CA 95670, (916) 355-0124.

The California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California* is an excellent source of location information (county and quadrangle), status (federal, State and California Native Plant Society), life form, phenology, and taxonomic information for California's many sensitive native plants. New editions are published approximately every four years. In addition, a menu-driven, data base version of the California Native Plant Society's *Inventory* is available.
Contact: California Native Plant Society, 1722 "J" Street, Sacramento, CA 95814, (916) 324-3816 or (916) 447-2677.

In addition, the California Energy Commission has worked with Alameda, Contra Costa, and Solano Counties, and the wind energy industry to study the effects of wind turbines on migratory birds. The *Wind Turbine Effects on Avian Activity, Habitat Use & Mortality in Altamont Pass & Solano County Wind Resource Areas 1989-1991, Final Report 1992,* available from the Energy Commission, describes the results of the study and suggests mitigation measures to reduce avian mortality.
Contact: California Energy Commission, Publications Office, 1516 Ninth Street, Sacramento, CA 95814, (916) 654-5200, FAX: (916) 654-4288.

RELATED CHAPTERS/ISSUES

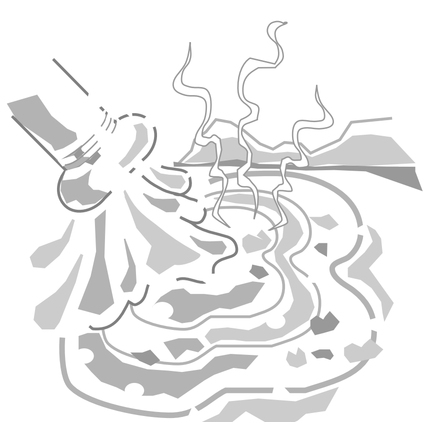
- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)
- Air Quality (Chapter 5.1)
- Water Use and Quality (Chapter 5.4)
- Visual and Noise Impacts (Chapter 5.5)

CHAPTER 5.3: HAZARDOUS MATERIALS HANDLING AND STORAGE

INTRODUCTION

The potential for accidental release of hazardous materials exists during the construction, operation, and closure of many types of energy facilities. Accidents not only result in public health hazards, but can also cause large economic loss to the involved businesses, costs to local government for emergency-related services, and a loss of public confidence in local government planning. Additionally, significant economic impacts to the community can result from accidents involving hazardous materials.

Although many of the laws regarding the management of hazardous materials were promulgated at the federal or state levels of government, it is often local governments that are ultimately responsible for implementing and enforcing such laws. (See the *Regulatory Environment* box on page 5.3.4) Therefore, local governments should be familiar with policies and procedures that ensure proper hazardous materials handling at facilities under their jurisdiction. Working with and providing advance guidance to prospective energy project developers will also result in a more efficient, effective, and expeditious permitting process which will benefit both the local community and the developer/applicant.



> *"... local governments will benefit from policies and procedures that ensure proper hazardous materials handling ..."*

It is important for any agency issuing construction and/or operation permits for energy facilities to identify:

- The types of hazardous materials that may be used or stored at such facilities, or transported to or from them
- The hazardous properties of such material
- The quantities of hazardous materials
- The potential impact on surrounding populations
- Safe handling, storage and transportation procedures
- Less hazardous alternative materials that may be available

While it would be difficult to list all the potentially hazardous materials that may be associated with energy facilities, this chapter identifies some of the more common materials in use and some less hazardous alternative materials that can often be substituted. (See the box on page 5.3.3.)

WHAT ARE HAZARDOUS MATERIALS?

Materials are hazardous if they have the potential to cause injury to life and/or damage to property and the environment. Acutely hazardous materials (also called extremely hazardous in federal legislation) have the potential to cause serious toxic effects as a result of short exposure periods. Hazardous and acutely hazardous materials possess at least one of the following properties: toxicity, flammability, corrosivity or reactivity.

◩ Toxic materials have harmful effects on human health or the environment.

◩ Flammable materials are those that are easily combustible, with a flash point equal to or less than 140 degrees Fahrenheit.

◩ Corrosive materials have a pH less than or equal to 2 or greater than 12.5. They dissolve some materials or burn skin and are toxic if vaporized.

◩ Reactive materials are those that are unstable or undergo rapid or violent chemical reaction with water or other materials.

Both the state and federal government have created various lists of hazardous and acutely (or extremely) hazardous materials that define the substances subject to various regulations. The state list of acutely hazardous materials and the federal list of extremely hazardous materials are identical (See Code of Federal Regulations, Vol 40, Part 355; California Code of Regulations, Title 22, Article 9).

HOW ARE HAZARDOUS MATERIALS USED IN ENERGY FACILITIES?

The hazardous materials used at an energy facility are dependent on the type of facility and the specific technologies utilized. There are, however, several operations common to most types of energy facilities that typically use hazardous materials. These operations include the consumption of fuel, the control of emissions, water treatment, generator cooling, and the transfer of heat.

◩ Consumption of Fuel. The type of fuel used in an energy facility may be hazardous. Fuels such as natural gas, propane, refinery gas, hydrogen, and light fuel oil can be flammable and/or explosive when not properly contained, while fuels such as coal, coke, biomass, and municipal solid waste are less flammable and pose less risk of explosion. Many facilities which typically use less hazardous fuels will often need to utilize backup or supplemental fuels which do pose a hazard. Other energy facilities, such as hydroelectric plants and wind turbines do not utilize combustible fuels at all.

◩ Emissions Control. Energy facilities involving combustion of fuels usually require emissions control. The extent of controls used is dependent on the fuel and the combustion pollutants produced. The use of high sulfur fuels can require extensive sulfur and particulate removal systems in addition to controls for nitrogen oxides (NO_X). Sulfur removal systems often produce hydrogen sulfide (H_2S) as an intermediate product. In some facilities sulfur control can be achieved without producing H_2S.

"Human error is the most common cause of accidental release of hazardous materials. Human error may be involved in the design, operation, or management of a facility."

Natural gas-fired facilities require less control than facilities using high-sulfur fuel, but may involve the use of anhydrous ammonia, which is a hazardous material, to control NO_X emissions. A release of either anhydrous ammonia or H_2S can pose a significant risk to public health. Aqueous ammonia, on the other hand, may be substituted for anhydrous ammonia. Nonhazardous urea-based compounds may be substituted for ammonia compounds in some cases.

Facilities which produce energy from municipal solid waste often require extensive control of acid gases in addition to many of the controls described above. Such controls typically require the use of both strong caustics and acids.

◩ Water Treatment. Energy facilities often use water for a variety of purposes such as steam production, cooling, and water injection for NO_X control. Water treatment requirements vary, dependent upon its uses and the quality of water available. The water treatment chemicals of choice are often hazardous materials, such as chlorine, hydrazine, strong acids, and strong caustics. Accidental release or inadvertent mixing of these materials can pose a significant risk to public health.

◩ Generator Cooling. Some large electrical generators require the use of hydrogen to cool the conductors in the rotor. Hydrogen is the only material that is technically feasible for use in this application. The risks associated with hydrogen, especially fire and explosion, increase with the amount of hydrogen present. To reduce risks, on-site generation of hydrogen, and its immediate use, is preferred over storage of large amounts for use over time.

COMMON HAZARDOUS MATERIALS USED BY ENERGY FACILITIES AND LESS HAZARDOUS SUBSTITUTES

Use of Material	Hazardous Material	Hazardous Characteristics	Alternate Material	Hazardous Characteristics
NO_X control	Anhydrous ammonia	Toxic, stored at high pressure	Aqueous ammonia	Less volatile, lower potential for atmospheric release
Water treatment	Hydrazine	Volatile, flammable, toxic, carcinogenic, reducing agent	Carbohydrazide	Less toxic, much less flammable, noncarcinogenic
	Chlorine Gas	Volatile, very toxic, corrosive	Pelletized chlorine, sodium hypochlorite, & sodium bromide	Not volatile, lower potential for atmospheric release, less corrosive, less toxic,
Generator cooling	Stored hydrogen	Explosive, flammable	Hydrogen generated on-site	Small quantities in the generator provide greatly reduced potential for explosion
Heat transfer fluid	Biphenyl-diphenyl oxide and others	Toxic, flammable	None	
Other	Hydrochloric acid	Corrosive, toxic	Ethylene diamine tetra acetic acid	
	Sulfuric acid	Corrosive, toxic	None	

THE REGULATORY ENVIRONMENT FOR HAZARDOUS MATERIALS HANDLING

The Superfund Amendments and Reauthorization Act of 1986 (SARA) established a nationwide emergency planning and response program and required reporting for businesses that handle significant quantities of hazardous or acutely (or extremely) hazardous materials. This measure also requires states to implement a comprehensive system to inform federal and local government agencies and the public when significant amounts of acutely hazardous materials are stored or handled at a facility. California has implemented much of SARA in the California Health & Safety Code and has also enacted other laws as shown below.

Federal	
• Superfund Amendments and Reauthorization Act 1986 (SARA)	Title 42, United States Code section 11001
• List of hazardous materials	Title 40, Code of Federal Regulations section 302.4
• List of extremely hazardous materials with threshold amounts requiring a RMPP (Risk Management and Prevention Program)	Title 40, Code of Federal Regulations part 355, Appendices A and B
• State and local emergency response plans	Title 40, Code of Federal Regulations, section 355.10 et seq.
State	
• CEQA Guidelines for significant impact: If a project creates a potential public health hazard or involves the use, production or disposal of materials which pose a hazard to people or animal or plant populations in the area affected	Title 14, California Code of Regulations, section 15064, Appendix G (v)
• Process Safety Management Program from Cal-OSHA	Title 8, California Code of Regulations, section 5189
• Toxic emissions inventory to local air district	Health & Safety Code section 44340
• Business Plan and RMPP subject to local approval	Health & Safety Code section 25500-41
• Storage & handling of hazardous materials requirements	Uniform Fire Code, Article 80
• SB 1082 requires a "Unified Program" be implemented by counties by 1/1/96 (See box on the following page.)	Health & Safety Code section 25404

◩ Heat Transfer. Some innovative energy production facilities utilize heat transfer fluids other than water (which is used in conventional facilities). An example is the use of biphenyl-diphenyl oxide as a heat transfer fluid in solar thermal facilities. This heat transfer fluid is a hazardous material which can pose a public health risk if accidentally released. The hazards associated with this material are normally compounded by the supplemental heating of the fluid in a gas-fired heater.

◩ Boiler Cleaning. Cleaning of scale deposits from the inside of heat transfer equipment often requires the use of strong acids. Hydrochloric acid is typically used. Release of hydrochloric acid or inadvertent mixing with other incompatible material can pose a significant public health risk. In some cases alternative materials can be used to reduce such risk. However, acids have been used in industry for many years and their safe handling and storage are common practice.

WHAT CAUSES ACCIDENTAL RELEASE?

The following three general types of causal factors are associated with accidental release of hazardous materials:

◩ Equipment failure refers to a spontaneous failure without an external event, negligent maintenance, or operation outside of designed limits. Equipment failure is rare for new equipment that is designed and maintained to current standards. Design codes are regularly updated as equipment failures occur. Ensuring that current standards are used for a proposed energy facility should greatly reduce this risk.

◩ External forces that can cause the accidental release of hazardous materials include fires, earthquakes, explosions, and collisions. Facility design and strategic location of hazardous materials can reduce the risk of accidental release due to these causes. Careful routing and management of vehicles that transport hazardous materials into or out of the facility may also reduce this risk.

SENATE BILL 1082
(Statutes of 1993, Chapter 418)

Senate Bill 1082 required that a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program) be developed and implemented by local governments by January 1, 1996. The Unified Program must consolidate the administrative requirements of:

- Hazardous waste generators and hazardous waste treatment
- Underground storage tanks
- Hazardous materials inventories and hazardous materials release response plans
- Acutely hazardous materials risk management program plans
- Uniform Fire Code hazardous materials management plans and inventories
- Above ground storage tank spill prevention control and countermeasure plans

The statute requires each county, and allows each city, to designate a Certified United Program Agency (CUPA) which must be approved by the California Environmental Protection Agency (Cal-EPA). The CUPA must consolidate all permits or other grants of authorization issued related to the handling of hazardous waste or materials into a single permit. It also requires the CUPA to consolidate, coordinate and make consistent to the extent possible any local or regional regulations, ordinances, requirements, or guidance documents pertaining to hazardous waste or hazardous materials.

The CUPA must also develop and implement a single, unified inspection and enforcement program in order to ensure coordinated, efficient and effective enforcement of local ordinances and regulations. It must also coordinate, to the maximum extent feasible, its inspection and enforcement program with those of other federal, state, and local agencies which affect facilities regulated by the Unified Program. The statute requires each air quality management district or air pollution control district, each publicly owned treatment works, and each office, board, and department within the Cal-EPA to coordinate its programs with those of the CUPAs.

◪ Human error is the most common cause of accidental release of hazardous materials. Human error may be involved in the design, operation, or management of a facility. The most important factor affecting the potential for human errors is the effectiveness of safety management practices at the facility. A safety management plan for hazardous materials should be required of every facility using hazardous materials. This plan can be based on the guidance provided by the American Institute of Chemical Engineers (AIChE) in *Technical Guidance for Management of Chemical Process Safety*. Additional guidance is provided in documents prepared by the California Occupational Safety and Health Administration supporting the new regulations regarding process safety management (PSM) programs. (See the INFORMATION RESOURCES section.)

WHAT FACTORS AFFECT THE POTENTIAL FOR IMPACTS FOR HAZARDOUS MATERIALS?

The factors that can affect the potential for impact of accidental releases of hazardous materials are typically site-specific. Some are subject to change over the project's life (e.g., the proximity and extent of population around the project). They include:

1) The quantity of the material on-site

2) The degree of toxicity or potential hazard under the proposed conditions of use and storage

3) External hazards associated with the project site

4) The distance to the nearest public receptor

5) The sensitivity of the receptors

6) Site-specific meteorological conditions

7) On-site and off-site emergency response capability

8) The extent and sensitivity of environmentally sensitive resources around the proposed site

Once information regarding these factors is available, modeling can be performed to determine the potential for impacts associated with all plausible release scenarios including the worst case scenario. The worst case would include the largest possible release under the least favorable meteorological conditions. Once the modeling is done, the agency and project proponent can develop methods for avoiding or mitigating such impacts to an acceptable level of risk as defined by the local government.

WHAT IS THE LOCAL GOVERNMENT ROLE?

Local governments, through their air quality, police, fire, and health departments, have the primary jurisdiction and responsibility for enforcement of applicable laws, implementation of state laws requiring emergency response planning, and ensuring the adequacy of hazardous materials management at facilities within their jurisdiction. They may also have responsibility as a CEQA lead agency for the permitting of some energy facility projects that use hazardous materials. Local governments may, therefore, need to develop their own policies and criteria for evaluating the risks associated with hazardous materials utilized in energy projects.

Either the local fire, public health, or emergency services department is usually designated the administering agency responsible for implementing regulations requiring

THRESHOLD OF SIGNIFICANCE: ENERGY COMMISSION STAFF APPROACH

The Energy Commission staff uses exposure criteria (levels) as a threshold for the purpose of identifying significant environmental impacts in power plant licensing proceedings. The Energy Commission staff's approach to choosing such criteria is to balance the small risk of accidental public exposure against the type of impact that would result. For low probability events staff recommends mitigation only for the potential for events with permanent injury or long term disability. Release scenarios that result in only transient irritation are not considered significant when it is unlikely that the event would ever occur. Thus staff focuses on low probability/high consequence events that have the potential to cause death or permanent injury. Mitigation for such events is appropriate for such high consequence events even if the probability of occurrence is low.

preparation of business plans and Risk Management and Prevention Programs (RMPPs). The Governor's Office of Emergency Services has developed a guidebook to help local government agencies develop requirements for RMPPs. Some communities have developed their own guidebooks for businesses to use when writing a RMPP. (See the INFORMATION RESOURCES section.)

The administering agency should be consulted in the early design stage of a project, when making structural changes is easiest and least costly. To involve it after a facility is built may require expensive and time-consuming engineering changes to satisfy its safety requirements. It may be desirable to have a representative from the administering agency in the planning department (at least part-time) for this purpose.

New state requirements for the consolidation of six existing programs are under one Certified Unified Program Agency (CUPA). (See the box, *Senate Bill 1082* on page 5.3.5.)

LOCAL GOVERNMENTS ESTABLISH FRAMEWORK FOR REVIEWS OF RISK

Local governments which permit energy facilities that handle hazardous or acutely hazardous materials may establish a framework to evaluate the significance of potential risks associated with their use. In other words, local governments can decide what constitutes a significant impact and at what point the risk of that potential significant impact will suggest the need for additional mitigation. Having such a framework already in place can provide a consistent and fair permitting process for all project developers.

Cal-OSHA GUIDELINES

Cal-OSHA guidelines for a Process Safety Management (PSM) audit include:

- Process safety information
- Process hazard analysis
- Operating procedures
- Training
- Contractors
- Pre-start-up safety reviews
- Mechanical integrity
- Hot work permit (such as welding or cutting)
- Incident investigation
- Emergency planning and response
- Injury and illness prevention
- Employee participation

See INFORMATION RESOURCES at the end of this chapter regarding ordering the Cal-OSHA Process Safety Management guidelines.

WHAT ARE BUSINESS PLANS AND RISK MANAGEMENT AND PREVENTION PROGRAMS (RMPPs)?

California law requires that a Business Plan be prepared for any proposed facility using reportable quantities of hazardous materials to protect public health and welfare by reducing the risk associated with the release of hazardous materials. If threshold quantities of acutely hazardous materials are involved, the administering agency may require an RMPP. Project developers are responsible for the preparation of Business Plans and RMPPs. These plans are subject to approval by local administering agencies.

A Business Plan is required to include a description of equipment, an inventory of hazardous materials, and a description of the location and use of all hazardous materials at the facility. It is usually based on detailed design information and is prepared after the final design of a project has been completed. The information in a Business Plan is necessary to protect the individuals responding to an incident, such as a fire, that involves the release, or potential release, of hazardous materials.

A Risk Management and Prevention Program (RMPP) is a facility's program for minimizing the risk of accidental release of acutely hazardous materials. It may be required of facilities handling acutely hazardous materials in amounts greater than or equal to threshold quantities established by the US-EPA (Title 40, Code of Federal Regulations part 355, App.A). In addition to the information contained in a Business Plan, a RMPP must also provide an analysis of potential avenues of accidental release of the acutely hazardous materials at the facility and an analysis of the potential off-site impacts that could be associated with plausible release scenarios. According to the California Office of Emergency Services, a RMPP should include documentation of:

- A safety review of design for new and existing equipment

- A safety evaluation of standard operating procedures

- A review of equipment reliability

- Preventive maintenance procedures

- A risk assessment for failure of specific pieces of equipment or operating alternatives

- Emergency response planning

- Internal or external auditing procedures to ensure that safety programs and safety engineering controls are being executed as planned.

WHAT IS A PROCESS SAFETY MANAGEMENT (PSM) PROGRAM?

Cal-OSHA requires that businesses that use highly hazardous chemicals have a Process Safety Management (PSM) program. A PSM is the proactive, rather than reactive, identification, evaluation and prevention of chemical releases that could occur as a result of failures in processes, procedures or equipment. Employers are required to develop within their workforce the necessary expertise, experience, judgment and initiative to properly implement and maintain an effective PSM program. Employer evaluation of process safety was required to begin in 1994 and be completed by 1997. Employers who merge the two sets of requirements for RMPPs and PSMs will better assure compliance with each. (See the *Cal-OSHA Guidelines* box on page 5.3.7.)

HOW CAN COMMUNITIES BALANCE RISK?

Even with application of all feasible mitigation, a project may still pose a significant risk. Such projects should not be rejected solely on the basis of such risk. Permitting agencies should first determine what public service is provided by the project. Public service can be more than the production of energy alone. When evaluating the acceptability of the risk associated with such projects it is also important to analyze the risks associated with its alternatives, including no project.

For example, a waste-to-energy project that burns municipal solid waste will have air quality impacts but may also reduce the need for landfill wastes, thereby eliminating environmental threats associated with landfilling, including the release of toxic gases and methane into the atmosphere and groundwater contamination.

This risk comparison must also reflect the need to provide the public with an adequate and reliable energy supply. Energy Commission staff are available to help local governments in conducting these evaluations.

HOW CAN COMMUNITIES REDUCE RISK?

There are four general strategies that can be employed to minimize the risks associated with hazardous materials used at energy facilities. The best way to reduce risk is to use all four strategies to the extent feasible. These strategies should be employed in the following order based on their reliability in reducing risk:

- Substitution of alternative, less hazardous materials

- Use of engineered controls

- Use of administrative controls to reduce human error

- Emergency response planning

In some cases, it may also be feasible to site facilities that must utilize hazardous materials in remote areas. While such remote siting reduces the risk to the public, it does little to protect workers, reduce the potential for economic loss, or reduce liability. It should also be noted that future encroachment may occur in such areas unless buffer zones are permanently established through the purchase of adjacent lands. This type of mitigation can require the purchase of large tracts of land to be effective, since some types of hazardous materials releases can result in significant impacts at large distances from the point of release. Thus, this type of strategy is less effective in addressing the overall potential for injury and other forms of loss and should be restricted to those facilities that must use the most hazardous types of materials.

◩ Material Substitution. The most certain way to reduce risk from hazardous materials is to substitute less hazardous materials where possible. For example, anhydrous ammonia is a substance often used in power production facilities to control nitrogen oxides. It is acutely toxic and is commonly stored as a liquefied gas at high pressure, thereby posing a high risk of a large accidental release and subsequent public health impacts. Aqueous ammonia, which is much less volatile, can be used as a substitute in many applications. (On the following page see the section "An Example of Risk Reduction Strategies: Using Aqueous Ammonia.")

Urea-based compounds that can be used with selective non-catalytic reduction (SNCR) systems pose a much lower health risk, no fire hazard, no reactivity hazard, and are therefore inherently safer than ammonia compounds. Currently only about 20 percent of power plants operating in California are candidates for SNCR systems due to the temperature range in which these compounds are effective. However, many of this 20 percent are smaller power plants that local government agencies permit. A non-ammonia compound is in the development and testing stage for use in selective catalytic reduction (SCR) systems and will probably be available in the near future.

Substituting less hazardous materials speeds the permitting process and may eliminate the need for preparation of a RMPP. Use of such materials may also reduce the costs of storage and handling facilities and liability insurance and the likelihood of lawsuits. These factors may more than offset the additional cost typically associated with use of a less hazardous material.

There may be cases where use of a less hazardous substitute may not be technically feasible, or where the project proponent may be able to provide adequate assurances that the risk of using a more hazardous material can be reduced to an acceptable level. Local governments should be prepared to evaluate each facility based on the merits of the individual permit application.

◪ Engineered Controls. Engineered controls are design features or equipment which are specifically undertaken to reduce the risk associated with hazardous materials storage, handling, or use. Examples of such controls include use of increased safety margins in structural design storage vessels, pressure relief valves, fire protection systems, vent scrubbers, excess flow controls, additional instrumentation, automatic shutdown systems, spill containment systems, etc.

Implementation of effective engineered controls can greatly reduce the risk of equipment failure and accidental releases of hazardous materials. Incorporation of such controls is common in modern design codes. As a result, equipment failure is rare for new equipment that is designed and maintained to current standards. Design codes are regularly updated as equipment failures occur. Ensuring that current standards are used for a proposed energy facility should greatly reduce the risk associated with equipment failure.

> *“Having specific policies and ordinances in place allows both the developer and permit agencies to know the specific requirements for an energy facility before expensive facility design plans are completed...”*

◪ Administrative Controls. Administrative controls are usually the only way to address the cause of most accidents (human error). Administrative controls may include employee training in the proper handling and storage of hazardous materials, or the use of checklists. Business Plans, RMPPs, and process safety management (PSM) programs can and should be used as a method to require accountability for hazardous materials management. Local administering agencies can carefully review these plans before they are approved and provide regular inspections on-site to ensure compliance. Providing effective review and enforcement of hazardous materials handling requirements can result in significant costs to local government. The city/county may want to consider a mechanism to recover such costs from hazardous materials handlers.

◪ Emergency Response Plans. The final risk reduction strategy should be an emergency response plan. Facilities using hazardous materials are responsible for developing their own emergency response strategy. Facilities must document their emergency response plans in their Business Plan or RMPP. Such plans should be developed in close cooperation with local emergency response authorities.

AN EXAMPLE OF RISK REDUCTION STRATEGIES: USING AQUEOUS AMMONIA

Power plants located in air quality non-attainment areas for ozone must use a NO_X control system. Two processes are typically used to control NO_X: selective catalytic reduction (SCR), and selective non-catalytic reduction (SNCR). Each introduces an agent into the process that reduces NO_X back into nitrogen and oxygen. SCR systems presently can use some form of ammonia as the reducing agent. SNCR systems and systems that are hybrids of the two can use a urea-based compound or aqueous ammonia.

Anhydrous ammonia is often the material of choice for use in NO_X control systems. It is, however, an extremely hazardous material that is stored under high pressure as a liquefied gas. It has the potential to be released in a catastrophic manner due to the pressure needed for storage, and can travel significant distances resulting in off-site fatalities and serious injury.

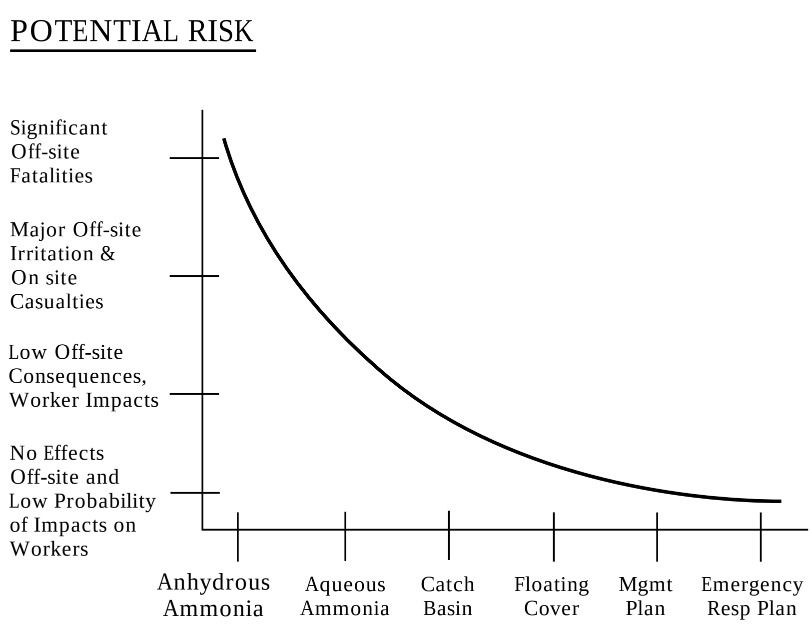
Aqueous ammonia is a substitute for anhydrous ammonia. It is bound to water and is released from a spill by evaporation from the spill surface. Since the release rate for evaporation is much slower than for a pressurized release, the degree of potential exposure resulting from an aqueous ammonia spill is greatly reduced.

Providing a catch basin in the area where transfers occur limits the area affected by an accidental spill and reduces the surface area available for evaporation. If the catch basin has a floating surface cover of polystyrene foam balls, the evaporation rate will be further reduced.

Implementation of an effective hazardous materials safety management plan, including training in proper handling procedures, and an emergency response plan will further reduce the possibility of an accidental spill and any resultant health damage.

The graph below is a visual representation of the decreasing risk of the above risk reduction strategies.

DECREASE THE RISK USING SEVERAL RISK REDUCTION STRATEGIES



Note: The above graph is used for illustration purposes only and is not meant to be an exact representation of the relationships involved.

HOW CAN POLICIES AND PROGRAMS RELATED TO FACILITY DESIGN SPEED PERMITTING?

Having specific policies and ordinances in place allows both the developer and permit agencies to know the specific requirements for an energy facility before expensive facility design plans are completed and eliminates time-consuming re-submittals. Providing standard conditions of use for particular types of energy facilities, or for facilities using particular hazardous materials, will reduce the time needed to permit a facility and provide consistent regulation of hazardous materials. (See Chapter 4 regarding the use of pre-application meetings.)

HOW CAN LOCAL GOVERNMENTS COVER ADMINISTRATIVE COSTS?

Options are available to local governments to recoup at least some of the costs of reviewing technical documents, and monitoring and enforcing hazardous materials regulations. First, the permit fees collected by a local agency can and should reflect the costs that are commonly associated with review and approval. Any ongoing monitoring costs can be part of the yearly permit fee structure.

Second, fines may be a source of recovery. For example, the Safe Drinking Water and Toxics Enforcement Act allows county health officials and police agencies that assist in the enforcement process to receive 25 percent of the fines that are collected, in addition to the 25 percent that district and city attorneys receive for use in funding enforcement activities.

Third, cost recovery ordinances may be adopted to allow the recovery of the costs of abating or cleaning up hazardous materials that are unlawfully released, discharged, or deposited upon or into any property or facility within that city or county. Costs may be collected for direct out-of-pocket city or county expenses, for the cost of city or county personnel involved in a corrective action, and for work contracted by the city or county. The costs may be recovered from whomever negligently or willfully caused the pollution, whomever owned or possessed the hazardous substance (regardless of fault), and whomever owned or possessed the container holding the hazardous material when it spilled. (See the CASE STUDIES section of this chapter.)

ECONOMIC CONSIDERATIONS

Unfortunately, the avoided costs from accident prevention become evident only when an accident actually occurs. The costs associated with accidental releases of hazardous materials can be very substantial and may not be limited to the direct cost of damages. Accidental releases can also result in plant downtime, permitting delays, restricted output, equipment repair, loss of markets, loss of public acceptance and confidence, and increased insurance costs (F. Lees, 1992).

A major cost often associated with an accidental release that results in public impact is the loss of public confidence in the permitting agency's ability to protect them from similar events at other facilities. Such a lack of public confidence can result in reduced development opportunities and significant economic impacts on the entire community.

> In the mid 1980s, Santa Barbara County, in response to increased federally approved offshore drilling activity requiring increased onshore facilities as support, created an Energy Division in their Resource Management Department. The Division is 100% funded by permit fees.
>
> *Contact:* William Douras, Santa Barbara Planning and Development Department, 123 E. Anapamu Street, Santa Barbara, CA 93101, (805) 568-2040.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

◩ The city/county can establish buffer zones around sensitive receptors such as schools, hospitals, and residences which exclude energy facilities that use hazardous or acutely hazardous materials in quantities that pose a significant risk.

◩ The city/county can require that any potential for significant hazardous materials' impacts on public health or safety be minimized to the maximum extent feasible. (This is a CEQA requirement.) This should include using state-of-the-art equipment and mitigation measures that reduce the probability of impacts to a level of insignificance. The extent of mitigation should be based on technical feasibility and the cost of mitigation measures. Project productivity and profitability can be secondary considerations in reducing the risk of significant public health impacts. The preferred order of risk reduction strategies is:

- Material substitution
- Engineered controls
- Administrative controls, and
- Emergency response plans.

◩ The city/county can develop a process to ensure accountability for facility safety management plans that in turn require early review and approval of such plans, and regular periodic inspections at all facilities that handle hazardous materials.

◩ The city/county can develop a process to coordinate hazardous materials management activities with other jurisdictions in the area.

IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

◩ Develop a framework to evaluate the significance of risks related to hazardous materials for the purpose of implementing policies and ordinances. The framework may include the basis of what constitutes a significant impact.

- Schedule a pre-application meeting with the energy project proponent and all interested local, state and federal agencies. The purpose of the meeting is to provide the developer with early feedback on the proposal, including the possible issues that may need to be addressed and mitigation measures that may be required. (See Chapter 4 for further information.)

- Revise zoning ordinances to reflect siting policies regarding energy facilities that use hazardous materials. Designate adequate industrially zoned land for energy facilities away from sensitive receptors such as schools, hospitals, parks, and residential areas.

- Require that the facility developers identify in the application the quantity and type of hazardous materials to be used at any proposed energy facility.

- Consider requiring the use of less hazardous substances, when technically feasible, in place of acutely hazardous materials in energy facilities. A variance from this requirement may be granted if the project proponent can demonstrate to the satisfaction of the city/ county that the risk associated with use of the acutely hazardous material can be reduced to an acceptable level.

- Consider requiring that all equipment at energy facilities meet current industry standards.

- Develop standard conditions of use for permitting various energy facilities or for the hazardous materials used by them.

- Develop design guidelines for handling and storage areas for hazardous materials, if it is not technically feasible to replace them with less hazardous substances, based on the recommendations set forth in the Uniform Fire Code, Article 80.

- Consider developing a fee structure to pay for plan, review and enforcement activities.

- Develop Risk Management and Prevention Program guidelines. (The Governor's Office of Emergency Services has created a guidebook to help communities develop their own guidelines based on the requirements of the law.)

- Create a hazardous materials management coordinating committee composed of members from the following departments: planning, building, fire, police, health, emergency services, public works, sewage and water treatment, purchasing, city/county attorney, city manager, and air pollution control district. Coordinating committees can promote information sharing, streamline permitting, educate staff, coordinate emergency response efforts, and facilitate law enforcement.

- Create an interjurisdictional hazardous materials management committee with other governments in the area. The committee should be composed of members from the following departments from the various jurisdictions: planning, building, fire, police, health, emergency services, public works, sewage and water treatment, purchasing, the city/county attorney, the city manager, and the local air district.

- Establish cost recovery ordinances. Include the cost of application evaluation, as well as monitoring services and cost of clean-up in the event of a release, as part of the permit fee structure.

CASE STUDIES

Contra Costa County and Los Angeles County have developed Risk Management & Prevention Program (RMPP) guidelines for businesses handling acutely hazardous materials. The guidelines detail the requirements for the RMPP and the associated technical studies (Hazard & Operability Studies, Off-Site Consequence Analysis, and Seismic Studies). *Contact:* Sandra Hollenbeck, Contra Costa County Health Services, Environmental Division, 4333 Pacheco Blvd, Martinez, CA 94553-2295, (510) 646-2286. *Contact:* Barbara Eu, Los Angeles County Fire Department, Hazardous Materials Division, 5825 Richenbacker Road, City of Commerce, CA 90040, (213) 720-5186.

The City of Irvine has assigned a representative from the Fire Department to spend part of his time in the Planning Department. This staff person performs plan review and answers applicant questions. The Fire Department representative has recently been indispensable as a resource when the City has made land use compatibility decisions involving hazardous materials. *Contact:* Bob Storchheim, City of Irvine, Planning Department, P.O. Box 19575, Irvine, CA 92713, (714) 724-6453.

The City of Modesto has had a cost recovery ordinance for hazardous materials cleanup and wastes or materials abatement since 1982. As required by law, responsible parties (persons who intentionally or negligently caused hazardous materials to be deposited onto property or into the atmosphere within the City) are billed for cleanup activities. Normal fire suppression activities are separated from those spent abating a hazardous materials portion of an incident. Department costs billed include labor, fringe benefits, equipment use, and indirect costs.

Modesto has been able to successfully recover costs under the ordinance. The ordinance has also reduced the number of hazardous materials releases. Repeated releases of anhydrous ammonia from the pressure relief system on an ammonia storage vessel at an energy facility caused complaints from neighbors. An emergency team was dispatched and the facility was billed. After a few such incidences, the facility installed a vent scrubbing system to capture material vented.
Contact: Blair Bradley, City of Modesto Fire Department, P.O. Box 642, Modesto, CA 95353, (209) 572-9512.

INFORMATION RESOURCES

Local Administering Agencies can provide local government permitting agencies and developers with the information they require to satisfy Business Plan and RMPP requirements. Administering Agencies should be involved from the start with the permitting of an energy facility in order to insure that risks from hazardous materials will be adequately mitigated, and to reduce the time and cost of permitting by providing developers with requirements in the early design stage.
Contact: Your local administering agency, usually the fire, public health, or emergency services department.

Governor's Office of Emergency Services has developed two documents to aid local agencies dealing with hazardous materials. *Guidance for the Preparation of a RMPP* serves as a resource to administering agencies in developing reporting requirements for facilities. Communities can also use it to develop their own RMPP guidelines. *The Hazardous Material Incident Contingency Plan* describes the state's hazardous materials emergency response organization and the relationship of the state to local, federal, volunteer and private organizations. This plan may be used by local governments to clarify their roles and relationships concerning hazardous material emergencies.
Contact: Governor's Office of Emergency Services, 2800 Meadowview Road, Sacramento, CA 95832, (916) 262-1750.

Cal-OSHA has guidelines for process safety (PSM) management programs to prevent releases of hazardous chemicals. The U.S. Department of Labor has the pamphlet *Process Safety Management (OSHA 3131-1993)* which summarizes the OSHA (PSM) standard.
Contact: Cal-OSHA, 455 Golden Gate Avenue, Room 5246, San Francisco, CA 94102, (415) 703-4050.

The U.S. Environmental Protection Agency, Department of Transportation, and Federal Emergency Management Authority have developed two guidebooks on hazards analysis. The *Technical Guidance for Hazards Analysis* provides technical assistance to local emergency planning departments to assess the lethal hazards related to potential airborne releases of extremely hazardous substances. The guide can assist local planners in:

- Conducting hazards analyses
- Providing community awareness
- Promoting consistency among local emergency plans

The *Handbook of Chemical Hazard Analysis Procedure* expands on the above guidebook by including information for explosive, flammable, reactive and otherwise dangerous chemicals.
Contact: Karen Sundheim, US Environmental Protection Agency Library, Region IX, 75 Hawthorne Street, San Francisco, CA 94105-3901, (415) 744-1508.

The Local Government Commission is a nonprofit, nonpartisan, membership organization for local officials, city and county staff, and other interested individuals. It has the following materials related to local government management of hazardous materials: *Government Coordination at the Local Level: Creating Internal and Interjurisdictional Coordinating Committees;* and *Cost Recovery: Making Polluters Pay for Cleanup.*
Contact: Publications, Local Government Commission, 1414 K Street, Suite 250, Sacramento, CA 95814, (916) 448-1198.

The Center for Chemical Process Safety of the American Institute of Chemical Engineers has developed guidebooks for the use, storage and handling of hazardous materials. Titles include: *Guidelines for Technical Management of Chemical Process Safety, Guidelines for Chemical Process Quantitative Risk Analysis, Guidelines for Process Equipment Reliability Data with Data Tables, Guidelines for Vapor Release Mitigation, Guidelines for Safe Storage and Handling of High Toxic Materials, Guidelines for Use of Vapor Cloud Dispersion Models,*

and *Guidelines for Hazard Evaluation Procedures.*
Contact: Center for Chemical Process Safety, American Institute of Chemical Engineers, 345 East 47th Street, New York, NY 10017, (212) 705-7338.

Frank P. Lees has written *Loss Prevention in the Process Industries - Hazard Identification, Assessment and Control, 1992.* This is the authoritative reference source of information on the management of hazardous materials. It was written to prevent loss of lives and economic losses due to hazardous materials incidents.
Publisher: Butterworth-Heinemann Ltd, Linacre House, Jordan Hill, Oxford, England, OX2 8DP.

RELATED CHAPTERS/ISSUES

- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)
- Air Quality (Chapter 5.1)
- Water Use and Quality (Chapter 5.4)

CHAPTER 5.4:
WATER USE AND QUALITY

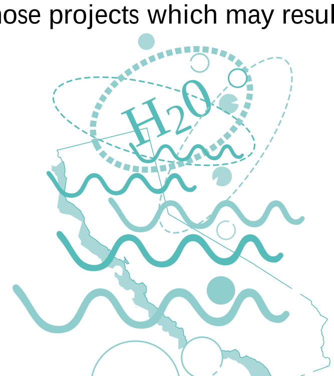
INTRODUCTION

Water is a critical issue in California and will continue to be so as population growth puts increasing pressure on existing water resources. With respect to energy facilities, local government should be concerned about the source of water utilized by the facility, including the quantity and quality needed, and the quality of the water discharged from the facility.

Local governments can be responsive and consistent when they provide energy project development guidance to prospective developers. Working with and providing advance guidance to prospective developers will result in a more efficient, effective, and expeditious permitting process which will benefit both the local community and the developer/applicant.

WHAT IMPACTS ON WATER RESOURCES ARE CONSIDERED SIGNIFICANT BY CEQA?

For those projects which are subject to CEQA, water resources may be a key issue in determining whether an EIR will be required. Those projects which may result in a significant adverse effect on water resources would be subject to an EIR.



The California Environmental Quality Act (Appendix G of CEQA Guidelines) deems a project will normally have a significant impact on water resources if there is the potential for:

- Substantial degradation of water quality, violation of existing water quality standards, or exacerbation of noncompliance of existing water quality standards
- Substantial degradation or depletion of groundwater resources
- Substantial interference with groundwater recharge, direction or rate of flow
- Substantial flooding, erosion or siltation
- Alteration of stream flow characteristics which result in upstream or downstream erosion, sedimentation or flooding
- Encouraging activities that will result in the use of large amounts of water or
- Using water in a wasteful way

HOW CAN WATER SUPPLIES BE AFFECTED BY ENERGY FACILITIES?

Energy production facilities, such as oil refineries or thermal power plants requiring cooling water, can use large amounts of water in their operations. Such facilities may affect not only local, but regional water supplies. Energy project use of groundwater, whether pumped directly by the facility or provided by another supplier, may lower the water table to a point where other users of the aquifer may experience increased pumping costs or reduced production from their wells.

Increased diversion of surface water may likewise affect downstream users and resources through reduced flows and lessened water quality. Hydroelectric dams can significantly alter stream flows, natural flooding cycles, and water quality. Biological resources, recreational opportunities, and other beneficial uses may be lost when water is impounded or diverted.

HOW CAN WATER SUPPLY IMPACTS BE REDUCED?

◩ Reuse of water. One way to reduce consumption by energy facilities is through the reuse of water. Historically in California, power plants sited in coastal areas have used “once-through” cooling processes which require the temporary diversion of a significant amount of water and result in associated adverse water quality and aquatic resource impacts. Inland facilities have historically recycled cooling water through their systems a number of times by using cooling towers, thereby reducing the amount of water a project requires. This, however, may pose wastewater discharge problems.

◩ Use of lower quality water. Regardless of quality, any water source can be used for cooling purposes if it is available in sufficient quantities. For example, reclaimed water from wastewater treatment plants is often available. The major drawbacks to the substitution of these waters for high quality fresh water is the degree of mineralization and nutrient enrichment they exhibit and the cost of treatment needed to make them suitable for cooling purposes. The tendency for scaling and/or fouling heat exchanger surfaces, which decrease the efficiency of the cooling process, are exacerbated with the use of lower quality waters. Boiler makeup water generally requires a significantly higher quality water than is necessary for cooling tower makeup.

The California Water Code declares that the use of potable domestic water for nonpotable uses, including industrial and cooling tower uses, is a waste or unreasonable use of water if reclaimed water is available under certain prescribed conditions.

The use of ocean water, because of the high concentrations of mineral salts, is best suited for once-through cooling. The use of brackish water for use in cooling towers is possible but the water must first be treated to prevent scaling. Cost of fresh water use in the future will be the major determinant in the use of non-fresh water for cooling purposes. Use of fresh inland water for power plant cooling should be approved only after it has been shown that other sources of water are not feasible.

◩ Use of alternative technologies. Another way to minimize water consumption is to employ alternative technologies that require less water. For example, instead of the standard wet evaporative cooling tower technology, either a dry cooling or combination wet-dry cooling technology could be used. Because these alternative technologies are more expensive and are not as efficient, it is likely these alternatives would only be desirable where the financial or environmental costs of water is significantly high.

HOW CAN WATER QUALITY BE AFFECTED BY ENERGY FACILITIES?

Energy facilities can adversely affect water quality through direct and inadvertent discharge of pollutants to adjacent surface and groundwater bodies. These pollutants include heat, suspended or dissolved chemicals, and sediments.

◩ Heat. Heat, a by-product of energy generation, may significantly raise the temperature of cooling water. The effects of discharging heated cooling water or other wastewater will depend on a host of factors including the size of the facility, heating technology, and the size and water temperature of the receiving waters. Hydroelectric dams may also affect the natural temperature of surface waters.

Heated water decreases the availability of oxygen in water for aquatic organisms. Different organisms have varying tolerances to increased water temperatures. Adverse effects may range from fish kills to reduced reproduction. Trout and salmon species found in

FACILITIES WITH POTENTIAL ADVERSE WATER QUALITY IMPACTS

Energy Facility Type	Potential Impact
Facilities using water in cooling process	Thermal impact of receiving waters, impact of water treatment chemicals
Facilities that handle and store chemicals	Surface and groundwater contamination
Facilities with holding ponds in water treatment	Groundwater and wildlife impacts
Hydroelectric Dams	Temperature, volume, velocity and turbidity of rivers, and groundwater recharge
Geothermal Facilities	Surface and groundwater contamination from arsenic, vanadium, sulfur, heavy metals, and salts in drilling sludge
Oil and Gas Facilities	Surface and groundwater contamination from drilling sludge

California are particularly sensitive.

- Suspended or dissolved chemicals. Recycling of water through a power plant may significantly increase the concentrations of naturally occurring, but toxic elements such as arsenic, copper and selenium in the water, as well as other organic and inorganic compounds. Furthermore, certain chemicals, such as those used for antifouling or descaling purposes, may be introduced into the cooling water discharge. Small concentrations of these organic and inorganic compounds may be highly toxic. The chemistry of these compounds in water is complex and may transform pollutants to forms with lesser, equal or greater toxicity.

As with temperature, aquatic organisms vary greatly in their sensitivity to trace metals and other organic and inorganic compounds. Some compounds, such as selenium, can accumulate in sediments and tissue and reach toxic levels. Inadvertent spills or releases of chemicals that are used in the development and operation of energy facilities may impact surface and groundwater quality as well. (See Chapter 5.3 on Hazardous Materials Handling and Storage.)

- Sediments. Earth moving activities associated with the construction of energy facilities may result in sediment being washed into adjacent water bodies. Erosion and sedimentation may even continue after construction. During and following intense rains, stormwater runoff may introduce contaminated soil and water into adjacent surface and groundwater bodies.

HOW CAN WATER QUALITY IMPACTS BE REDUCED?

Although existing laws regulate point and nonpoint discharges to water, local governments can participate in the development of project-specific water quality control standards and mitigation measures and ensure these measures are correctly implemented.

- Contain sediment and contaminated runoff during construction. During construction of an energy facility, the potential for water quality impacts can be reduced by ensuring that no sediment or contaminated run-off leaves the project site or enters on-site or off-site water-bodies. This can be achieved through stabilizing disturbed areas as soon as possible, routing run-off away from such areas, treating run-off before it leaves the project site and separating and treating run-off from areas where chemicals such as diesel fuel are stored and handled.

Such mitigation measures should be required as part of the erosion and sediment control plan and the construction storm water management plan. Although preparation and implementation of the storm water management plan is required by the Regional Water Quality Control Boards, local governments may require that these plans be submitted to them for their review and approval.

- Ensure adequate hazardous materials handling and storage. During operation, impacts can be reduced through ensuring chemical storage and handling areas are sited in areas with impervious surfaces and berms with sufficient capacity to accommodate spills, including storage tank failures, and potential runoff. Runoff from such areas should be kept separate from other runoff and treated before discharge. Such mitigation measures should be required as part of the industrial stormwater management plan and spill prevention and control plans. (See Chapter 5.3)

- Use water conserving technologies. Use of water conserving technologies such as air-cooled condensers or wet-dry cooling towers that reduce discharge amounts, can also reduce the potential for water quality impacts.

- Review discharge standards and monitoring program. Discharge of wastewater to land or other waters is regulated by one of the nine Regional Water Quality Control Boards. Nevertheless, local governments should ensure that any mitigation measures identified for the project during the environmental review process be incorporated into the permit requirements of the regional board. Innovative wastewater treatment approaches such as the use of wetlands should be encouraged.

HOW CAN WATER USE AND QUALITY IMPACTS BE ANALYZED?

Energy facility impacts on water use and quality can be analyzed by consideration of the following topics:

- Amount, source, and quality of water needed. The energy facility permitting agency can determine if the proposed water source, and the treatment and transmission systems necessary to provide the water source, are adequate to meet the construction and operation needs of the facility without adversely diminishing local or regional water supplies. A “will-serve” letter from the water provider is not adequate to ensure significant impacts to water supplies do not occur.

THE REGULATORY ENVIRONMENT FOR WATER USE AND QUALITY

WATER USE

In California, water use and supplies are controlled and managed by an intricate system of federal and state laws. Common law principles, constitutional provisions, state and federal statutes, court decisions and contracts or agreements all govern how water will be allocated, developed and used within the state.

Federal

The federal government involvement in water supply issues primarily addresses interstate commerce, international waters, and protection of public resources. The Federal Power Act requires hydroelectric projects using navigable waters or federal land to receive a license from the Federal Energy Regulatory Commission (FERC). FERC retains the right to license all non-federal hydroelectric facilities in the country. The Nuclear Regulatory Commission licenses all nuclear power plants. In addition, energy development on federal land requires approval from the appropriate federal agency. Actions affecting rivers named in treaties (for example, the Colorado River) or designated in specific legislation (Wild and Scenic Rivers Act) are concerns of the federal government. Finally, activities involving the water from the Central Valley Project may require Bureau of Reclamation approval.

State

Appropriative rights to surface waters within the state are administered by the State Water Resources Control Board. Groundwater management in certain areas of the state is administered either by judicial adjudication or an agency with statutory powers. California Water Code section 10753 (AB3030 passed in 1992) authorizes local governments to adopt groundwater management plans. In addition, recent court cases have deemed that the public trust doctrine may limit water rights. Certain transfers of water outside the watershed of origin also require State Water Resources Control Board approval.

In addition, there are several laws and policies that govern the use of wastewater in California. In general, the California Water Code requires the maximum use of wastewater. Specifically, the Water Code prohibits use of potable water for nonpotable uses, including cooling tower and other industrial uses, if reclaimed water is available under certain prescribed conditions. In addition, for power plants, the California Water Resources Control Board adopted a resolution encouraging the use of wastewater for power plant cooling and established the following order of preference for cooling purposes:

1) Wastewater discharged to the ocean
2) Ocean water
3) Brackish water or irrigation return flow
4) Inland wastewater of low total dissolved solids (TDS)
5) Other inland water

State Water Resources Control Board issues permits for the appropriation of surface water	California Water Code, Division 2, section 100 et seq.
State Water Resources Control Board encourages water conservation and maximum reuse of water, especially in water-short areas	Resolution 77-1

THE REGULATORY ENVIRONMENT FOR WATER USE AND QUALITY (CON'T)

State Water Resources Control Board's priority for sources of cooling water	Resolution 75-58.
Use of Reclaimed Water	California Water Code sections 13550 et seq.
Groundwater Management Plans	California Water Code section 10752 et seq.

WATER QUALITY

Federal

The Federal Water Pollution Control Act, or Clean Water Act, provides for the restoration and maintenance of the nation's water quality. It provides for the elimination of the discharge of pollutants, and prohibits the discharge of pollutants in toxic amounts. The act sets forth the National Pollutant Discharge Elimination System Permit Program (NPDES). The Clean Water Act, section 307(b) and 307(c), also sets forth pretreatment requirements for discharges to publicly owned wastewater treatment plants. The Environmental Protection Agency has added requirements for such discharges. These discharges are not subject to NPDES Permits, but are subject to federal and local requirements. The United States Environmental Protection Agency permits deep well injection within the state.

Clean Water Act regulates disposal of waste from point sources to navigable waters	Title 33, United States Code sections 1251-1387
Safe Water Drinking Act regulates deep well disposal	Title 42, United States Code sections 300 et seq.
The Resource Conservation and Recovery Act establishes proper methods for handling and disposal of hazardous and non-hazardous wastes	Title 42, United States Code sections 6921-6939

State

California's Porter-Cologne Water Quality Control Act and the Safe Drinking Water and Toxic Enforcement Act established agencies and standards for controlling the water quality in the state. Authority to issue NPDES Permits has been delegated by the federal government to the state. These are issued by Regional Water Quality Control Boards (RWQCB). RWQCB also regulate water quality in the state by issuing pretreatment requirements for publicly owned wastewater treatment plants. The regional boards also issue permits for waste disposal to dry land and regulate stormwater discharges. These permits guarantee that certain named substances are kept at or below levels deemed to be safe.

Porter-Cologne Water Quality Control Act, grants the State Water Resources Control Board and the Regional Water Quality Control Boards the authority to regulate discharges to land, surface and groundwaters	California Water Code section 13000 et seq.
Safe Drinking Water and Toxics Enforcement Act prohibits contaminating drinking water with chemicals known to cause cancer or chemicals reproductive toxicity	California Health and Safety Code section 25249.5 et seq.

Emergency water demands should be identified in the event that the primary water source is interrupted.

The source of the water will affect the nature of the analysis. For example, if the source is groundwater, the effects on other users through the draw-down of groundwater levels, the ability to recharge the aquifer and movement of contaminants in the aquifer should all be considered. Analysis of surface water use also needs to look at the effect on other users through adverse impacts on water quality.

- Use of water consumption reduction means, such as water conservation, use of lower quality water, and use of alternative technologies, as discussed in a previous section.

- Impacts on biological and recreational resources and aesthetic values. (Please refer to Chapters 5.2 and 5.5).

- The ability of the treatment plant and the water delivery system to accommodate increased flows.

- Wastewater discharge requirements. For wastewater discharges, the analysis needs to consider the amount, quality and method of discharge. The method of discharge will be either through evaporation ponds, discharge to natural or man-made water bodies, deep well injection or discharge to the sewer system and wastewater treatment plant. Although each of these disposal methods requires permits, either from state, federal or local governments, it is still necessary for the energy facility permitting agency to address the potential impacts to water quality and biological resources.

Damaged liners within evaporation ponds may allow contamination of surface and groundwater bodies. Discharges to the sewer and wastewater treatment system may exceed the ability of the system to handle increased flows, interfere with the treatment process or limit the ability to reuse treated effluent for irrigation or other purposes. Deep well injection has the potential to contaminate groundwater aquifers. Discharges to man-made or natural surface water bodies may significantly affect water quality and biological resources.

> *"Due to the large number of special districts within California, management of water supplies or wastewater treatment plants may or may not rest with the local government evaluating a proposed energy facility."*

- Chemical spill containment. Related considerations include whether there is adequate spill containment around chemical storage and handling areas, not only for the volume of chemicals contained but also to accommodate precipitation from a ten-year storm.

- The potential for off-site waste disposal sites or transportation of toxic materials to degrade water quality needs also to be addressed, as should the adequacy of the proposed treatment of chemical spill and runoff.

WHAT IS THE LOCAL GOVERNMENT ROLE IN THE REGULATION OF WATER USE AND QUALITY IN ENERGY FACILITIES?

Due to the large number of special districts within California, management of water supplies or waste water treatment plants may or may not rest with the local government evaluating a proposed energy facility. Local governments have the opportunity, if not the requirement, to adopt policies and ordinances addressing erosion and sediment control, hazardous materials handling, water conservation and wastewater discharges to local sewer systems. Local governments can actively participate in hearings of state and regional water control boards for permit hearings and regulation development.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can work closely with the California State Water Resources Control Board (WRCB) and local water district to ensure that an energy facility applicant identifies adequate sources of water for facility construction and operation that will not adversely affect the local or regional water resource and other users of the resource.

- The city/county can involve the appropriate Regional Water Quality Control Board (RWQCB) early in the permit process for energy facilities to ensure the maximum protection of water resources in the area.

- The city/county can require a proponent of an energy facility to identify the anticipated amount of water needed during construction and operation, as well as the source of that water. The proponent should also identify a reliable backup source of water for use in case of emergency when the primary source is not available.

- The city/county can encourage the use of non-fresh water for cooling water for thermal power plants.

- The city/county can consult with responsible biological resource agencies regarding CEQA documentation to ensure that energy facility discharges, which may meet NPDES permit standards, will not adversely affect sensitive species. (See Chapter 5.2 on *Biological Resources* for further details.)

IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Consider requiring that the local water district or agency identify how the necessary water for the energy facility will be provided.

- Consider requiring the developer to investigate and discuss the use of non-fresh water in the operation of the facility, as well as all other available conservation measures.

- Provide incentives such as permit assistance and reduced permit fees for applicants that implement water-saving measures into their permit application and operations.

- Consider requiring spill containment dikes and berms around areas where materials that can adversely affect water quality are handled and stored. These should be sized to accommodate the volume of stored material plus precipitation from a 10-year storm. Require the developer to implement an emergency response plan for the accidental release of such materials.

- Provide for adequate mitigation procedures to ensure that surface water quality is not impacted by sedimentation due to erosion. Suggested mitigations include, but are not limited to, the use of sediment traps and catch basins, lined diversion ditches and energy dissipaters.

- Consider requiring a water quality monitoring plan to identify degradation, if it occurs, for energy facilities that have potential adverse water quality impacts. Provide a mechanism to add mitigation measures if water quality monitoring identifies problems.

- Provide an emergency water supply plan. If an emergency water supply cannot be secured, facility operations may be required to be discontinued until the primary water supply is again available.

- Consider requiring the developer to provide monetary compensation or an alternate water supply to water users adversely impacted by the facility's degradation of water quality.

- Consider requiring monetary compensation to publicly-owned treatment works for upgrading their facilities to handle the wastewater discharges from an energy facility.

CASE STUDIES

Siskiyou County has developed zoning ordinances in its Energy Element related to water quality protection. The County encourages the use of portable tanks and sumpless drilling for geothermal facilities when the well is located within 500 feet of surface water. The County also requires stream monitoring and emergency planning for spills and blowouts of the wells. For any thermal facility, the County requires the identification of the source and disposal plan of cooling water, and encourages the use of less water or recycled water. *Contact:* Rick Barnum, Siskiyou County Planning Department, P.O. Box 1085, Yreka, CA 96097, (916) 842-8200.

Lassen County has adopted an Energy Element which addresses erosion control, water quality permits and geothermal development and water quality, and requires consideration of the level of efficiency and water conservation measures for proposed energy facilities. Erosion control plans are required to include channelling stormwater runoff into adequate sewage/stormwater systems, use of energy dissipaters, and culvert and ditch cleaning.

The County requires that developers get all necessary RWQCB permits. It discourages geothermal development in riparian or wetland areas, prohibits uncontrolled discharge of geothermal fluids to the site or surrounding area, and encourages carefully planned injection of geothermal fluids as an alternative to surface disposal.
Contact: Lassen County Department of Community Development, 707 Nevada Street, Susanville, CA 96130, (916) 251-8269,
FAX: (916) 251-8373.

The Lake County Sanitation District, in cooperation with the California Energy Commission, US Department of Energy, US Environmental Protection Agency, Department of Commerce and local economic development agencies and several geothermal developers, is working on a treated wastewater discharge injection system that will result in the improvement of local water quality. The City of Clearlake and community of Lower Lake in Lake County, are growing communities which have had to limit growth due to a Regional Water Quality Control Board prohibition on new sewer hook-ups. This measure was adopted because the wastewater treatment plant is over capacity and has had unauthorized discharges of secondarily treated wastewater to the surface water of Clear Lake.

A public/private partnership is designing a pipeline to transport the treated wastewater to the Geysers steam field for injection into the geothermal reservoir. This injection will result in the recovery of about 70 megawatts of electricity. In addition to the energy benefits, the project will also provide an environmentally-superior method of wastewater disposal; will help retain hundreds of jobs in the region; and provide added tax and lease revenues for local communities, and state and federal governments.
Contact: Mark Dellinger, Lake County Planning Department, 225 N. Forbes Street, Lakeport, CA 95453, (707) 263-2273.

Glenn County's Energy Element contains policies that limit development of hydroelectric facilities to those that demonstrate that there will be no adverse effect on the availability or quality of water downstream or on recreation opportunities. The county also requires review by the Regional Water Quality Control Board and Department of Fish and Game for hydroelectric facilities. The policies require all project proposals to include a contingency plan to mitigate the adverse effects of drought or excessive rain.
Contact: Glenn County Planning Department, 125 S. Murdock Street, Willows, CA 95988,
(916) 934-6540.

INFORMATION RESOURCES

The Central Valley Regional Water Quality Control Board has published *Guidelines for Protection of Water Quality During Construction and Operation of Small Hydro Projects* a good reference for determining mitigation measures for small hydroelectric facilities.
Contact: Central Valley Regional Water Quality Control Board, 3443 Routier Road, Sacramento, CA 95827, (916) 255-3000.

Sierra County prepared *Environmental Assessment of Hydroelectric Development within the North Yuba River Basin of Sierra County* in 1989 as a detailed analysis of the issues and mitigations for small hydroelectric development in the county.
Contact: Sierra County Planning Department, P.O. Box 530, Downieville, CA 95936,
(916) 289-3251.

The California Department of Water Resources' Division of Local Assistance (DLA) offers programs to help local governments with their planning and permitting functions. DLA encourages more efficient use of California's water through a number of urban and agricultural water conservation programs, including gray water use and industrial water conservation. Staff also assists local agencies in analyzing water recycling plans and helps them through the regulatory process. Staff can provide information on subsidence caused by ground water extraction, as well as other types of subsidence throughout the State.
Contact: California Department of Water Resources, Division of Local Assistance, 1020 9th St., Sacramento, CA 94236-0001,
(916) 327-1649.

RELATED CHAPTERS/ISSUES

- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)
- Biological Resources (Chapter 5.2)
- Hazardous Materials Handling & Storage (Chapter 5.3)
- Appendix F, Power Plant Generating Efficiency

CHAPTER 5.5: VISUAL AND NOISE IMPACTS

INTRODUCTION

This chapter includes two main sections covering the potential visual and noise issues regarding energy facilities. Following background information on each issue there are ideas for general plan policies, mitigation and implementation for avoiding potential visual and noise impacts. Also included are case studies and information resources for these "nuisance" impacts. Local government planning and permitting efforts will be most successful when project developer and agency coordination, and public involvement are included from the beginning. (Please refer to the energy facility-related planning process discussed in Chapter 3.)

The visual and noise impacts of some energy facilities may be regarded as unpleasant or nuisances, and are generally treated as such. In addition, noise may be a disturbance to some activities of animals, including the rearing of young, feeding, and nesting behavior.

The section on Visual Resources begins on this page. The Noise Impacts section begins on page 5.5.7.

The reader interested in potential odor impacts from energy facilities should refer to Chapter 5.1 on Air Quality.

> “*A project’s visual impact on a community depends on how the project affects visual character or visual quality.*”

5.5.1 VISUAL RESOURCES IMPACTS

Visual resources are the natural and cultural features of the environment that can be viewed. The construction and operation of energy facilities may cause adverse visual impacts by introducing human-made features into a generally natural setting or by creating discordant visual contrasts with an existing urban setting.

BASIC VISUAL RESOURCES ASSESSMENT FACTORS

Several factors are important in determining the susceptibility of the existing setting to visual impacts. These include visual quality, viewer sensitivity, visibility, and viewer exposure.

- Visual Quality. Visual quality is the value of visual resources. In general, human modifications to the view in natural areas lower visual quality. Even in urban areas, natural features are generally preferred over human-made features. Visual quality may be described as high, moderate, or low. There is greater concern over protecting high quality views than protecting those of low quality. For example, there would be more concern over siting a large, combustion-type electric generation facility in an area of natural beauty than placing it in an existing industrial zone.

- Viewer Sensitivity. Viewer sensitivity describes the level of interest or concern of potential viewers. Existing surrounding land uses are a useful indirect indicator of viewer response. For example, the addition of another similar industrial facility in an established industrial zone would probably not affect the level of concern of the people working in or traveling through the area. The same facility next to a community park would probably affront the sensibilities of many of the park’s users. Uses found to be sensitive to visual impacts, from the most to the least sensitive, are recreational, residential, agricultural, commercial and industrial.

◩ Visibility. Visibility describes how easily something can be seen. It depends on the presence or absence of screening, the angle of view, meteorological conditions, time of day, and lighting. Placing project structures behind other structures is an example of screening, as is the use of walls, berms, trees, or other landscaping. The viewer's angle will also affect the visibility of the project. The more direct the angle of view, the greater the visibility.

◩ Viewer Exposure. Viewer exposure depends upon viewer distance from the feature or view, the number of viewers who will see the view, and the length of time the view will be seen.

Distance is important because fewer details remain with greater distance. At long range, only the horizon and major land forms such as mountains are visible. In the middle distance, surface features may be visible such as forests or clusters of buildings. At close range, textures and colors are perceptible on objects such as energy facilities.

The number of viewers can be described in terms of absolute numbers of viewers or the percentage or type of affected viewers in the view shed. The higher the number of viewers, especially of more sensitive viewers, the more significant the impact.

The longer the duration of the view, the greater the impact. Visual impacts during construction are often unavoidable, but are not permanent and, while unpleasant, are less likely to be significant than are the long-term impacts of the completed project. (Another example of extended exposure to energy facilities is the presence of electric transmission lines that run for long distances and are in public view for much, if not all, of their length.)

ENERGY FACILITIES WITH POTENTIAL VISUAL IMPACTS

Facility Type	Potential Visual Imapct
Utility-Scale Wind Turbines	Large tracts of land Highly visible locations (ridges) Change from rural to industrial
Utility-Scale Solar Facilities	Large tracts of land Concentration of sunlight Change from rural to industrial Vegetation removal, scarring
Hydroelectric	Change from free-flowing to industrial use Dams are often large Vegetation removal, scarring
Geothermal Facilities (electrical generation)	Large plants Cooling tower plumes Drilling equipment Sometimes pipelines Change from rural to industrial Vegetation removal, scarring
Gas/Oil Facilities	Large processing plants Tall derricks, drilling equipment Pipelines
Combustion Facilities	High exhaust stacks Emission plumes Massive appearance
Transmission Lines	Introduction of industrial element Long, linear facilities can affect many viewers Impacts can depend on tower types

WHAT ARE THE NEGATIVE VISUAL IMPACTS OF ENERGY FACILITIES?

A project's visual impact on a community depends on how the project affects visual character or visual quality. A project can adversely affect visual character or visual quality by creating contrast with the form, line, color, texture, or spatial arrangement of the existing setting; by introducing a dominant element to a view; by blocking a scenic view; or by causing light or glare. Energy facilities can produce glare (if reflective materials are used) that can shine on surrounding areas. Nighttime lighting can be directly visible or can illuminate the sky.

HOW CAN YOU DETERMINE THE SIGNIFICANCE OF VISUAL IMPACTS?

For those projects which are subject to CEQA, the Guidelines to the California Environmental Quality Act (CEQA) (section 15382) define a significant effect on the environment as one that produces "a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including...objects of...aesthetic significance." The Guidelines also state that a project will normally have a significant effect on the environment if it will have a substantial, demonstrable negative aesthetic effect (Supplementary Document G (b)). The Guidelines also recognize that a project may have a significant environmental effect if it produces new light or glare, results in the obstruction of any scenic vista open to the public, or creates an aesthetically offensive site open to public view (Supplementary Document F, Environmental Checklist Form, Section VII, Light and Glare, Item (a), and Section XVIII, Aesthetics, Items (a) and (b)).

Other state and federal laws also can help determine if an energy facility has significant visual impacts when the resources they were meant to protect are impacted by the facility. The California Coastal Act in Public Resources Code section 30251 states that "scenic and visual qualities of coastal areas shall be protected as a resource of public importance." The state has also developed the California Scenic Highway Program to protect the views from designated highways. The Wild and Scenic Rivers Act includes protection of the visual resources of the federal lands involved. (See the box on *The Regulatory Environment for Visual Resources* on the next page.)

Local governments and regional entities may also choose to protect certain vistas or visual resources, and may do so in their ordinances, policies and plans. See the box below on *Questions to Consider to Evaluate Visual Impact Significance* for pertinent questions to help determine if a significant adverse visual impact may result from a project.

WHAT INFORMATION CAN BE USED TO ASSESS VISUAL RESOURCES IMPACTS?

Appropriate information includes:

1) A description of the existing regional and local visual setting, including the topographic, vegetative, hydrologic and cultural elements of the landscape as it exists prior to the proposed project

The baseline setting should address:

a) A description of the viewshed

b) The existing visual quality in the viewshed

c) Viewer sensitivity

d) Visibility

e) Viewer exposure

f) Identification of the most sensitive viewing locations or "Key Observation Points" (KOPs)

QUESTIONS TO CONSIDER TO EVALUATE VISUAL IMPACT SIGNIFICANCE

- Will the project substantially alter the existing viewshed, including any changes in natural terrain?
- Will the project deviate substantially from the form, line, color, and texture of existing elements of the viewshed that contribute to visual quality?
- Will the project substantially degrade the existing visual quality of the viewshed or eliminate visual resources?
- Will the project be in conflict with directly identified public preferences regarding visual resources?
- Will the project comply with local goals, policies, designations or guidelines related to visual quality?
- Will the project significantly increase light and glare in the project vicinity, particularly nighttime glare?
- Will the project result in significant amounts of backscatter light into the nighttime sky?
- Will the project result in a significant reduction of sunlight, or the introduction of shadows, in areas used extensively by the community?
- Will the project result in a substantial visible exhaust plume?

THE REGULATORY ENVIRONMENT FOR VISUAL RESOURCES

Federal	
Wild and Scenic Rivers Act protects the visual quality of designated rivers	Title 16, United States Code section 1271 et seq.
National Environmental Policy Act (NEPA) - Established the federal basis for addressing aesthetics	Title 42, United States Code sections 4321 to 4332
State	
CEQA - defines significance and includes aesthetics	Public Resources Code section 15382
California Coastal Act - protects the scenic and visual qualities of coastal areas as a resource of public importance	Public Resources Code section 30251
California Scenic Highway System	Streets and Highways Code section 260 et seq.
Local	
Open Space Element in General Plans	Government Code section 65302
Zoning and design guideline authority	Government Code section 65800 et seq.

2) Topographic maps to show the location and the viewshed(s) of the project and its related facilities, and the locations of the KOPs

3) Photographs of the sites of the project and related facilities from each KOP

4) Simulations showing the project and related facilities from each KOP

5) A discussion of the methodology used to evaluate impacts resulting from the project and related facilities

6) A discussion of the significance of the visual impacts from construction and operation of the project, including:

a) A comparison of the pre-project visual setting with expected construction and operation visual impacts from each KOP

b) A discussion of cumulative impacts

7) A discussion of the mitigation measures (see the box titled *Potential Visual Mitigation Measures*) to eliminate or reduce the significant visual impacts of the project, including:

a) Design (including relocation)

b) Color and texture

c) Landscaping

d) Lighting

8) A compliance monitoring plan to ensure successful implementation of required mitigation

GENERAL PLAN IDEAS FOR VISUAL RESOURCES

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

POTENTIAL VISUAL MITIGATION MEASURES

If it has been determined that an energy facility will result in significant visual impacts, the following mitigation measures may be employed to reduce the impact to a level of non-significance:

1) Relocation

a) Find a different site where the project will not cause significant visual impacts

2) Facility design

a) Paint the facility to minimize contrast with the surrounding environment
b) Avoid or reduce exhaust stack plumes
c) Reconfigure equipment/buildings to be less visible
d) Reduce the size of equipment/buildings to be less visible
e) Eliminate equipment/buildings
f) Replace disturbed vegetation

3) Lighting and glare

a) Design all lighting to not shine directly on nearby residences or streets
b) Shield all lighting to minimize illumination of the nighttime sky
c) Use non-reflective colors and materials

4) Screening

a) Plant a vegetative barrier with a long-term maintenance plan
b) Build a perimeter fence

5) Transmission lines

a) Bury transmission lines
b) Use an existing right-of-way
c) Avoid ridgetops and upper slopes
d) Locate transmission lines adjacent to the slope in valleys
e) Use existing vegetation to screen view of transmission lines
f) Use a curving right-of-way in forested areas to reduce line of sight
g) Follow natural contours
h) Use dull, non-reflective finishes
i) Vary the width of the right-of-way, remove vegetation in an irregular pattern
j) Use transmission structures that minimize visibility

- The city/county can designate significant viewsheds/corridors based on local preference and can develop a management plan to protect them. The city/county can seek the input of the public to identify the most visually sensitive areas.

- The city/county can designate industrial land away from sensitive viewing areas in order to reduce the possibility of conflict.

- The city/county can develop an order of preference for the development of transmission line corridors. For example:

  1) Use existing lines

  2) Upgrade existing lines to meet increased demand

  3) Build new lines parallel and adjacent to existing lines

  4) Build new lines requiring new corridors

- The city/county can support the development and use of standard criteria for determining significant adverse visual effects, and provide suggested mitigation measures to reduce visual impacts.

IMPLEMENTATION IDEAS FOR VISUAL RESOURCES

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Organize a committee to determine significant local viewsheds. The committee can be composed of members from interested municipal departments (such as the planning and zoning departments), community organizations (such as historical or environmental groups), local businesses, and the general public. This committee can also develop and propose for city council or county supervisor approval, an order of preference for development of transmission line corridors.

- Revise zoning ordinances to separate industrial areas from areas designated for protection because of their visual significance.

- Develop standard questions for determining significant adverse visual impacts and develop mitigation suggestions to reduce visual impacts. (See also the box on the previous page entitled *Potential Visual Mitigation Measures*.)

CASE STUDIES FOR VISUAL RESOURCES

Colusa County developed a Transmission Line Element for its General Plan that contains policies to work with adjoining jurisdictions, utility companies, and state agencies in the siting process for new transmission lines. The Element also includes an order of preference for transmission line development (use of existing lines, upgrade existing lines to meet increased demand, parallel and adjacent lines, and lines requiring new corridors), and sensitivity rating for types of agricultural lands, transmission line routing in agricultural land, and tower type preference. The county also seeks local input to identify areas of most visual sensitivity, alternate routes, and to rate route alternatives when planning for new transmission lines.
Contact: Colusa County Planning Department, 220 12th Street, Colusa, CA 95932, (916) 458-8877.

Mono County's Conservation/ Open Space Element contains policies to designate important scenic resources and scenic highway corridors for protection, to preserve the visual identity of areas outside communities, and to protect significant scenic areas by maintaining land in those areas in public ownership. Proposed activities to implement these policies include identifying the scenic resources and coordinating with state and federal visual policies, restricting development in areas outside of communities, purchasing conservation easements, and use of zoning regulations to preserve open space.
Contact: Mono County Planning Department, P.O. Box 8, Bridgeport, CA 93517, (619) 932-5217.

INFORMATION RESOURCES FOR VISUAL RESOURCES

The United States Department of Agriculture has written *The Visual Management System in Agriculture Handbook* which includes a chapter titled "National Forest Landscape Management." The chapter includes the rationale and methodology used to determine the value of visual resources within the National Forest system and the potential impacts on them.
Contact: United States Department of Agriculture, United States Forest Service, 630 Sansome Street, San Francisco, CA 94111, (415) 705-2874.

The United States Department of the Interior's *Visual Resource Management Program* includes the methodology to be used in assessing the value and impacts to visual resources on lands under its control. Energy facilities that are on or cross lands managed by the National Park Service or Bureau of Land Management will have to use this methodology.
Contact: United States Department of the Interior, Bureau of Land Management, California State Office, 2800 Cottage Way, Room E-2807, Sacramento, CA 95825, (916) 978-4754.

5.5.2 NOISE IMPACTS

Noise may be associated with the construction and operation of energy facilities.

◩ Construction Impacts. Potential community impacts during energy facility construction include speech interference, and disruption of school or worship activities during the daytime and sleep disturbance at night.

Some communities have determined that a certain amount of construction noise, while exceeding local standards, is unavoidable and have chosen to exempt it from the limits in their ordinances. They do, however, restrict particularly noisy operations to certain hours of the day.

◩ Operation Impacts. While construction noise impacts are temporary, operational noise impacts potentially last for the life of the facility.

Operational noise levels are rarely allowed to exceed local limits since they could continue day and night for many years.

The effects of noise on people can be classified as follows:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as anxiety or hearing loss

Community noise impacts are almost always in the first two categories, while workers in industrial plants can experience the more physically damaging effects of the last category.

NOISE TERMINOLOGY

The following definitions are important when talking about noise impacts.

- *Decibel* (dB) is a unit of measurement that describes the magnitude (loudness) of a particular quantity of sound (sound level) with respect to a standard reference value.
- *A-Weighted Sound Level* (dBA) is a number representing the sound level which contains a wide range of frequencies weighted in a manner representative of the human ear's response.
- *Ambient Noise Level* is the sound level that exists at any instant at a point as a result of the combination of many distant sources which are individually indistinguishable. Statistically, it is taken as the sound level that is exceeded 90 percent of the time.
- *Tone* is a sound at a particular frequency. Distinct tones are easily perceived by the human ear.

HOW CAN THE SIGNIFICANCE OF NOISE IMPACTS BE DETERMINED?

There are also several concepts related to the subjective human response to noise that will help to determine if energy facility noise impacts are significant. In general, when determining a person's subjective response to a new noise by comparing it with the existing noise level to which he or she is accustomed, the more the level or tone of a new noise exceeds the existing ambient noise level or tonal quality, the less acceptable the new noise will be.

A study on increases in A-weighted noise levels has shown that, in general:

ENERGY FACILITIES WITH POTENTIAL NOISE IMPACTS

Facility Type	Potential Noise Impact
Most facilities during construction	Equipment and delivery noises Pile driving
Facilities with solid fuel delivery (Biomass, Municipal Solid Waste, Coal)	Delivery equipment noises
Biomass facilities	Fuel chipping/grinding
Facilities with pressure release valves (Cogeneration, Biomass, Geothermal)	High pitched steam release valve noise
Utility Scale Wind	Turbine noises and vibration
Hydroelectric	Turbine noises

- Outside of a laboratory, a 3 dB change is considered a barely noticeable difference.

- A change in sound level of at least 5 dB is required before any noticeable change in community response would be expected.

- A 10 dB change is subjectively heard as an approximate doubling in loudness and almost always causes an adverse community response. (National Academy of Sciences, 1977.

When noises are combined, people do not perceive them to increase in linear fashion. For example, if the sound of a car passing by is 30 dB, the perceived sound level of two cars passing by is not 60 dB, but 33 dB, an increase of 3 dB. As the difference in the decibel values of two additive noises increases, smaller increments are added to the larger decibel amount to predict the combined sound level.

Operation noise impacts on a community usually require great scrutiny since they may last for the life of the facility. There are three situations where noise levels from the operation of an energy facility have potentially significant impacts:

- The operation raises the ambient noise level 3 dBA or more even though the resulting ambient noise level increases from below the maximum acceptable level to above the maximum acceptable level established in local plans or ordinances.

- The operation raises the ambient noise level 5 dBA or more even though the resulting ambient noise level is below the maximum acceptable level established in local plans and ordinances.

- The operation introduces an annoying tonal quality into ambient sound levels.

WHAT INFORMATION CAN BE USED TO ASSESS POTENTIAL NOISE IMPACTS?

Both construction and facility operation impacts can be predicted in advance by the project designer. They may also both be measured and analyzed during construction and facility operation with on-site worker safety level measurements and off-site measurements at specified locations. The off-site measurements should be taken at the identified sensitive receptors, such as nearby residences, schools, hospitals, etc.

Useful assessment information includes:

a) A description of the project's noise-producing features, including the range of noise levels expected, and the tonal and frequency characteristics expected

b) A description of the noise-sensitive environment, including any sensitive receptors, i.e., residences, hospitals, libraries, schools, places of worship and other facilities where quiet is important

c) A list of applicable noise laws, plans and ordinances

THE REGULATORY ENVIRONMENT FOR NOISE

Federal	
Occupational Safety and Health Act stipulates maximum worker noise exposure levels	Title 29, Code of Federal Regulations, section 1910 et seq.
State	
California Occupational Safety and Health Administration sets employee noise exposure limits	Title 8, California Code of Regulations, sections 5096-5098
CEQA Guidelines state a project's impacts are significant if it increases substantially the ambient noise levels for adjoining areas	Title 14, California Code of Regulations, sections 15064, Appendix G (p)
Local	
A Noise Element is required in each local General Plan to establish acceptable noise limits for various land uses, usually used to enable policing of annoying noise	Government Code section 65302
Nuisance abatement	Civil Procedure Code section 731

d) A survey, typically conducted for at least a 24 hour period, preferably during the quietest part of the week, and analysis of the pre-existing ambient noise regime, including measurements and analyses at affected sensitive receptors

e) A description of the potential noise impacts, including estimates of expected noise impacts upon construction and operation workers, and estimates of expected noise levels at sensitive receptor locations

f) A description of cumulative noise impacts

g) A description of the project's proposed noise control features, including specific measures proposed to protect workers, and specific measures proposed to mitigate noise impacts on sensitive receptors to a level of insignificance

h) Identification of any problem areas

GENERAL PLAN IDEAS FOR NOISE IMPACTS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can require the project developer to design, implement and maintain an effective noise complaint resolution program during construction and subsequent operation of the energy facility.

- The city/county can require an ambient noise survey and analysis prior to construction, and can require noise surveys of the facility and of the surroundings (worker protection and ambient surveys) after the energy facility is operational. If the surveys indicate that either the workers or the community has been significantly impacted, further mitigation can be required.

IMPLEMENTATION IDEAS FOR NOISE IMPACTS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Construction Noise Impacts. When off-site impacts from the construction of an energy facility exceed acceptable levels, the following mitigation measures may be required individually or collectively. Sample mitigation measures include:

  - Provide functioning mufflers on construction equipment to reduce the noise levels to the extent possible.

  - Locate noise sources (e.g., compressors) away from sensitive receptors where possible.

  - Erect a temporary noise barrier (wall or berm) around construction site.

  - Limit noise-producing construction work to daytime hours.

  - Establish an effective noise complaint resolution process. The process should include publishing in advance in local newspapers when construction and/or operation will commence, as well as the schedule for particularly noisy operations (such as steam blows), and establishing and publishing a telephone number to call with noise complaints. A noise complaint resolution form should also be developed and records maintained to ensure that community concerns are adequately addressed. See the example of a noise complaint resolution form on the following page.

- Operation Noise Impacts. When off-site impacts from the operation of an energy facility are expected to exceed local standards, or are found to exceed local standards after operation begins, the following mitigation measures may be required, individually or collectively, to reduce the impacts to an acceptable level. Sample mitigation measures include:

  - Install quieter equipment.

  - Redesign and rebuild noisy equipment.

  - Apply acoustic treatment on or around noisy equipment.

  - Install acoustic barriers as appropriate, including walls or enclosures around noisy portions of the facility, and walls or berms around facility property line.

  - Limit extreme noise-producing operations to daytime hours.

  - Establish an effective noise complaint resolution process. (See accompanying form on the following page).

  - Retain the right to modify noise mitigation requirements if subsequent construction and operation noise levels of an

NOISE COMPLAINT RESOLUTION FORM

PROJECT NAME:
CITY/COUNTY WHERE PROJECT IS LOCATED:

Complainant's Name and Address: Complaint Log No.

Phone Number:

Date complaint received:
Time complaint received:

Nature of noise complaint:

Definition of problem after investigation by plant personnel:

Date complainant first contacted:

Initial noise levels at 3 feet:	dBA	Date:
Initial noise levels at complainant's property:	dBA	Date:
Initial noise levels at 3 feet:	dBA	Date:
Initial noise levels at complainant's property:	dBA	Date:

Description of corrective measures taken:

Complainant's signature: ______________________________ Date:

Approximate installed cost of corrective measures: $

Date installation completed :
Date first letter sent to complainant: (copy attached)
Date final letter sent to complainant: (copy attached)

This information is certified to be correct:

Plant Manager's Signature: ______________________________

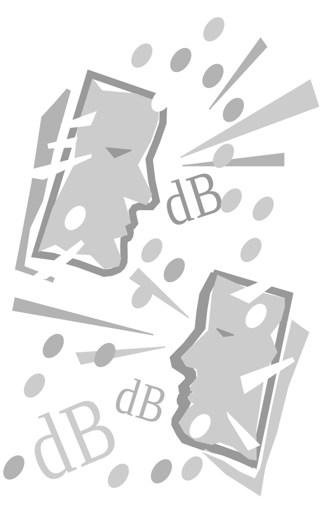
(Attach additional pages and supporting documentation, as required.)

energy facility, based on construction and operation noise surveys, exceed the projected levels originally permitted. Accurate preconstruction estimates of noise levels will reduce the time and cost associated with later revisions.

CASE STUDIES REGARDING NOISE

Alameda County requires in its conditional use permits for wind energy generators that these facilities be located more than 1000 feet in the upwind direction and at least 300 feet in any other direction from any existing dwelling or building site.
Contact: Alameda County Planning Department, 399 Elmhurst Street, Hayward, CA 94544, (510) 670-5400, FAX: (510) 785-8793.

Solano County's *Wind Turbine Siting Plan and Environmental Impact Report* contains policies that prohibit wind turbines which exhibit high infrasonic noise generation potential from locating within one mile of residential uses or land zoned for residential use.
Contact: Solano County Environmental Management and Planning Department, 601 Texas Street, Fairfield, CA 94533, (707) 421-6765.



Kern County's Energy Element contains a policy that requires an acoustical analysis for energy project proposals that might impact sensitive and highly-sensitive uses as listed in the Noise Element of its General Plan.
Contact: Kern County Department of Planning and Development Services, 2700 M Street, Bakersfield, CA 93301, (805) 861-2615.

INFORMATION RESOURCES REGARDING NOISE

The California Energy Commission has information on dealing with energy facility noise levels, measurements, and mitigations. The Commission has licensed numerous energy facilities since it was first authorized to do so, and has developed expertise that it is willing to share with others less familiar with energy facility permitting. The Commission staff has developed a document on noise which may be useful to local governments.
Contact: Engineering Office, Energy Facilities Siting and Environmental Protection Division, California Energy Commission, 1516 Ninth Street, Sacramento, CA, 95814, (916) 653-1608.

The California Department of Health Services has issued *Guidelines for the Preparation and Content of Noise Elements in General Plans,* and *Model Community Noise Control Ordinances.* While there are no direct state regulations for off-site noise levels, these publications may help a community develop a set of evaluation criteria.
Contact: California Department of Health Services, 744 P Street, Sacramento, CA 95814, (916) 445-4171.

The Governor's Office of Planning and Research has developed *General Plan Guidelines,* including those for the required Noise Element in every General Plan.
Contact: Governor's Office of Planning and Research, 1400 10th Street, Sacramento, CA 95814, (916) 445-4831.

The National Academy of Sciences published (1977) a report entitled *Guidelines for Preparing Environmental Impact Statements on Noise*, Appendix A, page 3, in the Report on Working Group 69 on Evaluation of Environmental Impacts of Noise by the Committee on Hearing, Bioacoustics and Biomechanics Assembly of Behavioral and Social Sciences National Research Council.

NOTES NOTES NOTES

CHAPTER 5.6: PUBLIC CONCERNS ABOUT ELECTRIC AND MAGNETIC FIELDS (EMF)

INTRODUCTION

Both electric and magnetic fields occur naturally and are present around electrical equipment, appliances and power lines. Recent interest and research have focused on whether magnetic field exposure affects human health. Before this, most of the focus was on electric fields. This new focus started with reports of a possible link with cancer in humans presumed to have been exposed for long periods to magnetic fields. No such association was suggested in these reports when examining exposure to electric fields from the same sources.

Although there is general agreement among scientists that the cancer or other disease-causing potential of magnetic fields has not been established from the available evidence, it is also true that the possibility of such health effects cannot be dismissed by scientists based on the same evidence.

Because of this uncertainty, most utility regulatory agencies in the U.S. have acknowledged the need for clarifying research while some now consider it appropriate to incorporate field reduction techniques at minimal cost for new and upgraded power system projects. The present scientific uncertainty also means that public health officials cannot establish a standard or level of exposure known to be safe or harmful.

The challenge for local governments is how to respond reasonably to the concerns of local citizens in the face of scientific uncertainty. Public concerns may relate to both new and existing power lines and other electrical power facilities. Both new and existing power lines, for example, may affect existing or planned land uses and community development in general. Generally, utilities have taken the initiative to inform citizens about the current state of the knowledge on magnetic field issues. Local governments and utilities working together can ensure electric facility development in a manner consistent with the general plan.

> *"...an electric field is created when an appliance is plugged into the energized circuit while the magnetic field is produced only when the appliance is turned on."*

This chapter presents background information about electric and magnetic fields. First, we describe the basic nature of each field as commonly encountered in the environment and summarize findings from early and recent scientific studies on the health effects issue. We then discuss what the federal and state governments are doing to address concerns about EMF. Finally, we present recommendations on how local governments might address the present concern with regard to EMF sources in their respective areas. We hope that the information and resources provided will assist local governments in making informed decisions for their respective communities and in working with utilities and addressing state policies and programs.

HOW DID THE CONCERN OVER EMF EXPOSURE BEGIN?

The modern concern over possible EMF health effects can be traced mostly to reports by Soviet scientists in the mid-1960s about health effects among occupationally exposed individuals. The effects reported were effects other than cancer. Based on knowledge of the basic nature of EMF, the electric field component of EMF was assumed more likely than the companion magnetic field to be responsible for these effects. Despite serious flaws in the epidemiological studies involved, these reported findings served throughout the world to intensify research on the EMF health effects issue. Most such research focused on the electric fields for the kinds of non-cancer effects suggested by these Soviet reports.

Scientists who have reviewed these research findings generally agree that they neither confirmed the early Soviet report of effects nor established biological mechanisms that might be responsible for such effects. The internal electric fields, currents and energy that might be induced by exposure to fields from even the highest-voltage lines would be much smaller than those occurring naturally in the body. For these and other reasons, no attempt was made in the past by regulatory agencies to establish health-based numerical limits on fields from power-system and other common EMF sources.

WHAT IS THE REASON FOR THE PRESENT LEVEL OF CONCERN OVER EMF EXPOSURE?

The present-day concern over EMF and health began with a 1979 report of a higher than normal incidence of cancer in children assumed by the authors to have been exposed to above-normal levels of EMF because they lived near power lines. The cancers involved are generally rare, of mostly unknown causes, difficult to link to any one environmental agent, and at the levels suggested, difficult to detect in the types of human (epidemiological) studies involved.

Since electric fields cannot penetrate building materials like magnetic fields, the authors assumed, without actual measurements, that only the magnetic fields could have been responsible for such cancers. When field measurements were made in similar studies conducted later, no such direct cancer link was detected for magnetic or electric fields, raising the possibility that the reported cancer risk increase could have been due to factors other than magnetic fields. It is because of the ubiquitous nature of electricity and EMF that any possibility of a health risk was identified as in need of further scientific investigations.

WHAT TYPES OF RESEARCH HAVE BEEN CONDUCTED TO ADDRESS THIS MOSTLY CANCER RISK-BASED EMF CONCERN?

Basically, three kinds of studies have been conducted since the early reports of cancer:

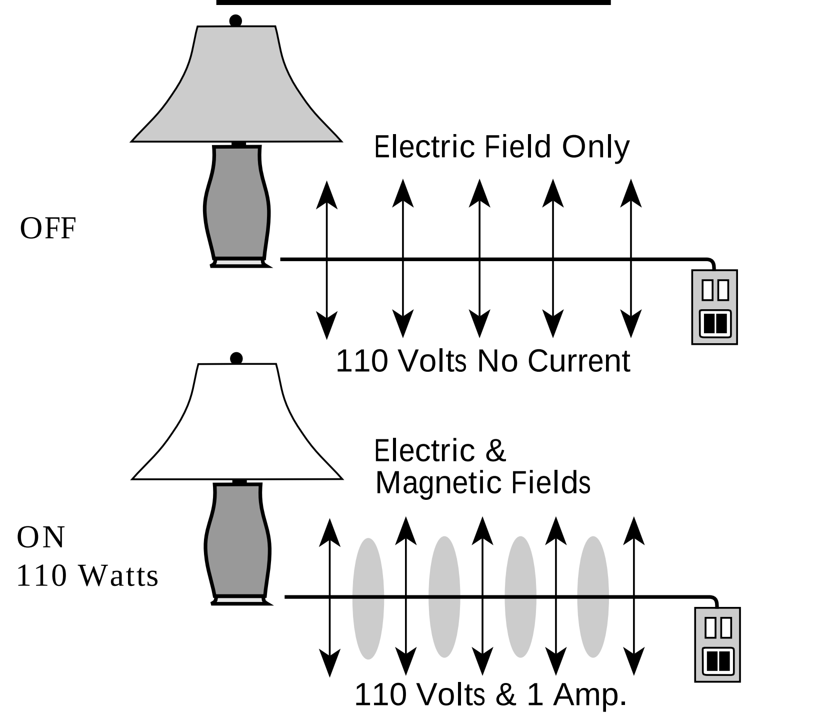
1) Laboratory studies that expose single cells, groups of cells, or organs to fields under a variety of conditions to look for measurable effects which can provide insight into how effects in humans or laboratory animals might be produced

2) Laboratory studies that expose animals or humans to fields under controlled conditions and to look for effects in body function chemistry, disease or behavior

3) Epidemiological studies within human populations exposed in the home, work place or from medical applications, to look directly for any effects of exposure

These studies have been difficult to conduct mostly because of the difficulty in establishing a unit of dose to the exposed study subject, identifying what characteristics or

TWO KINDS OF FIELDS IN EMF



Electric fields are generated by voltage, while magnetic fields are generated by current. Both types of fields occur around power lines.

SOURCE: Colusa County Transmission Line Element types of exposure might be most biologically important, detecting the usually small effects of such weak fields and identifying the biological mechanisms that might be involved.

Biological effects have been reported in some of the laboratory studies on EMF. Most of these effects are observed only using electric or magnetic fields much stronger than those encountered in the residential environment. Biological effects of these types do not necessarily point to the potential for human health effects.

Determining whether or not these effects influence human health is complicated because they are subtle, do not increase with increasing field strengths, and results are not consistent from one laboratory to the next. These and other factors have made it difficult to assess the possibility of human health effects from such reports of biological effects.

DO THESE RESEARCH FINDINGS SUGGEST A HEALTH RISK TO THE EXPOSED PUBLIC?

As noted in the introduction to this chapter, most scientists now agree that the available EMF research findings have not established either power-system electric or the magnetic field as posing a risk of cancer or non-cancer effects to the exposed public. The same conclusion has been reached by several scientific review panels such as those of the Environmental Protection Agency (1992), Oak Ridge Associated Universities (1992), the National Radiological Protection Board of Great Britain (1994), the American Physical Society (1995), the Swedish Electric Safety Board (1993), and the National Research Council (1996). (Also see page 5.6.7 for information about the review of the National Research Council.) While such health risk has not been established, there is agreement among those in favor of some type of action that these same findings have not ruled out the possibility of such health risks, hence the appropriateness, in some cases, of measures to reduce exposures. Given the limited nature of the evidence suggesting the possibility of a health risk, there is general agreement among those in favor of some type of action that only measures with minimal costs would be justified (either relative to system design, or placement away from humans) since a health benefit might not necessarily result.

WHAT ARE ELECTRIC AND MAGNETIC FIELDS?

Electric and magnetic fields are invisible force fields present in nature, and in the case of the man-made power-system fields of the present focus, around any wire or device in which electricity flows. Since these power-system fields exist and can be measured separately in the environment, they can be considered separately with regard to any biological effects they might produce. (See the insert, *Measurement of EMF* on page 5.6.5)

Electric fields represent the forces that charges exert on other charges while magnetic fields represent the additional forces that moving charges exert on other moving charges. Voltage is the force applied across a conductor to cause charges to move from one point on that conductor to another. This directional movement of electric charges constitutes current flow.

The strength of the fields from any given source will diminish rapidly with distance away from that source. Therefore, one way to reduce human exposure is to increase the distance between the source and potentially exposed humans.

TYPICAL 60-Hz MAGNETIC FIELDS MEASURED AT VARIOUS DISTANCES FROM SOME ELECTRICAL APPLIANCES - mG

	1.2 Inches	12 Inches	39 Inches
• Microwave Oven	750-2,000	40-80	3-8
• Clothes Washer	8-400	2-30	0.1-2
• Electric Range	60-2,000	4-40	0.1-1
• Electric Shaver	150-15,000	1-90	0.4-3
• Fluorescent Lamp	400-4,000	5-20	0.1-3
• Hair Dryer	60-20,000	1-70	0.1-3
• Television	25-500	0.4-20	0.1-2

SOURCE: Bonneville Power Administration, 1993.

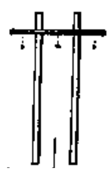
WHERE ARE POWER-SYSTEM ELECTRIC AND MAGNETIC FIELDS FOUND?

An electric field is produced whenever voltage is applied to energize a circuit, but a magnetic field will be produced only when electric current flows in that circuit. This means, in the examples shown in the insert on page 5.6.2, *Two Kinds of Fields in EMF,* that an electric field is created when an appliance is plugged into the energized circuit while the magnetic field is produced only when the appliance is turned on. Since both fields are associated with the generation and use of electric power, they will be found around electric power plants, transmission and distribution lines, substations, transformers, wall wirings, building grounding systems, as well as electrical appliances and equipment.

The voltage on any circuit in a power system typically varies very little so the electric fields that are produced will remain relatively steady at any given point around that circuit. Since the magnetic field is produced only when current flows, its magnitude will vary according to the current in the conductor. This means, in the case of power lines, that the magnitude of the magnetic field will vary constantly over time according to changing loads on the line.

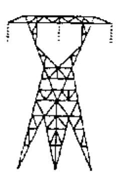
TYPICAL TRANSMISSION LINE ELECTRIC & MAGNETIC FIELD STRENGTHS

115kV



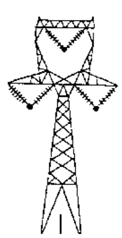
	Approx. Edge of Right-of-way 15m (50ft.)	30m (100ft.)	61m (200ft.)	91m (300ft.)
Electric Field (kV/m) 1.0	0.5	0.07	0.01	0.003
Mean Mag. Field (mG) 30	7	2	0.4	0.2

230kV



	Approx. Edge of Right-of-way 15m (50ft.)	30m (100ft.)	61m (200ft.)	91m (300ft.)
Electric Field (kV/m) 2.0	1.5	0.3	0.05	0.01
Mean Mag. Field (mG) 58	20	7	2	1

500kV



	Approx. Edge of Right-of-way 20m (65ft.)	30m (100ft.)	61m (200ft.)	91m (300ft.)
Electric Field (kV/m) 7.0	3.0	1.0	0.3	0.1
Mean Mag. Field (mG) 87	30	13	3	1

SOURCE: DOE/BP-2081, *Electric Power Lines*, November 1993.

Given the well established potential shock hazards and other environmental effects of power-system fields, (such as audible noise and radio and television interference), power lines and related facilities are designed and operated in ways that reduce the intensity of their electric and magnetic fields without affecting safety, reliability, efficiency, maintainability and economy of operations. The procedures and design measures involved have been established from research and industry experience.

MEASUREMENT OF EMF

The strength of electric fields from any source is measured in volts per meter (V/m) or kilovolts (one thousand volts) per meter (kV/m). Magnetic field strength is measured most commonly in gauss. The milligauss (mG), or one thousandth of a gauss, is used for describing fields of relatively low intensities. For power lines, electric and magnetic field strength measurements are made, by convention, at a height of 1 meter (3.3 ft) from the ground. When a line is proposed for any location, estimates of expected electric and magnetic fields can be calculated using computer programs. Such estimates can then be used to assess potential public exposure as well as the effectiveness of specific field reduction measures proposed for any location along a chosen route.

WHAT ARE COMMON LEVELS OF EXPOSURE TO POWER-SYSTEM ELECTRIC AND MAGNETIC FIELDS?

Since the intensity of electric and magnetic fields decreases with distance from the source, any individual would be exposed at levels dependent on his or her distance from the source in question. (See the inserts on pages 5.6.3 and 5.6.4 showing fields to which an individual might be exposed near sources of electric and magnetic fields.) Individuals using any of the common electrical appliances shown might be exposed to magnetic fields at levels reaching up to tens or thousands of milligauss at very close distance. Such exposures would be much greater than most commonly happen around power lines. The intensity of fields from point sources such as appliances diminishes more rapidly with distance than happens with fields from more expansive sources such as power lines. Therefore, appliances or electrical equipment do not contribute significantly to the background residential levels to which the individual may be exposed involuntarily for long periods of time.

According to a report by the Department of Energy (DOE), the background magnetic levels (away from appliances) in the typical American home varies from 0.5 to 4.0 mG depending on the presence of their main sources such as power lines, unusual wall wirings and grounding systems. The average value is 0.9 mG. Although exposure to appliance-related fields would be much greater than to fields from the typical power line, it is important to note that such high-level exposures would occur only for the relatively short period the appliance is in use. Scientists have not determined whether such high-level, but short-term exposures would be more biologically significant than the low-level, but long-term background exposures. Such exposure differences are noted only to show that relatively high-level magnetic field exposures are not confined to the powerline environment.

According to the same DOE report, several EMF studies of effects in humans (epidemiological studies) have used two or three mG as an arbitrary cut off point for distinguishing between presumably exposed and unexposed groups, but not to suggest a safety threshold. There is no scientific evidence for human effects at these or any other levels. It would therefore be inappropriate to use these, or any other numerical value as an exposure threshold of regulatory significance. (See INFORMATION RESOURCES at the end of this chapter for the DOE booklet).

For any given overhead line, the strength of measured magnetic fields will depend on such characteristics as the distance from the line, the height of the line, the amount of current (not voltage) in the line, distance between conductors and conductor arrangement. For information on the measurement of EMF, see the insert on page 5.6.5.

CAN EMF PENETRATE OBJECTS?

Electric fields cannot penetrate most materials; therefore, trees, houses and other large objects can shield the individual from them. By contrast, magnetic fields can penetrate most materials, therefore, buildings, trees, other large objects, and the ground cannot shield the individual from them.

Placing power lines underground (where their conductors are placed closer together) usually decreases the strength of their magnetic fields as compared to similar overhead lines. However, exposure to the individual standing directly above the underground line may be the same or even higher than those associated with comparable overhead lines. This means, therefore, that undergrounding might not necessarily reduce exposure to fields from power lines. Because the conductors of underground lines are placed closer together, the intensity of their magnetic fields diminishes more rapidly with distance than happens with comparable overhead lines.

The ability to penetrate building materials also means that power lines, whether overhead or underground, can add to the average (background) levels in nearby residences and contribute to long-term exposures not within the direct control of the individual.

EMF PROGRAM ASSISTANCE TO LOCAL GOVERNMENTS

The California Department of Health Services in conjunction with the California Public Health Foundation, as part of their EMF Program, can provide the following assistance:

- Interpret the state of the science with regards to what is known and not known about exposure to magnetic fields and possible effects on human health.
- Give presentations on the state of the science about EMF to community groups, including boards of supervisors, which may be concerned about or interested in exposure to magnetic fields from powerlines.
- Provide advice on the content of technical documents such as exposure assessment protocols that local governments may develop.
- Provide a list of jurisdictions which have developed policies related to EMF.
- Provide advice to a particular local government about a perceived disease cluster that it or its constituents are concerned may be associated with exposure to magnetic fields from powerlines.
- Provide advice on organizing community groups in areas of their jurisdiction where there is a concern about magnetic field exposure from powerlines.
- Send out program documents if a particular local government wishes to follow the Program's progress.
- Encourage local government representatives to attend the Stakeholder Advisory Committee meetings.

For assistance, contact M.A. Stevenson of the Electric and Magnetic Fields Program at (510) 450-3818.

WHAT IS MEANT BY PRUDENT AVOIDANCE WITH REGARD TO EMF EXPOSURE?

The term "prudent avoidance" is often used in literature relating to EMF. This term was defined by M. Granger Morgan, of the Department of Engineering and Public Policy at Carnegie Melon University to mean "Limiting exposure which can be avoided with small investments of money and effort. [Emphasis added.] Don't do anything drastic or expensive until research provides a clearer picture of whether there is any risk and, if there is, how big it is."

The difficulty with using this term is that there can be differences in opinion about what is "prudent" in regards to particular costs or inconveniences. In California, the California Public Utilities Commission (CPUC) has established a policy of reducing exposures to electric and magnetic fields for new and upgraded energy facilities through no-cost/low-cost measures for EMF management. (Refer to the CPUC and utilities' sections below.)

The states that have responded to the present concern have mostly established policies designed to ensure that exposure to fields from new power-system sources do not exceed those from existing ones. In no case have there been requirements to modify existing sources.

WHAT IS THE FEDERAL GOVERNMENT DOING TO ADDRESS EMF?

One of the more recent actions of the federal government was to establish the Electric and Magnetic Fields Research and Public Information Dissemination (EMF RAPID) Program, as required by the Energy Policy Act of 1992. The U.S. Department of Energy (DOE) administers the overall program and directs research on exposure assessment and field management techniques. The National Institute of Environmental Health Sciences (NIEHS) directs the risk assessment and health effects research. The public information component of the program is the responsibility of both DOE and NIEHS. They have developed several publications to inform the public about the current state of knowledge of EMF research.

In 1991, Congress asked that the National Research Council review the EMF research literature for evidence of any health risk to exposed humans. Based on a comprehensive evaluation of over 500 EMF studies conducted over a seventeen-year period, the National Research Council concluded in an October 31, 1996 report, with regard to residential exposure, that it found no consistent and conclusive evidence that EMF poses a health hazard to exposed humans. The committee did not address the possible effects from occupational exposure in this report. It called for more research to explain the factors responsible for a small increase in childhood leukemia in houses close to power lines which may be the result of factors other than magnetic fields. It also called for more research into the relationship between high exposures to EMF and breast cancer in animals already exposed to other carcinogens. (See the insert, *Conclusions of the National Research Council Regarding the Possible Health Effects of Exposure to Residential Electric And Magnetic Fields*).

Research conducted under the RAPID program covers a broad range of scientific disciplines and complements EMF research being conducted in the United States and throughout the world. The program coordinates and focuses the federal EMF effort and provides a central point from which to evaluate research findings, interpret them for the public and disseminate the information.

For information available to the public, see the INFORMATION RESOURCES section at the end of this chapter.

CONCLUSIONS OF THE NATIONAL RESEARCH COUNCIL REGARDING THE POSSIBLE HEALTH EFFECTS OF EXPOSURE TO RESIDENTIAL ELECTRIC AND MAGNETIC FIELDS

"Based on a comprehensive evaluation of published studies relating to the effects of power line frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposures to these fields present a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.

The committee reviewed residential exposure levels to electric and magnetic fields, evaluated the available epidemiologic studies, and examined laboratory investigations that used cells, isolated tissues, and animals. At exposure levels well above those normally encountered in residences, electric and magnetic fields can produce biologic effects (promotion of bone healing is an example), but these effects do not provide a consistent picture of a relationship between the biological effects of these fields and health hazards. An association between residential wiring configurations... and childhood leukemia persists in multiple studies, although the causative factor responsible for that statistical association has not been identified. No evidence links contemporary measurements of magnetic-field levels to childhood leukemia."

(Conclusions from the Executive Summary of the Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems, October 31, 1996)

HOW IS ENERGY FACILITY EMF BEING ADDRESSED IN CALIFORNIA ?

Design, construction and operation of electrical transmission facilities in California is generally outside the regulatory authority of local governments. Depending on the particular facility, this authority may rest with the California Public Utilities Commission (CPUC), the California Energy Commission, or a publicly owned utility.

The CPUC specifies requirements for the shock hazard safety of all electrical transmission facilities in the state. Since (a) all power lines and related facilities must meet the shock hazard safety requirements of the CPUC and (b) EMF reduction measures might impact facility safety, efficiency, reliability and maintainability, the Energy Commission staff considers it most appropriate for all state and local agencies to regard CPUC's policy on EMF reduction (discussed below) as a basis for assessing the acceptability of all power-system sources in the state.

In 1988, the California Legislature directed the CPUC and the Department of Health Services (DHS) to jointly review the scientific information available on EMF health effects and to report their findings in consultation with the Energy Commission and other state and federal agencies. The findings were presented in a September 15, 1989 report to the Legislature. This report concluded that available scientific evidence did not show a reliable link between exposure to electric or magnetic fields and health effects, and was insufficient to warrant regulatory action.

California Public Utilities Commission (CPUC).

Following the September 5, 1989 report , the CPUC established a 17-member group in January 1991, to develop consensus recommendations on an interim EMF policy for electric utilities under its jurisdiction, pending scientific/ medical conclusions. The group consisted of representatives of the general public, consumer advocacy groups, environmental groups, state agencies, utility worker unions, and utility representatives. In response to recommendations of this group, the CPUC issued a Decision on November 2, 1993.

In this decision, the CPUC:

- Ordered Investor Owned Utilities (IOUs) to develop and implement no-cost and low-cost steps to reduce EMF levels at new and upgraded facilities; to develop EMF design guidelines for the construction of new and upgraded facilities; to continue providing free uniform residential and work-place EMF measurement programs; and to provide yearly bill inserts to their customers regarding the EMF issue

- Established a $1.5 million four-year educational program and a $5.6 million four-year non-experimental research program to be funded by California ratepayers and managed by the California Department of Health Services

The CPUC has included the no-cost and low-cost magnetic field reduction measures as a requirement in its certification process for new and upgraded transmission lines of 50Kv to 200Kv and substations (General Order 131-D), having determined that the existing knowledge on the health issue did not justify setting any numerical exposure standards.

California Energy Commission.

The Energy Commission, through its staff, was a member of the EMF consensus group discussed above. The staff of the Energy Commission supports the recommendations that emerged from that process. The Energy Commission, like the CPUC, has not set any health-based limits concerning either electric or magnetic fields.

When an applicant seeks a license from the Energy Commission for a power facility and transmission lines, the staff conducts an independent analysis for the proposed project. This analysis includes examination of design measures proposed to be incorporated into the project to limit human exposure to magnetic fields and, in the case of utility projects, to implement the utility's EMF management guidelines. Staff considers the possible measures that might be incorporated in a given project in light of their effectiveness, effects on safety, reliability, efficiency, and cost practicality. The analysis, together with any conclusions based on it, is included in the staff's recommendations concerning whether the Energy Commission should grant a license or impose certain conditions on a licensee.

State Department of Health Services.

The CPUC's November 1993 Decision (see above) established a four-year EMF Research and Education Program (Program). The CPUC selected DHS to be the program manager to oversee and coordinate EMF-related research, facilitate public education and policy analysis in California, interpret research findings, and advise (the CPUC and other agencies) on any health-based need for changes to existing EMF policies. The Program is structured to allow substantial input from the general public and other interested parties through the EMF Program Stakeholders Advisory Committee. The committee, consisting of core and ex-officio members, provides a forum where citizens and professionals can express any concerns about potential health effects and can ask questions about EMF policy. Local government representatives are invited to participate as ex-officio members or as visitors at the publicly noticed meetings. The committee advises DHS Program staff regarding program direction.

The Education and Technical Assistance Subcommittee was formed in the spring of 1995 to provide the EMF Program with input for future activities that may be of assistance to local governments. The insert on the previous page presents types of assistance currently available to local governments.

- State Department of Education.

While noting that EMF health effects have not been established for exposed humans, the California Department of Education established regulations in 1993 that included specific distance requirements for the area between the edges of the property line of new schools and the rights-of-way of high-voltage lines. These regulations were established conservatively on the basis of electric field strengths for the various classes of high-voltage transmission lines. The regulations were the result of public concerns and included the input of the Department of Health Services and California utilities. These regulations have no particular relationship to magnetic field exposures since magnetic fields are proportional to current rather than voltage. They also do not address exposures from either electrical sources within school grounds or the location of new lines in the area around schools. The distance requirements are specified in the California Code of Regulations, title 5, section 14010c (Regulations for School Site and Plans) as follows:

- 100 feet for 50-133 kV lines
- 150 feet for 220-230 kV lines
- 350 feet for 500-550 kV lines

Since (a) no EMF health effects have been established and (b) the most biologically important types of exposures are yet to be established, such distance requirements should not necessarily be seen as providing any health benefits. EMF exposure as noted in these regulations is one of many factors that should be considered in the choice of sites for new schools.

WHAT ARE SOME OF THE ACTIONS BEING TAKEN BY CALIFORNIA UTILITIES TO RESPOND TO EMF CONCERNS?

All IOUs (and many municipal utilities) have incorporated the CPUC specified no-cost low-cost concept in their field management policies regarding the design and operation of new and upgraded facilities, including transmission lines, distribution lines, and substations.

Many utilities have EMF information programs for their employees and the general public, provide technical assistance to local agencies and also provide updates on research findings.

Utilities generally consider it important to involve the public as they present the rationale for the choice of exposure reducing measures proposed for a particular power line. Customer questions on EMF exposure are handled through answer lines usually dedicated to this purpose. When desired, residential field measurements are made mainly by either the utility staff or with a meter loaned to the interested individual.

Where an individual or group desires modification of an existing facility, a number of utilities have shown a willingness to allow the modification at the expense of the entity desiring it provided such modifications do not impact safety, maintainability, reliability and efficiency. Because field strengths are influenced by many factors, utilities would be unable to guarantee that the fields in question would be lower than before the desired modifications.

WHAT IS BEING DONE ABOUT EMF IN SCHOOLS?

Individual school districts in California have acted on a case-specific basis to assess magnetic field exposures in schools and, in a few cases, have negotiated actions with utilities to reduce exposures from existing energy facilities. However, there presently are no scientific reasons for children to be more sensitive than adults to the effects, if any, of EMF. Therefore, such modifications would not necessarily provide any health benefits. The actions taken in these few

CONTACTS FOR EMF INFORMATION AND GUIDELINES

Utilities	Contact	
Anaheim Public Util. Dist.	Dave Pine	(714) 254-4288
Burbank Public Service Dept.	Greg Simay	(818) 953-9640
City of Alameda Electric Dept.	Bill Lewis	(510) 748-3901
City of Banning Public Utilities	Tim Trewyn	(714) 922-1247
City of Colton Electric Utility	Nitin Modi	(909) 370-5104
City of Redding Electric Dept.	Frank Ryan	(916) 245-7017
Glendale Public Service Dept.	William Hall	(818) 956-2107
Imperial Irrigation Dist.	Rich White	(619) 339-9477
Los Angeles Dept. Water & Power	Info-line	(213) 367-2616
Modesto Irrigation District	Randy Erickson	(209) 526-7491
Pasadena Water & Power Dept.	Henry C. Lee	(818) 405-4479
Pacific Gas and Electric Co.	Info-line:	(800) 743-5000
Riverside Electric Utilities Dept.	David Redding	(800) 442-4950
Sacramento Municipal Utility District	Info-line	(916) 732-6009
San Diego Gas & Electric Co.	Info-line:	(800) 336-SDGE
Santa Clara Electric Dept.	Larry Owens	(408) 244-SAVE
Sierra Pacific Power Co.	Kuldip Sandhu	(702) 689-4581
Southern California Edison Co.	Info-line	(800) 200-4723

State Agencies	Contact	
California Department of Health Services/California Publication Health Foundation	M.A. Stevenson	(510) 450-3818
California Energy Commission	David Maul	(916) 654-3941
California Public Utilities Commission	Jody London	(415) 703-1137

cases to reduce exposure have been due to concern among some members of the public about the possibility of such sensitivity.

The typical cost of any such modifications would be much higher than justifiable per present CPUC policy. Alterations in transmission lines have been done in a few school districts, with costs to them ranging from $20,000 to $100,000 or more. The Energy Commission staff does not encourage such expensive measures with regard to schools or any other location.

The cost of such actions (as with residential customers) is borne by that school district or the customer.

Only no-cost or low-cost steps have been taken in the majority of cases with regard to EMF. In several cases, the main sources of magnetic fields in the schools were found not to be power lines. In these cases, the sources were electrical appliances or equipment, faulty wiring, or school transformers.

WHAT CAN LOCAL GOVERNMENT AGENCIES DO TO ADDRESS PUBLIC EMF CONCERNS?

This section provides ideas for local governments on how best to address some of the concerns that the public may have about electric and magnetic fields. Public concerns about EMF exposure relate to developments (such as residential areas, schools, day care centers) near existing power lines or substations, as well as the development of new or upgraded power lines and substations in their communities.

As noted in the above section on the California Public Utilities Commission (CPUC), the policies of that state agency require investor-owned utilities to address EMF in the construction of new or upgraded utility facilities with the use of no cost and low cost measures. The CPUC EMF-related policies do not require changes to existing energy facilities.

Jurisdictions throughout California have been struggling with developing policies and practices to assist them as the permitting agencies for projects which are proposed adjacent to existing power lines or substations. Local governments are cautioned against adopting any specific numerical standard of magnetic field strength or specific buffers or setbacks, until there is a scientific basis for doing so. (The adoption of numerical standards is inconsistent with the CPUC EMF policy for new electrical facilities.) In addition, CEQA does not require or encourage the analysis of EMF because the impacts are presently unknown and speculative. (Sec. 15145 of CEQA Guidelines)

Local government policies can, of course, designate preferences for land use in general plans. However, due to the present scientific uncertainty surrounding the EMF issue, local governments should exercise caution regarding potential policy pitfalls and give due consideration to the no-cost and low-cost EMF reduction policy of the CPUC. Planning provisions that discourage development adjacent to transmission lines or rights-of-way may create legal controversy between local governments and property owners. Local fiscal as well as legal problems may also result from the perception of "safe" and "unsafe" zones and potential property value variations.

Local governments should also be wary of simply adopting a policy that another jurisdiction adopted after its own study and review. There may be unique local land use issues in different jurisdictions which require different policies. Notwithstanding the above cautions, ideas are provided for your consideration in the following local government program areas:

Local Government and Public Education and Involvement

• Whether the facilities are new or existing, local governments are encouraged to stay informed by working with all stakeholders, including the CPUC and the Energy Commission when they have jurisdiction, the utility, constituents, and developers.

• Participate in the Electric and Magnetic Fields (EMF) Program Stakeholders Advisory Committee Meetings as an ex-officio member or as a visitor to ask policy or technical questions, to learn about the state program and what research is being done. (See insert E*MF Program Assistance to Local Governments* on page 5.6.6.)

• If you are unable to attend any meetings, you may request information from the EMF Program on the state of the science, state policy development, and technical assistance available. You may request to be put on the mailing list as an interested party.

• Provide a status report to the governing body (Board of Supervisors/City Council) periodically regarding the current status of EMF health studies (using EMF Program information) and policy or implementing measures adopted by local utilities, state agencies and other local jurisdictions. Invite a well-informed EMF Program speaker or panel to make a presentation at governing body or public meetings.

• Learn from the experience, both positive and negative, of other counties and cities regarding how EMF is being addressed.

The DHS EMF Program can provide a list of cities and counties which have worked to develop EMF-related policies. The EMF Program also plans to collect case study information. (Information about the Colusa County Transmission Line Element appears on page 3.11 of Chapter 3.)

• Work with the local or State Department of Health Services and local utilities in the development of public education efforts regarding the issue of EMF and health. Invite the public to attend briefings regarding EMF and EMF management techniques. See the insert on page 5.6.6 regarding assistance from DHS in organizing community groups.

• Include the public in discussions of EMF management during early community involvement for the siting of electric generating facilities and power lines and include the CPUC EMF policy in the discussions.

Local Planning Considerations

• Land use planning techniques and zoning provisions can provide, in general, that:

a) human exposure to magnetic fields be considered and

b) the heightened public concern over childhood exposure be considered.

• Land use designation within and adjacent to rights-of-way can be made to limit unnecessary human exposure, but at the same time allow for flexibility so that local governments can respond to evolving scientific findings.

Working With Utilities/Project Proponents

- Consult with project proponents to keep informed regarding the location of planned new or upgraded power lines, substations, and transformers, and the implementation of feasible EMF-reducing design measures. Inquire whether the local utility intends to design and operate the new facilities in keeping with current CPUC EMF policy, where applicable. Include this information in a status report to your governing body.

- Express specific local concerns to "lead" and "responsible agencies" during the permitting process when the local agency does not have the lead.

GENERAL PLAN AND IMPLEMENTATION IDEAS

The following are ideas which can be used for the development of general plan policies and implementation programs, providing they are consistent with the entire general plan.

In addition, working with and providing advance guidance to prospective energy project developers will result in a more efficient, effective, and expeditious permitting process which will benefit both the local community and the developer/applicant.

- Local governments can, whenever possible, maintain a public information program of the current state of knowledge about EMF. Monitor the research and policy developments concerning EMF. Include written material about EMF, what is being done, and what options individuals have based on the current knowledge about potential health risks, if any.

- When the safety element (or any other appropriate element) of the general plan is revised, local agencies can include a commitment to monitor the research and policy developments concerning EMF. Any exposure standards, if established in the future by state and/or federal agencies, should be considered for inclusion in the general plan and applicable ordinances.

- Local agency planning for new energy facilities (for which the local government has authority) or for upgrades to existing facilities can ensure implementation of no-cost and low-cost EMF reduction measures consistent with the CPUC policy.

- Local governments can adopt land use plans which accommodate and include preferences concerning the location of new power lines consistent with a no-cost and low-cost policy.

- Local governments can coordinate with the appropriate local utility the adoption of land use plans that designate preferred secondary uses for rights-of-way.

- Local governments can coordinate joint review of land use applications with the appropriate local utility for areas where significantly increased electrical demand may be anticipated.

- Local governments can ensure that developers and planners have access to information about EMF so they can consider factors influencing public EMF exposure in the context of proposed projects.

- Local governments can choose to discourage some types of new development adjacent to existing transmission lines and rights-of-way.

- Local governments can encourage commercial, industrial or open space land uses adjacent to existing transmission lines and rights-of-way.

INFORMATION RESOURCES

Some National Reviews of EMF Research:

Advisory Group on Non-Ionizing Radiation. 1992. *Electromagnetic Fields and Cancer* 3(1). National Radiological Protection Board. United Kingdom. Chilton, Didcot, Oxon, OXII ORQ.

American Physical Society. 1995. *Power Line Fields and Public Health.* College Park, Maryland.

California Public Utilities Commission Decision 93-11-013 of November 2, 1993 on the interim steps to develop policies and procedures for addressing the potential health effects of electric and magnetic fields of utility facilities.

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Expert Group of the Danish Ministry of Health on Non-ionizing Radiation. 1993. *Report on the Risk of Cancer in Children with Homes Exposed to 50 Hz Magnetic Fields form High-Voltage Installations.* Danish Ministry of Health, Copenhagen, Denmark.

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National Radiological Protection Board (NRPB) of United Kingdom. 1994. *Electromagnetic Fields and the Risk of Cancer*. Supplementary Report of the Advisory Group on Non-Ionizing Radiation. Documents of NRPB 5(2). Chilton U.K.

National Research Council. 1996. *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields*. National Academic Press, Washington D.C.

Oak Ridge Associated Universities Panel. 1992. *Health Effects of Low-Frequency Electric and Magnetic Fields.* ORAU 92/F8. Prepared for the United States Committee on Interagency Radiation Research and Policy Coordination. U.S. Government Printing Office: GPO #020-000-00443-9.

Peach, H.G., W.J. Bonwick, R. Scanlan, and T. Tyse. 1992. *Report of the Panel on Electromagnetic Fields and Health to the Victorian Government.* Minister of Health, Melbourne, Australia.

Science National Board for Electrical Safety. 1993. *Revised Assessment of Magnetic Fields and Health Hazards.* Stockholm, Sweden.

Swedish National Board of Electric Safety. 1993. *Revised Assessment of Magnetic Fields and Health*. Stockholm, Sweden.

Universities Consortium on Electromagnetic Fields. March 1992. *Investigation in Powerline Frequency EMF and its Risks to Health: A Review of the Scientific Literature*. Colorado.

Other Publications:

BPA (Bonneville Power Administration). 1993. *Electrical and Biological Effects of Transmission Lines.* DOE/BP-0945, published 1989, second edition, revised February 1993. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon.

California Energy Commission. 1992. *High-Voltage Transmission Lines: Summary of Health Effects Studies.* Energy Facilities Siting and Environmental Protection Division, July 1992 Staff Paper.

EPRI (Electric Power Research Institute). 1982 Transmission Line Reference Book 345 KV and above. 2nd edition, revised. Palo Alto, CA.

———1994. *Electric and Magnetic Field Fundamentals. A Resources Paper.* Publication, BR-103745.

———1995. *EPRI EMF Seminar: Understanding the Science, Proceedings.*

Harvard Center for Risk Analysis. “EMFs and Childhood Cancer: Are You Convinced?” in *Risk in Perspective*, Volume 4, Number 2, March, 1996. Harvard School of Public Health, Boston, MA.

Heath, Jr., MD, Clark W. “Electromagnetic Field Exposure and Cancer: A Review of Epidemiologic Evidence” in *CA - A Cancer Journal for Clinicians*, Volume 46, Number 1, Jan./Feb. 1996

McNeal, Martha O. “Emerging Public Policy Regarding Electric and Magnetic Fields” in *Journal of Environmental Regulation*, Winter 1994/95, pp. 29-42.

Merritt, Robert E. "Public Agency Responses to EMF Concerns" in *Land Use and Environment Forum,* Volume 3, Number 4, Fall 1994, pp. 241-245.

Morgan, M. Granger. 1995. *Fields from Electric Power: What are they? What do we know about possible health risks? What can be done?* (A general public information brochure and associated booklets.) Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA.

Morgan, M. Granger. 1989. *Electric & Magnetic Fields from 60-Hertz Electric Power: What Do We Know About Possible Health Risks?,* Department of Engineering and Public Policy, Carnegie Mellon University, 129 Baker Hall, Pittsburgh, PA, 15213.

NESC (National Electrical Safety Code), 1993. The American National Standards Institute (ANSI) Standard C2-1993, The Institute of Electrical and Electronics Engineers (IEEE). Approved June 23, 1992, Section 9, Rule 92, Paragraph E; Rule 93, Paragraph C, No. 6.

Pacific Gas and Electric. June 1994. *Transmission, Distribution, and Substation EMF Design Guidelines,* San Francisco, CA, 51 pp.

Sage, Cindy. "EMF, Policy and Science: A Plaintiff's View" in *Land Use & Environment Forum,* Volume 3, Number 4, Fall 1994, pp. 234-253.

Sahl, Jack. "EMF, Policy and Science: One Utility's View" in *Land Use and Environment Forum,* Volume 3, Number 4, Fall 1994, pp. 238-240.

San Diego Gas & Electric. May 1994. *EMF Design Guidelines for Transmission, Distribution, and Substation Facilities,* San Diego, CA, 65 pp.

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Southern California Edison. May 1994. *EMF Design Guidelines for Transmission, Distribution, and Substation Facilities,* Irwindale, CA, 65 pp.

U.S. Department of Energy, National Institute for Occupational Safety and Health, the National Institute of Environmental Health Sciences, and Oak Ridge National Laboratory. September 1996. *Questions and Answers. EMF in the Workplace*. Provides information on EMF basics, research results and studies, workplace exposures, and extensive EMF references. Single copies are available free from the EMF InfoLine, (800) 363-2383. Also available online at the EMF RAPID Home Page, www.niehs.nih.gov/emfrapid/home.htm

U.S. Department of Energy and the National Institute of Environmental Health Sciences. January 1995. *Questions and Answers about EMF, Electric and Magnetic Fields Associated with the Use of* [Residential] *Electric Power,* available in both English and Spanish. Single Copies are available free from the EMF InfoLine: (800) 363-2383. Multiple copies of the booklet can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. (202) 512-1800.

U.S. Environmental Protection Agency, Radiation Studies Division, Office of Radiation & Indoor Air, December 1992. *EMF in Your Environment: Magnetic Field Measurement of Everyday Electrical Devices.* Washington, DC 20460.

HOTLINES & INTERNET

[Contacts in California are listed in the insert on page 5.6.10]

EMF InfoLine (800) 363-2383. The EMF InfoLine is managed by the U.S. Environmental Protection Agency (EPA) and responds to public inquiries about 60-Hz EMFs and radio frequency radiation. It is jointly supported by the EPA and the EMF Research and Public Information Dissemination (RAPID) Program.

ENVIRO-HEALTH Hotline
(800) 643-4794. The National Institute of Environmental Health Sciences operates a hotline to answer questions about various environmental health issues, including EMF.

EMFRAPID Home Page
http://www.niehs.nih.gov/emfrapid/home.htm
Provides information about the federal government's EMF research effort, including public information materials. The home page is maintained by the National Institute of Environmental Health Sciences and is funded by the EMF Research and Public Information Dissemination (EMF RAPID) Program.

ORGANIZATIONS & AGENCIES

California Department of Health (CDHS)
Special Epidemiological Studies Program
2151 Berkeley Way, Annex 11, 5th Floor
Berkeley, CA 94704
(510) 540-2669

California Energy Commission (CEC)
Energy Facilities Siting and Environmental Protection Division
1516 9th Street
Sacramento, CA 95814
(916) 654-3924

California Public Utilities Commission (CPUC)
Energy Advisory Branch
Commission Advisory & Compliance Division
505 Van Ness Avenue
San Francisco, CA 94102
(415) 703-1567

Department of Engineering and Public Policy-Carnegie Mellon University
129 Baker Hall
Pittsburgh, PA 15213
(412) 268-2670

National Institute of Environmental Health Sciences (NIEHS)
P.O. Box 12233
Research Triangle Park
North Carolina, 27709
(919) 541-3345

United States Environmental Protection Agency (EPA)
Office of Radiation and Indoor Air
Radiation Studies Division
Washington, DC 20640
(800) EMF-2383 EMF Hotline

EPA Regional Office
74 Hawthorne Street
San Francisco, CA 94105
(415) 744-1047

World Health Organization (WHO)
523 23rd Street, NW
Washington, DC 20037
(202) 861-3222

RELATED ISSUES/CHAPTERS

- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)

NOTES NOTES NOTES

CHAPTER 5.7: ENERGY FACILITY CLOSURE/ABANDONMENT

INTRODUCTION

Some improperly abandoned energy facilities can pose problems for communities and for the surrounding environment. Contaminated soil and water, leaking wells, unsafe and unsightly buildings and equipment are some of the possible problems associated with such facilities. Proper closure and abandonment of energy facilities will ensure the safety of the site and allow for future alternate uses.

Planning for the proper closure or abandonment of energy facilities presents many complexities. Abandonment generally entails one or more steps after operations are permanently terminated, such as removal of equipment, remediation of contaminated soils and water, and restoration. The timing and the efforts expended on these activities can be controversial.

It may also be difficult to know at the time of permitting what the conditions will be at facility closure time. In addition, the determination of what constitutes a public nuisance or a safety hazard can be controversial. In some cases the state and federal regulations may be vague. The type of facility and its location will usually affect whether potential abandonment issues exist.

There is greater potential for public nuisances and safety hazards for some types of energy facilities than for others. Potential abandonment issues for different facilities are addressed on the following page. Most local government experience in California with abandonment issues is related to oil and gas facilities since they have existed for many years here, there have been numerous older sites improperly abandoned years ago, and they have presented serious public nuisance and safety hazards. Because of this experience, most of the ideas in this sub-chapter stem from issues and legal authority related to oil and gas development.

"The type of facility and its location will usually affect whether potential abandonment issues exist."

The ideas presented, therefore, are generalizations and do not mean that the problems associated with the abandonment or closure of oil and gas fields necessarily apply to all other types of energy facilities.

The location of an energy facility can be an important factor in determining whether it may become a public nuisance. For example, if the facility is located in an industrial zone planned for the long-term, it is less likely to be considered a nuisance than if it is located by itself near an area frequented by people.

Energy facilities which may benefit from facility closure/abandonment planning and implementation include:

- Existing improperly abandoned facilities (such as oil fields and facilities abandoned long ago)
- Facilities currently in operation
- Facilities not yet permitted

For energy facilities that are in operation or not yet permitted, local governments may have the most control, but they also have options for dealing with existing improperly abandoned energy facilities.

However, local governments may be preempted by state or federal authority over certain energy facilities. For example, the Department of Conservation, Division of Oil, Gas and Geothermal Resources has authority over facilities in state designated oil development fields.

For energy facilities under their jurisdiction, local governments can set time limits for considering whether a facility is abandoned. Local governments can also state preferences even when they do not have facility jurisdiction. Some facilities temporarily halt operations due to resource or energy price fluctuations. It would be unreasonable to require a project owner to remove equipment and reclaim a site if operations are expected to resume in a short while. While the project owner's future intent for the site should be considered, local governments may need to protect the community from nuisances and hazards from energy facilities that may never come back on line, and whose owner may walk away from them. To prevent that from happening, some local governments have required an abandonment plan, including financial security, as part of the permit process.

WHAT POTENTIAL IMPACTS ARE ASSOCIATED WITH ENERGY FACILITY CLOSURE OR ABANDONMENT?

The potential impacts associated with abandoned energy facilities are the potential contamination of air, water and soil at facilities that handled or stored hazardous materials. Facilities with wells, and with above ground and underground storage tanks, have the potential to contaminate the soil, groundwater, surface water and air if the equipment is not properly removed or plugged. The potential for such contamination exists during the operation of the facility as well, but if proper operating procedures are in place to prevent hazardous materials impacts, the impacts during closure should also be greatly reduced. (See Chapter 5.3 on *Hazardous Materials Handling and Storage.*)

Many energy facilities have equipment and buildings that constitute dangerous situations if not removed or isolated from the public. These facilities may also reduce the visual quality of an area and conflict with other potential future uses. If buildings or equipment are removed from the site, revegetation (perhaps using native plant species) may be required in order to reduce erosion impacts. Proper abandonment procedures, as with proper construction procedures, will reduce impacts to a variety of on-site and off-site resources.

ARE THERE SPECIAL CONSIDERATIONS FOR DIFFERENT TYPES OF ENERGY FACILITIES?

- Energy facilities that extract, process, transport or store petroleum products have the potential to adversely impact soil, water, biological resources and air quality. Oil and gas wells, processing facilities, pipelines and storage tanks may leak during operation. If improperly removed, plugged or otherwise contained at closure, safety concerns will arise, and soil and water contamination can occur.

- Geothermal facilities share some of the potential contamination problems with oil and gas facilities. Geothermal water or steam often contains heavy metals and other hazardous materials. Wells, pipelines, and production facilities are potential sources of spills or leaks that could negatively affect the local environment. Extraction areas resulting from the operation of geothermal facilities can also have subsidence problems that may not become evident until after they have closed.

- Abandoned wind turbines pose some of the same problems as those in operation. If the blades are not dismantled and made inoperative, bird collisions and noise impacts may continue. The visual impacts and use of the often large tracts of land will continue.

- Large solar facilities can have several abandonment problems. If not dismantled, they can prevent other uses including restoration of many hundreds of acres. Most large-scale solar facilities in California have natural gas backup systems which have abandonment issues including health and safety concerns. Solar thermal facilities currently use hundreds of thousands of gallons of heat transfer fluids that pose substantial cleanup costs should a spill occur.

- The closure of any solar photovoltaic (PV) facility will need to address the reuse, recycling or disposal of the PV panels which may contain hazardous materials.

- Waste-to-energy facilities can have hazardous materials leakage and hazardous ash contamination problems (leachate) both during and after operation. Site cleanup is often necessary.

- Abandoned hydroelectric facilities may result in silted over reservoirs and stagnant water. If not properly maintained or removed, a deteriorating dam may pose an especially dangerous flooding situation downstream.

- Oil and gas pipelines can either be removed or abandoned in place (cleaned and plugged). In areas where the presence of pipelines conflicts with other potential uses, such as recreational activities on beaches, removal will probably be the preferred abandonment procedure. In other areas where incompatibility is less of an issue, there may be fewer environmental impacts associated with proper abandonment in place.

- Electric transmission lines, when abandoned, may provide opportunities for communities to use the corridors for other purposes. There may be safety issues associated with the removal of the wires and

THE REGULATORY ENVIRONMENT RELATED TO ENERGY FACILITY CLOSURE

Federal	
• Closure requirements and financial responsibility for Underground Storage Tanks (USTs)	Title 40, Code of Federal Regulations, section 280.10 et seq.
• Identification and listing of hazardous waste	Title 40, Code of Federal Regulations, section 261.1 et seq.
• Well closure requirements and financial responsibility for hazardous waste injection wells	Title 40, Code of Federal Regulations, sections 144.60 et seq., 146.70 et seq.
State	
• Closure requirements for USTs that store hazardous materials	Title 23, California Code of Regulations, section 2670 et seq.
• Closure and post-closure plans and financial requirements for solid waste landfill	Public Resources Code section 3500 et seq.
• Well abandonment standards for energy facilities with water wells on site	Water Code section 13750 et seq.
• Closure plan and financial responsibility for closure and liability for energy facilities permitted to store or treat hazardous waste on-site	Health & Safety Code section 25245 et seq.
• Operating requirements and financial responsibility for energy facilities that have oil, gas or geothermal wells	Public Resources Code section 3200 et seq.
Local	
• Facility closure plan requirements for energy facilities permitted by local fire departments to store hazardous materials on site	Uniform Fire Code section 80.101 et seq.
• Local ordinances related to facility closure	

poles, such as the proper handling and disposal of wooden poles treated with certain wood preservatives.

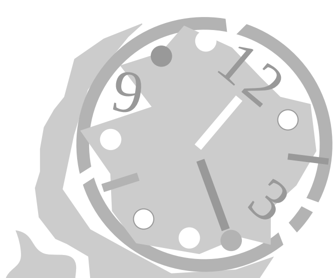
HOW CAN FACILITY CLOSURE/ ABANDONMENT PLANS BE USED?

A facility closure/abandonment plan provides information and time schedules for facility abandonment. However, not all abandonment plans need to contain the same level of detail.

- Preliminary closure/ abandonment plan.

A preliminary closure/abandonment plan can be included with the initial permit application. It should include a description of the equipment and materials that will be utilized at the location and a rough estimate of the cost of abandonment and restoration or rehabilitation of the site. Its purpose is to alert the owners and the permitters of the facility to potential abandonment issues so that they can be prepared for, and possibly minimized, during facility operation. It should also provide an idea of the eventual cost.

Energy facilities often operate for long periods of time. Requiring a detailed, final abandonment plan at the beginning may lock both parties into a program that is outdated by the time the facility is closed. Use of a preliminary closure plan with the original permit may be all that is needed to reduce potential abandonment impacts during operation.



- Final closure/abandonment plan. A final closure/abandonment plan can be developed closer to the time of closure which will be able to take advantage of the most current technology and be tailored to the actual impacts of the facility rather than to the anticipated impacts at the time of the permit.

A final closure/abandonment plan is much more detailed and includes exact abandonment and restoration procedures that are intended to be carried out by the facility owner. A final plan can be prepared, and receive agency approval, at any time during the permitting or operating stages of a facility, but ideally should be in place before a facility is closed. A final evaluation can be done at the time of closure and revisions of the plan can be made.

WHAT ARE SOME SPECIAL CONSIDERATIONS OF A CLOSURE/ABANDONMENT PLAN?

Questions that need to be considered in an energy facility closure/ abandonment plan include:

- Will equipment or structural changes occur? That is, can the equipment be left as is, or should it be removed or otherwise made inaccessible?

- If fuels or hazardous material have been handled or stored on site, what will happen to them? Will they continue to be stored on site? What will be done with their containment vessels? Has any contamination resulted? How will contaminated soil and water be remediated?

SUGGESTED CONTENTS FOR A FINAL FACILITY CLOSURE/ABANDONMENT PLAN

- A project description including a discussion of future plans for the area occupied by the facility
- A project schedule including the equipment and personnel needed to accomplish the project; removal plans for equipment with details of procedures, work sequences, manpower requirements, water requirements, hazardous material disposal and safety
- Remediation measures for soils and groundwater (the California Department of Toxic Substances Control may get involved with soil and groundwater contamination)
- Restoration methods for returning the site to natural conditions and a discussion of topography, soil stabilization and aesthetic values
- Revegetation methods and protection measures for sensitive biological resources during abandonment
- A rezoning discussion of the appropriate zoning for the site based upon surrounding land uses and future desired use by the land owner
- A detailed discussion of the potential significant environmental impacts and proposed mitigation measures
- A discussion of financial responsibility and assurance

- Will it be necessary for any maintenance activities to continue? Will site security be required to prevent exposure to hazardous material or dangerous situations?

- Will impacts continue after closure or abandonment? If so, how can they be mitigated?

WHAT ARE THE PRINCIPAL PERMITTING ISSUES OF ENERGY FACILITY ABANDONMENT PLANNING?

The exact requirements for proper facility closure/abandonment will depend upon the type of materials that is/was present at the site, the type of equipment used, and any site specific conditions that would normally be identified in a California Environmental Quality Act (CEQA) analysis at the time of the original permit. For example, if sensitive biological resources have been identified at a facility, mitigation required during construction and operation may need to be addressed during abandonment as well. For energy facilities that were originally permitted before CEQA came into effect, abandonment conditions can be added to subsequent permits, provided the conditions are related to the activities for which the permit is sought. (The federal, state, and local regulatory environment is presented on page 5.7.3.)

One of the best ways to ensure a safe facility when it is closed is to require proper operating conditions when it is open. Proper operating conditions include hazardous materials management plans, accurate record-keeping, and security. In addition, local governments must be concerned with transfer of ownership, financial responsibilities, and the timing for developing and implementing closure plans.

Permit conditions that establish proper operating procedures will allow the operator of a facility to correct problems that are causing contamination and thus reduce the amount of cleanup at abandonment.

- Accurate and thorough record-keeping during construction and operation will make it easier to produce an abandonment plan by allowing for an early assessment of environmental issues prior to abandonment. A record of all the known materials that have been used on-site, the location of their storage and use, plus reports of spills or other accidents will aid in the development of the plan. If there are known cultural, biological, or other sensitive areas on-site, it will be easier to decide how to properly close the facility while protecting the resources.

> *"One of the best ways to ensure a safe facility when it is closed is to require proper operating conditions when it is open."*

- Operations monitoring is also part of an early assessment of potential pre-closure conditions. Such monitoring should ensure that no improper activities occur during the productive life of an energy facility, thus making the abandonment procedure less difficult.

- Site security during the operation of the facility will ensure that no unknown materials are transported to the site, and thus unaccounted for in the records. If potentially dangerous equipment remains on-site after closure, site security may need to continue after abandonment. Hazardous material should not remain on-site after final closure. The closure plan should include timely removal.

- Transfer of ownership of an energy facility without complete knowledge of the potential closure issues may be a problem. It is important to ensure that new facility owners are subject to the existing permits and abandonment requirements, including timing of abandonment procedure and financial responsibilities.

- Establishing financial responsibility and assurance mechanisms has been used by some local governments to ensure that money will be available to return an energy facility site to an earlier condition, if appropriate, or some other, productive use. (See the table on the following pages.)

- Abandonment timing schedules should be set by local governments. Two schedules should identify when abandonment plans must be completed and when abandonment proceedings must be started. Setting a time limit for when final abandonment plans must be submitted to the local government is necessary so that the plans will be in place when a facility is ready to shut down. It will also give the local government a chance to comment on, and require alterations to, a plan prior to approval and implementation.

SUMMARY EVALUATION OF FINANCIAL ASSURANCE MECHANISMS

(Researched by Santa Barbara County for application to oil and gas facility abandonment and closure)

Financial Mechanism (Availability)	Accessibility	Cost	Effectiveness	Adaptability
Trust Fund (public or private)	High to moderate for decommissioning	Moderate; about 1% of face value	High, if fully paid; moderate to low if buildup is allowed	High
Enterprise Fund (public only)	Moderate, particularly if restrictions on fund use are established	Low, unless funds must be placed in a trust fund	Low, if fund functions only as an accounting mechanism; moderate to high if funds are placed in a trust fund	Moderate to high
Government Securities - • General Obligation Bonds (public only)	Low; laws limit bonding capacity and require voter approval	High to moderate; costs include interest payments, expense of issuing bonds, & expense of holding funds	High if bonds have been issued & use of funds is carefully restricted	Moderate to low; mainly a source of funds, not an assurance mechanism
• Certificates of Participation (public only)	Low to moderate; avoids some obstacles of bonds; most available for facilities with a large & certain revenue stream	High to moderate; more expensive than general obligation bonds	High if certificates have been issued & use of funds is carefully restricted	Moderate to low; mainly a source of funds, not an assurance mechanism
• Revenue Bonds (public only)	Low; laws limit bonding capacity & require voter approval; most available for facilities with a large & certain revenue stream	High to moderate; more expensive than general obligation bonds	High if certificates have been issued & use of funds is carefully restricted	Moderate to low; mainly a source of funds, not an assurance mechanism
Letter of Credit (public or private)	High for large, financially strong entities; weak for others	Moderate 1 to 1.5% of face value per year	High	High

Financial Mechanism (Availability)	Accessibility	Cost	Effectiveness	Adaptability
Security Bonds (public or private)	Low for decommissioning	Moderate to high; 0.35 to 5% of face value per year	High to moderate	High to moderate
Insurance (public or private)	Unavailable for decommissioning	High to moderate	High to moderate	Very low, because decommissioning is a certain event, but unpredictable in timing
Risk Retention Group Coverage (public or private)	Not legal for decommissioning	Moderate to high; likely to be at least as expensive as insurance	Moderate to high, depending on group's financial strength	Not legally authorized
Cash	High for financially strong entities	Low	High	High
Corporate Parent Guarantee (private only)	Low; available only to private firms that are subsidiaries with financially strong parents	Low; parent is not likely to charge a fee	Moderate; depends on financial means test that guarantor must pass	Moderate
Financial Means Test (public)	Low in short term because test has only recently been developed; available to financially sound agencies only	Low, agencies passing the test would not be required to pay a third party or to set aside funds	Depends on terms of test; new test is likely to have uncertain effectiveness; does not reduce problem of delays in performance	Moderate
Financial Means Test (private)	Moderate if existing test is used as model; available to large, financially sound firms only	Low; firms passing the test would not be required to pay a third party or to set aside funds	Depends on terms of test; does not reduce problem of delays in performance	Moderate

An idle facility must be considered abandoned at some point. Local government policies describing when particular types of facilities will be considered abandoned alert facility operators when something must be done, for example to reactivate the facility or to initiate abandonment procedures.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can develop a definition of abandoned energy facilities based on the time period during which the facility is not operating at a designated percentage of its potential capacity.

- The city/county can require developers of energy facilities to include a preliminary abandonment plan as part of the original permit for the facility. At least one year before a facility is scheduled to cease operations, the project owner can submit for approval a final abandonment plan that details exactly what will be done to restore the site to its original, pre-energy facility condition.

- The city/county can require appropriate operating conditions at energy facilities, including a hazardous materials management plan (if hazardous materials are handled or stored on-site), accurate and thorough record-keeping, and site security. The city/county can monitor the operations of energy facilities to ensure compliance with all permit conditions, including abandonment planning and implementation.

- The city/county can require a status report for all existing energy facilities under its jurisdiction including operational, idle, previously but improperly abandoned facilities, and facilities previously not permitted by the city/county. The status report could assess the issues that may be of concern at abandonment, provide an estimate of the timing of facility closure and abandonment implementation, and estimate the cost of abandonment procedures. The status report could be updated every five years.

IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Develop a definition of abandoned energy facilities for energy facilities expected to be in operation in the city/county. The local planning department, or other appropriate local government agency, should develop the definition.

- Develop guidelines for the requirements of abandonment plans. See the box on page 5.7.4 for items which can be included.

- Consider requiring an abandonment plan as a condition of a land use or conditional use permit.

- Consider requiring a financial security mechanism of the facility owner to ensure adequate funding for facility abandonment procedures.

- Consider requiring that equipment and construction materials be recycled or reused when feasible.

- Require a periodic status report of all energy facility abandonment plans within the city/county's jurisdiction. Provide a time schedule for when the report is due, and impose fines for late submittal. The fines will provide an incentive to complete the report in a timely manner, and can augment developer fees paid into an energy facility abandonment fund.

CASE STUDIES

Alameda County requires site restoration for wind farms that do not produce electricity for one year and which do not demonstrate to the Zoning Administrator that the equipment will again be operational.
Contact: Steve Richards, Alameda County Planning Department, 399 Elmhurst Street, Hayward, CA 94544, (510) 670-5400.

Glenn County has adopted a policy in its Energy Element to require the dismantling of wind turbine blades within six months of the time when the facility is no longer operational or not producing electricity. If not operated for two continuous years, the site is to be restored to its natural or previous state.
Contact: Glenn County Planning Department, 125 S. Murdock Street, Willows, CA 95988, (916) 934-6540.

Lassen County has an Energy Element policy that requires, as a condition of the use permit, reclamation of abandoned geothermal sites in accordance with an approved reclamation plan and the requirements of the Department of Conservation; Division of Oil, Gas and Geothermal Resources. *Contact:* Lassen County Department of Community Development, 707 Nevada Street, Susanville, CA 96130, (916) 251-8269, FAX: (916) 251-8373.

The City of Palm Springs has adopted a zoning ordinance related to Wind Energy Conversion Systems (WECS). Regarding unsafe and inoperable WECS, the ordinance states that any commercial WECS that have not generated power for 12 consecutive months shall be declared a public nuisance which shall be abated by repair, rehabilitation, demolition or removal.

The proper abatement method shall be determined by the Director of Planning and Zoning. If the operator of the WECS can demonstrate that modernization, rebuilding or repairs are in progress or planned and the WECS will be returned to service as soon as possible, the WECS may not be declared a nuisance. If the power production is halted due to lack of electricity purchase by a contracted utility, that period of non-purchase will be added to the 12 months.

The ordinance requires that when WECS are no longer operable, the site be restored to its condition prior to installation. A bond or other appropriate form of security may be required to cover the cost of removal and site restoration. *Contact:* Richard Patenaude, City of Palm Springs, Department of Planning and Building, P.O. Box 2743, Palm Springs, CA 92263-2743, (619) 323-8245, FAX: (619) 322-8360.

Santa Barbara County is developing a report "Abandonment of Oil and Gas Production Fields and Related Facilities." Proper abandonment is described in the report as the permanent termination of use and the series of steps that lead to the restoration of any oil and gas sites within the county's jurisdiction. The abandonment steps include the removal of all above-ground facilities, the remediation of contamination, the restoration and recontouring of the grounds, the revegetation of the land and, if applicable, the rezoning of the land to its highest and best use in order to protect the public health, safety and welfare, and promote sound land use planning in the county.

The draft report considers a policy to require periodic status reports of all oil and gas production facilities. The status reports will be used to help the county and operators to identify early possible abandonment problems. The reports will also estimate costs of the proper abandonment of a project so that operators can provide adequate bonding and financial planning. *Contact:* Doug Anthony, Santa Barbara County, Planning and Development Department, Energy Division, 1226 Anacapa Street, Santa Barbara, CA 93101, (805) 568-2040.

INFORMATION RESOURCES

Additional local governments having policies and/or ordinances concerning the abandonment of oil and gas facilities, including wells and pipelines, can be used as a source of information regarding their experiences. These include: San Luis Obispo County, Ventura County, the City of Huntington Beach Fire Department, the City of Los Angeles Fire Department (Harbor Industrial and Commercial Well Unit), and the City of Torrance.

RELATED ISSUES/CHAPTERS

- Air Quality (Chapter 5.1)
- Biological Resources (Chapter 5.2)
- Hazardous Materials Handling and Storage (Chapter 5.3)
- Water Quality and Use (Chapter 5.4)

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DISTRIBUTED GENERATION

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CHAPTER 6

ENERGY AWARE

PLANNING GUIDE: *ENERGY FACILITIES*

CHAPTER 6: DISTRIBUTED GENERATION

The California Energy Commission will provide a new chapter of this Guide in 1997 to address the topic of distributed generation in a more comprehensive manner than included herein. Distributed generation is one portion of a distributed energy 'system.' This system of distributed resources serves local areas only and may consist of small electric generation and storage devices as well as demand-side management techniques. The new chapter will focus on electric generation devices and any storage devices that may be used in conjunction with them. Such devices include small gas-fired generation and cogeneration systems, photovoltaics, fuel cells, small-scale wind turbine development, small-scale batteries and advanced storage technologies.

Local governments will want to be knowledgeable about distributed generation and related devices because, due to the devices' relatively small size, local governments will be involved in permitting them. The introduction of more distributed generation devices into communities will provide for greater opportunities, as well as greater necessity, for local governments and local utilities or other energy providers to work together in electrical service planning and permitting efforts. There can be benefits to the communities and to utilities with the use of these devices in specific situations. Such potential benefits, as well as potential permitting issues, will be addressed in the new chapter.

The new chapter will provide information, as current as possible, about new developing technologies and the potential uses of available or soon to be available devices. Rapid technological developments are being made in distributed generation devices. Costs will continue to decrease as markets increase both in this country and abroad. Distributed energy systems can provide possible solutions to the costs and environmental challenges of expanding and upgrading existing electrical systems to meet local increased loads or local electrical demand peaks. We believe that this new chapter will be timely and of particular interest to local governments as both permitters and potential customers. Smooth, efficient, and consistent permitting processes for these devices will benefit local governments, utilities, businesses or others using the devices, and California manufacturers seeking larger markets for the devices.

In this edition of the Guide, the reader can find some discussion of distributed resources in the following areas: page 2.6 and the footnote of page 2.9, page 3.1, Guest Author articles by Carl Weinberg and Donald Aitken at the end of Chapter 3, the glossary, and some of the technologies described in Appendix B.

NOTES NOTES NOTES

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APPENDICES

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ENERGY AWARE
PLANNING GUIDE: *ENERGY FACILITIES*

APPENDIX A:
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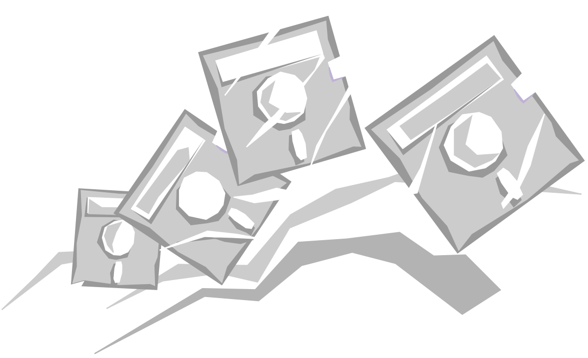

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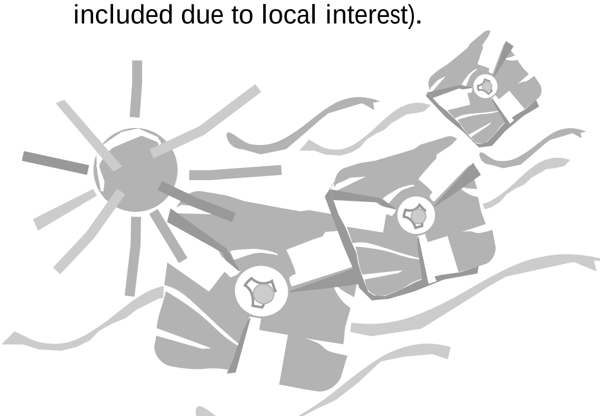
APPENDIX B: ENERGY FACILITY DESCRIPTIONS AND ISSUES

USING THIS APPENDIX

This appendix addresses the types of energy facilities that a local government may encounter either in its planning processes or in permitting a specific project proposed by a developer. It is not intended to be a complete reference manual of every energy facility type, but it can assist local governments in acquiring some familiarity with energy facilities and their potential permitting issues which can improve the permitting process from the standpoint of local governments and of project developers.

You will find a brief overview of a large number of specific energy production, generation, transmission, distribution, and energy storage and management facility types. (These categories of facilities were briefly defined in Chapter 1.) Facilities discussed include both those that are currently available commercially as well as those that are likely to become available within 12 years (although a few longer-term technologies, such as nuclear fusion and ocean wave energy conversion, are included due to local interest).



Appendix B contains the following:

- Table B-i is an index for locating the energy facility descriptions. For the purposes of this appendix, the facilities are organized into two broad categories:

  1) electric generation and storage and

  2) other energy facilities.

- Table B-ii is a matrix of specific energy facility types and their major potential permitting issues and relative levels of significance. This can be used in conjunction with the issues described in Chapter 5. Please note that issues associated with transmission lines, such as EMF, are included only in the transmission line facility type. However, since transmission lines are connected to most types of generating facilities (power plants), issues related to electrical transmission facilities may accompany them also.

- Energy facility sections which contain facility descriptions, the major equipment configurations and applications, notation of commercial status, potential permitting issues, and references. Some of the sections are based on types of fuel and contain more than one specific facility type.

See Appendix F, "Power Plant Generating Efficiency", beginning on page F.7, for a comparison of typical efficiencies which may be achieved with various generation technologies.

For information on a generating or storage technology not listed in Table B-i, please refer to the Energy Commission's Energy Technology Status Report (ETSR) and/or contact the Energy Commission's Siting and Permit Assistance Program. The *ETSR* is a biennial staff report that provides technology evaluations for more than 230 electrical generation, storage and transmission, and end-use technologies. It serves as an important reference for use both internally at the Energy Commission and by other research and government institutions. In order to satisfy multiple levels of interest by readers, the most recent *ETSR,* published in 1992, is available in three forms, ranging from abbreviated to extremely detailed. (See the insert on the following page for more detailed information.)

HOW TO OBTAIN ETSR (Energy Technology Status Report) PUBLICATIONS

Energy Commission publication no. P500-92-007E is the *1992 ETSR Report Summary*. It includes a technology evaluation matrix that provides an at-a-glance assessment of each technology's commercial status, major remaining research and development goals, and major deployment issues. Also included in this publication is a summary of the levelized cost of generation for each technology, expressed as a range of costs as a function of facility ownership.

Energy Commission publication no. P500-92-007 is the *1992 ETSR Final Report*. It includes all of the information provided in the *1992 ETSR Report Summary* plus one-page (front and back) "fact sheets" for each technology. These fact sheets include a description of the technology (often with a simplified schematic of the process), and more detailed information for each technology relative to the technology's commercial status, major research and development goals, and deployment issues. Also included is a list of references used in the development of the *ETSR*.

Energy Commission publication no. P500-92-007A V1 and P500-92-007A V2 are Volumes 1 and 2 of Appendix A of the *1992 ETSR*. Appendix A contains the detailed electric generation technology evaluations, in the form of unabridged research work, which form the basis for all *ETSR* fact sheets and matrices. This appendix should be referred to when the most detail is needed.

To obtain a copy of these *ETSR* publications, contact the Energy Commission's Publications Office.

California Energy Commission
Publications Office
1516 Ninth Street, MS-13
Sacramento, CA 95814
(916) 654-5200

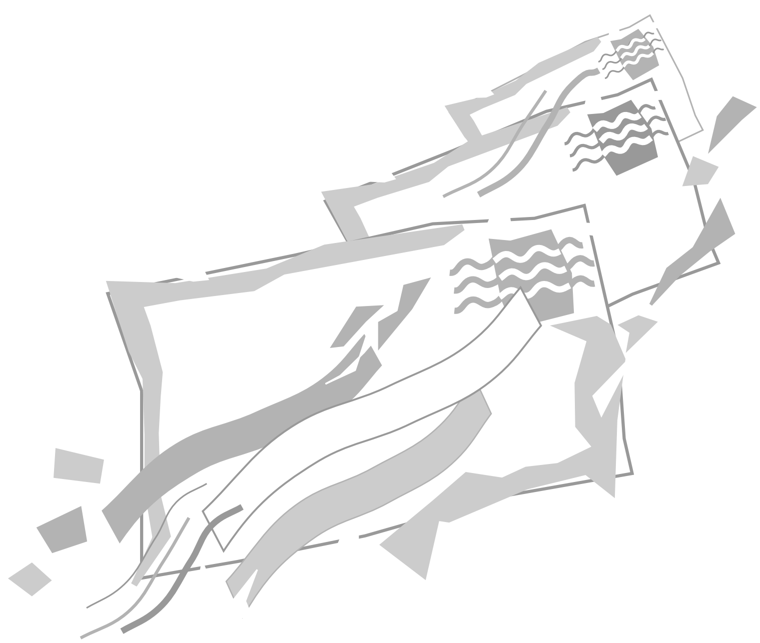


TABLE B-i
INDEX TO ENERGY FACILITY TYPES

TABLE B-ii MATRIX OF ENERGY FACILITY TYPES VS MAJOR PERMITTING ISSUES

POWER PLANTS	Hazardous Materials Hand-ling and Storage	Air Quality	Water Use and Quality	Electromagnetic Fields	Biological Resources	Nuisance (Noise, Odors, andVisual)	Energy Facility Abandon-ment/Closure	Land-intensive
ANAEROBIC DIGESTION (B-1)	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate
BATTERY STORAGE (utility-scale) (B-2)	moderate	insignificant	insignificant	moderate *	insignificant	insignificant	insignificant	insignificant
BIOMASS (B-3)								
Direct Combustion	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate
Thermal Gasification	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate
COAL (B-4)								
Conventional Coal-fired Boilers	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate
Fluidized Bed Combustors	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate
Integrated Gasification Comb. Cycle	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate
FLYWHEEL ENERGY STORAGE (B-5)	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
FUEL CELLS (B-6)	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
GEOTHERMAL (B-7)								
Liquid-Dominated								
Flashed Steam	significant	significant	significant	insignificant	moderate	moderate	significant	moderate
Binary	moderate	moderate	significant	insignificant	moderate	moderate	significant	moderate
Rotary Separator (retrofit)	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
Vapor-Dominated	significant	significant	significant	insignificant	moderate	moderate	significant	moderate
HYDROELECTRIC (B-8)								
Conventional Hydro								
Dam	insignificant	insignificant	significant	insignificant	significant	significant	significant	significant
Run-of-River	insignificant	insignificant	significant	insignificant	significant	moderate	insignificant	insignificant
Pumped Hydro (storage)								
Conventional	insignificant	insignificant	significant	insignificant	significant	significant	significant	significant
Modular	insignificant	insignificant	significant	insignificant	significant	significant	moderate	moderate
MAGNETOHYDRODYNAMICS (B-9)	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate

* Potential impact if no proper shielding.

= no or insignificant issue = potentially moderate issue = potentially significant issue

TABLE B-ii MATRIX OF ENERGY FACILITY TYPES VS MAJOR PERMITTING ISSUES

POWER PLANTS (continued)	Hazardous Materials Hand-ling and Storage	Air Quality	Water Use and Quality	Electromagnetic Fields	Biological Resources	Nuisance (Noise, Odors, andVisual)	Energy Facility Abandon-ment/Closure	Land-intensive
MUNICIPAL SOLID WASTE (B-10)								
Mass Burn (direct combustion)	Significant	Significant	Significant	Insignificant	Significant	Significant	Significant	Moderate
Refuse-Derived Fuel (dir. combustion)	Significant	Significant	Significant	Insignificant	Significant	Significant	Significant	Moderate
Pyrolysis/Thermal Gasification	Significant	Significant	Significant	Insignificant	Significant	Significant	Significant	Moderate
Landfill Gas Recovery	Insignificant	Significant	Significant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
NATURAL GAS AND OIL (B-11)								
Advanced Gas Turbines	Significant	Moderate	Significant	Insignificant	Insignificant	Moderate	Moderate	Insignificant
Boilers	Significant	Significant	Significant	Insignificant	Significant	Significant	Moderate	Insignificant
Cogeneration	Significant	Significant	Significant	Insignificant	Insignificant	Moderate	Moderate	Insignificant
Combined Cycles	Significant	Significant	Significant	Insignificant	Moderate	Moderate	Moderate	Insignificant
Compressed Air Energy Storage	Significant	Significant	Insignificant	Insignificant	Moderate	Moderate	Moderate	Significant
Simple-Cycle Gas Turbines	Significant	Significant	Insignificant	Insignificant	Insignificant	Moderate	Moderate	Insignificant
Steam-Injected Gas Turbines	Significant	Significant	Significant	Insignificant	Insignificant	Moderate	Moderate	Insignificant
NUCLEAR (B-12)								
Fission	Significant	Insignificant	Significant	Insignificant	Significant	Significant	Significant	Moderate
Fusion	Significant	Insignificant	Significant	Insignificant	Significant	Significant	Significant	Moderate
OCEAN WAVE (B-13)	Insignificant	Insignificant	Significant	Insignificant	Significant	Significant	Significant	Insignificant
SOLAR PHOTOVOLTAIC (B-14)								
Distributed Photovoltaic Systems	Insignificant	Insignificant	Insignificant	Moderate *	Insignificant	Insignificant	Insignificant	Insignificant
Utility-Scale Systems	Insignificant	Insignificant	Insignificant	Moderate	Moderate	Moderate	Moderate	Significant

* Potential impact if no proper shielding.

Insignificant = no or insignificant issue; Moderate = potentially moderate issue; Significant = potentially significant issue

TABLE B-ii MATRIX OF ENERGY FACILITY TYPES VS MAJOR PERMITTING ISSUES

POWER PLANTS (continued)	Hazardous Materials Hand-ling and Storage	Air Quality	Water Use and Quality	Electromagnetic Fields	Biological Resources	Nuisance (Noise, Odors, andVisual)	Energy Facility Abandon-ment/Closure	Land-intensive
SOLAR THERMAL (B-15)								
Concentrating Systems								
Parabolic Troughs	significant	significant	significant	insignificant	moderate	significant	significant	significant
Parabolic Dishes (no gas assist)	insignificant	insignificant	insignificant	insignificant	moderate	moderate	moderate	significant
Parabolic Dishes (gas assist)	insignificant	significant	insignificant	insignificant	moderate	moderate	moderate	significant
Central Receivers	insignificant	insignificant	significant	insignificant	moderate	significant	significant	significant
Salt Ponds	significant	insignificant	significant	insignificant	significant	moderate	significant	significant
WIND (B-16)								
Distributed Wind Systems	insignificant	insignificant	insignificant	insignificant	insignificant	significant	moderate	insignificant
Utility-Scale Systems	insignificant	insignificant	insignificant	insignificant	moderate	significant	significant	significant
OTHER ENERGY FACILITIES								
Elec. Trans. & Distr. Systems (B-17)	insignificant	insignificant	insignificant	significant	significant	significant	insignificant	significant
Energy Prod. Wells (oil, gas, geo) (B-18)	significant	significant	significant	insignificant	moderate	moderate	moderate	moderate
Ethanol and Methanol Production (B-19)	significant	significant	significant	insignificant	moderate **	moderate	moderate	moderate **
Alt. Fuel Charging/Fueling Stations (B-20)								
Electric Vehicle Charging	insignificant	insignificant	insignificant	moderate *	insignificant	insignificant	insignificant	insignificant
Liquified Petroleum Gas	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
Methanol and Ethanol	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
Natural Gas	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
Geothermal Direct Use (B-21)	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant
Pet. & Pet. Product Storage Facilities(B-22)	significant	moderate	moderate	insignificant	insignificant	moderate	significant	moderate
Pipelines (B-23)	moderate	insignificant	moderate	insignificant	moderate	moderate	significant	significant
Refineries (B-24)	significant	significant	moderate	insignificant	moderate	significant	significant	significant
Terminal Facilities (B-25)	significant	moderate	significant	insignificant	moderate	moderate	significant	moderate

* Potential impact if no proper shielding.

** Potential impact for crop production.

= no or insignificant issue = potentially moderate issue = potentially significant issue

B-1. ANAEROBIC DIGESTION

Anaerobic digestion is one of three major waste-to-energy technologies (the others are Biomass and Municipal Solid Waste, discussed in Sections B-3 and B-10, respectively). Anaerobic digestion, also known as methane fermentation or biological gasification, uses microbiological methods to produce a gas from biomass fuels such as animal manure, or municipal waste fuels such as sewage sludge from sewage treatment facilities.

The anaerobic digestion of municipal solid waste mixed with sewage sludge or manure can also occur in what is called high-solids digestion. This process is currently undergoing research and development, and is close to commercialization.

The resulting gas, called biogas or digester gas, is a mixture primarily of methane and carbon dioxide. Note: the natural anaerobic digestion process that occurs in landfills is discussed separately in Section B-10, Municipal Solid Waste.

The most basic anaerobic digesters are covered lagoons where the natural microbial activity within the lagoon generates biogas that is then captured by the cover. An alternative digester design consists of mixing tanks with a mechanism for stirring in order to obtain even suspension of the sludge particles. The tanks can be either above ground or sunk into the ground part way. Temperature affects the rate of digestion and should be maintained in the range between 95˚F and 105˚F.

Other equipment typically includes holding tanks or lagoons, covers, piping, and other vessels for reactions, along with the power generation equipment. Another digester design involves pushing the waste through a cylindrical reactor over a period of time. This design is called a plug flow digester and can be used with waste streams with a higher solids concentration. Mixing occurs as a result of the friction between the waste and the digester walls as it is pushed through. Solids concentrations can be on the order of 11 to 13% by volume. A typical fuel is municipal solid waste mixed with sewage sludge.

In order for an anaerobic digester to be economical, the cost of transporting the organic waste from its place of origin to the digester must be kept to a minimum. Thus, digesters are typically located at wastewater treatment facilities or large dairies. Systems are typically small and custom-designed for the particular quality and production rate of the waste.

◩ Biomass-based fuels. Biomass-based fuels that are suitable for anaerobic digestion include high-moisture agricultural food processing wastes (such as tomato and grape pomace and cheese whey) and animal manures from dairies and feedlots. While manure may be available as a fuel source year-round, agricultural food processing residues may only be available during certain months.

In each of these cases, the fuel is free at the source. It must, however, be collected, processed and either used on-site or transported to an off-site location. Where unprocessed wastes cause odor and water pollution, such as in large dairies, anaerobic digestion reduces the odor and liquid waste disposal problems and produces a clean fuel suitable for electricity generation. Typically the biogas is combusted in an engine-generator, producing between 10 kW and 2 MW.

◩ Sewage sludge as a fuel. Anaerobic digestion is a mature technology used in municipal wastewater treatment. Anaerobic digestion has been used for many years primarily to stabilize the sewage sludge, and thus reduce pollution from it. Power production from the biogas produced has historically been seen as a secondary benefit.

After treatment in anaerobic digesters, the remaining sewage sludge is still high in water content, with only one percent to three percent solids. The treated sludge can be spread over large parcels of land without further processing, or it can be dried or otherwise processed to produce a cake-like product that consists of 15 percent to 30 percent solids. That material can then be transported fairly economically and is suitable for a number of final applications, including composting, land application, and combustion.

The Hyperion Energy Recovery System operated by the city of Los Angeles recovers the biogas created by the anaerobic digestion of waste-activated sludge and primary-treated sludge. The biogas is scrubbed for hydrogen sulfide removal and then used as a fuel in a combined-cycle cogeneration plant consisting of four gas turbines and one back pressure turbine, for a total of about 15 MW gross.

The remaining treated sludge then undergoes mechanical dewatering and evaporation processes to dry the sludge. The resulting sludge powder is then gasified under high temperature, and the gas produced is then combusted and additional electricity is produced in a steam turbine. See section B-10 (Municipal Solid Waste) for more on electricity generation via thermal gasification.

◩ Permitting Issues Some of the major issues associated with anaerobic digestion facilities include:

- Ability to meet air quality requirements
- Ability to ensure that health risks are kept to a minimum (since the pre-digested organic waste may contain disease-causing organisms, especially in the case of sewage sludge or animal manures)
- Possibility of odor nuisance if wastes are stored prior to digestion
- Disposal or further processing of remaining (treated) high-water-content sludge (although the treated sludge is safer than the untreated sludge)
- Possible impact to groundwater if leaching beds are used
- Ability to handle accidental spills;
- Changes in visual quality (although these may be minor if the digester system is located at the site where the wastes are received or produced)

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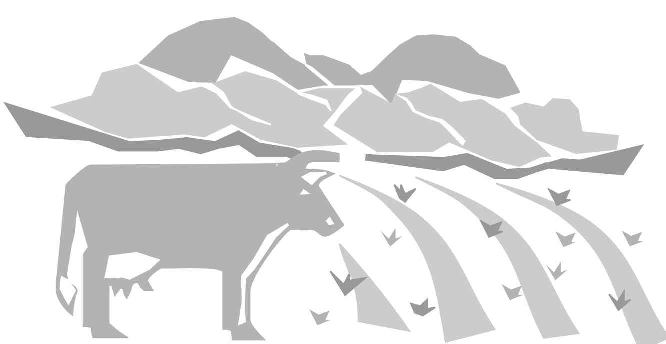
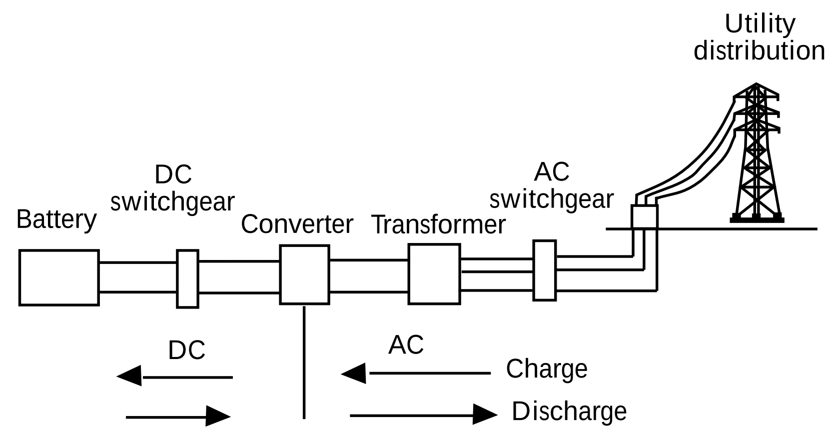


B-2. BATTERY STORAGE (UTILITY-SCALE)

COMPONENTS OF A UTILITY BATTERY SYSTEM



SOURCE: "Utility Battery Storage Systems Program Plan". FY 1994 - FY 1998; U.S. Department of Energy

Utility-scale batteries are modular energy storage devices that store electricity in chemical form for use at a later time. Such batteries are typically charged with relatively inexpensive, off-peak electricity and are then discharged during peak demand periods, releasing their stored energy as electricity (see figure). Using this "load leveling" process, utilities have an alternative to the traditional approach to meeting peak loads by adding more generation capacity. Batteries can be used for many other utility applications such as reliability and power quality, transmission and distribution equipment deferral, spinning reserve, and frequency regulation. A battery system provides the largest value when it is used for more than one application at the same installation.

Unlike other storage technologies, such as conventional pumped hydroelectric which can range up to hundreds of MW in size, battery storage systems are much smaller and are appropriate for applications in small distribution areas as well as at the utility service area level. In addition, batteries can be located virtually anywhere, including urban areas, and can be controlled remotely. They can achieve full load in about five milliseconds.

There are three major types of utility-scale battery technologies that have been selected by the U.S. Department of Energy's (DOE) Utility Battery Storage Systems Program as the prime candidates for further analysis and development: lead-acid, sodium/sulfur, and zinc/bromine.[1] Of these, only the lead-acid battery is available commercially. Southern California Edison (SCE) has installed a 10 MW/40 MW-hr[2] flooded lead-acid battery storage system at its Chino substation that has been in operation for more than seven years. It is the largest load-leveling utility battery system in the world. The Puerto Rico Electric Power Authority (PREPA) has a 20 MW flooded lead-acid battery in operation in San Juan which primarily provides spinning reserve capability and frequency control support to the island. Due to their satisfaction with the performance of the system, PREPA has decided to install a second battery storage system.

The U.S. DOE program is attempting to develop an improved valve-regulated (sealed) lead-acid (VRLA) battery that will match or exceed the performance of the flooded lead-acid battery at a cost equal to or lower than the flooded lead-acid battery without sacrificing the inherent VRLA advantages (low maintenance, spill- and leak-proof, no hydrogen hazard during charging, and compact installation.)

A recycling industry is already in place for worn out cells (the automotive battery industry is based on lead-acid batteries.) The two other more advanced types of batteries being developed by the DOE program, the sodium/sulfur and the zinc/bromine, are still in the early stages of development and are not expected to be available commercially until the year 2000. These advanced batteries are expected to have potentially long lives (30 years versus five to 10 years for lead-acid batteries) and lower costs than lead-acid batteries. A recycling industry will need to be developed for these technologies. The recycling of sodium/sulfur batteries is environmentally benign. The recycling of zinc/bromine batteries is also relatively benign, but is slightly

[1] The names refer to the chemicals inside the battery cells.

[2] Utility-scale batteries are typically identified by their maximum power and energy capabilities. Thus, the SCE battery is capable of producing a maximum power output of 10 MW. It is able to sustain that power output for four hours (i.e., 10 MW for four hours equals a total energy discharge of 40 MW-hr.)

more complicated. However, neither type of battery involves the use of hazardous materials.

The batteries themselves do not emit any pollutants, although there could be emissions from the generating sources that are used to charge the batteries (e.g., if the generating sources are fossil fuel-fired). Depending on the air emissions characteristics of the generating sources which charge the batteries off-peak versus the air emissions characteristics of an alternative fossil fuel-fired technology which may otherwise be required to meet the peak load, there could be a substantial net air quality benefit (in terms of amount of pollutants emitted as well as the timing of their release.)

◪ Permitting Issues. Only a small amount of land is required for battery systems (about 0.6 to 1.5 kWh of energy storage per square foot, or 26 to 65 MWh of energy storage per acre), which can probably be found at most typical substations. Spill containment and fire prevention equipment is required. The only water pollution occurs in the event of an acid spill (flooded lead-acid batteries only.) If there is a spill, the acid must be neutralized, treated with absorbents, and the absorbents disposed of as hazardous wastes.

There are no air quality, noise, or odor impacts. Visual impacts are limited since batteries would typically be located at existing or planned substations. The battery would be considered to be hazardous waste and would need to be recycled or disposed of accordingly at the end of its life.

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B-3. BIOMASS

Biomass is one of three major waste-to-energy technologies (the others are Anaerobic Digestion and Municipal Solid Waste, discussed in Sections B-1 and B-10, respectively). Biomass power plants typically use biomass resources (e.g., residues from forestry and forest product mill operations, residues from agricultural field crops and food processing operations, and manure) as fuel in one of three processes: direct combustion systems that produce heat used to generate electricity via boiler/steam turbine subsystems; thermal gasification systems that create a "producer gas" which is combusted in boilers or engine-generator sets; and anaerobic digestion reactors which create a "biogas" that can then be combusted in boilers or engine-generator sets.

Anaerobic digesters, which can use biomass residues such as animal manure and high-moisture agricultural food processing wastes as well as municipal wastes such as sewage sludge, are discussed separately in Section B-1.

Forestry and forest product mill residues are generated from logging and mill processing operations, respectively. The amount of logging residue is directly related to the amount of timber harvested; hence, forestry-based biomass plants are highly dependent on the economics of the timber industry. Forestry and mill residues are generally available throughout the year. Large biomass facilities, however, typically stockpile three to six months or more of fuel, in order to minimize the impact of potential supply disruptions.

Agricultural crop residues include wastes generated from field crops such as straw as well as fruit and nut crops. Agricultural crop residues are generally available only during a two- to four-month harvesting season, typically between the months of May through December. As a result of this limited availability, biomass plants may use mixtures of agricultural and forestry residues with varying harvest seasons, or they may stockpile the fuel in order to maintain year-round operation.

Agricultural food processing residues include waste from processing berries, fruits, grains, nuts, and vegetables. Such residues are divided into low- and high-moisture content categories, since different energy recovery processes are used for each. Low-moisture content wastes, such as pits, shells, and nuts, are potentially suitable for the combustion and gasification technologies discussed below. High-moisture content wastes, such as tomato and grape pomace, are suitable for anaerobic digestion processes and are discussed separately in section B-1.

In 1992, 66 biomass direct combustion facilities were operating in California. These facilities had a total capacity of about 850 MW. This represents the largest biomass energy industry of any state in the U.S. The seven million bone dry tons (BDT) per year of biomass residue used by these facilities represents only about 15 percent of the total bio-mass resource potential of 47 million BDT identified in a collaborative study by the California Energy Commission and the U.S. Department of Energy's Western Regional Biomass Energy Program.

Of the 47 million BDT potential, livestock manure is the most abundant resource, accounting for more than 25 percent of the total. Chaparral and field and seed crop residue together contribute over 30 percent of the total biomass resources potential. Less abundant are lumber mill waste, forest slash, and urban yard wastes. Fruit and nut crops, food processing waste, urban wood wastes, vegetable crops, energy crops, and nursery crops contribute the least amount of biomass.

As mentioned previously, only 15 percent of this total biomass potential is being used for energy production purposes (although another 16 percent is used for non-energy commercial purposes such as conversion to fertilizer and plywood.) The biomass resources that are currently being used for energy production include lumber mill waste, livestock manure, urban wood waste, forest slash, food processing waste, fruit and nut crop residue, and field and seed crop residue.

Wood waste is the primary fuel source in the biomass combustion industry. It accounted for about 73 percent of the total biomass fuel consumption in 1990. Of the 66 biomass direct combustion facilities, 61 use wood wastes either exclusively or in combination with other biomass resources.

At present, the outlook for both existing biomass plants as well as new plants is uncertain, due primarily to economic barriers. Many existing biomass plants are qualifying facilities (QFs) that have Interim Standard Offer 4 (ISO4) contracts that were first made available in 1983. The ISO4 contracts provide the option for some QFs to obtain fixed energy prices for up to ten years, after which energy prices revert to the short-run avoided cost of the purchasing utility.

The short-run avoided cost, which is tied to natural gas prices, is far below the fixed, forecasted energy prices specified in the ISO4 contracts at the end of the fixed-price, ten-year period. As a result, QFs are experiencing substantial revenue reductions once they reach the "Year 11 Cliff.". See Chapter 2, section 2.1 for more on the topic of QF contracts.

In addition to the economic problems faced by many existing biomass plants, new facilities may not be cost-effective, especially in a more competitive environment. The capital costs for biomass facilities tend to be high compared to natural gas-fired combined cycle plants. In addition, the fuel cost for the industry's most popular fuel, wood waste, increased dramatically during the 1980s due to increased demands associated the rapid growth of the industry.
At present, California biomass energy producers are examining new ways to become more market competitive. Among the concepts being investigated are ways to reduce or eliminate biomass fuel costs (e.g., by accepting biomass "wastes" directly at the power plants), restructuring their debt load, and reconfiguring their electricity generation profiles (to optimize the generation of electricity during the utilities peak periods). In addition, biomass energy producers are investigating their capability to generate alternative high value products (such as ethanol) that could help diversify and increase their revenue streams.

BIOMASS DIRECT COMBUSTION

Direct combustion of biomass employs conventional steam boiler technology. There are four basic methods: pile burners; spreader-stokers which include fixed, dumping, and travelling grates; suspension and cyclonic burners; and fluidized bed combustors. In California, the most typical configurations used for biomass are spreader-stokers and fluidized bed combustion systems. However, the type of combustion system used depends on the properties of the fuel being combusted. For example, fluidized bed combustion systems are more commonly associated with facilities handling agricultural residues, while spreader-stokers are more typically used at facilities fueled primarily with forestry residues.

As mentioned earlier, there were 66 biomass direct combustion facilities operating in California in 1992. Most of these facilities are relatively small, generally averaging around 20 to 25 MW.

◩ Permitting Issues for Biomass Direct Combustion Facilities. Some of the major issues associated with biomass combustion facilities include:

- Reliability of the fuel source (both in terms of supply and price stability)
- Possible difficulty and space constraints associated with stockpiling the biomass fuel
- Ability to meet air quality requirements
- Disposal of ash
- Possible classification of the ash as a hazardous material
- Use of large amounts of water for cooling purposes (if wet cooling towers are used)
- Possible impacts on the long-term harvesting of agricultural and forestry residues if the lumber or agricultural practices upon which they depend are disrupted
- Removal of forestry residues must be conducted in a manner to minimize impacts such as excessive soil disturbance by machinery, increased soil erosion, disturbance of wildlife habitat and migration routes, and interruption of forest nutrient recycling if too much residue is removed
- Transportation and noise impacts from the transportation of the biomass from its point of creation to the centrally-located energy facility (generally not a factor with on-site facilities such as farms or food processing facilities, or small off-site facilities)

BIOMASS GASIFICATION

Biomass gasification involves reacting biomass residues in the presence of very limited quantities of air or oxygen. This thermo-chemical conversion process generates a producer gas containing hydrogen, methane, carbon monoxide, nitrogen, water, and carbon dioxide. This gas can then be burned directly in a boiler, or scrubbed for combustion in an engine-generator set to produce electricity.

Biomass gasification technology using air as the oxidant is commercially available for the generation of producer gas and its subsequent burning in a boiler. While the producer gas can also be used in engine-generator sets to produce electricity, it is necessary to clean (scrub) the gas of particulates, tars, and oils before it can be burned in an engine.

Currently, no commercially operating biomass gasification facilities of any type are in California. There may be, however, some limited development of biomass gasification facilities in California in the future, particularly if there are dramatic improvements in the technology and/or significant increases in electricity prices.

- Permitting Issues for Biomass Gasification Facilities. In general, many of the issues already identified for biomass direct combustion facilities also apply. In addition, there may be wastewater streams produced that would require treatment.

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B-4. COAL

Coal deposits form from plant materials by the action of heat, supplemented by pressure, over millions of years. The major elemental components of coal are carbon, hydrogen, and oxygen. Minor elements include sulfur, silicon, nitrogen, aluminum, iron, calcium, magnesium, potassium, sodium, and titanium.

Coal is by far the most abundant fossil fuel in the U.S. At the beginning of 1985, the demonstrated reserve base, which is the amount considered to be technically and economically minable, was 478 billion tons (where one average ton of coal has the same heating value of 22,000 cubic feet of natural gas). Neither California nor its nearby states of Oregon, Nevada, Idaho, and Arizona have any significant coal reserves. While other states with large coal reserves pursued coal-fired technologies, California turned to its own indigenous resources, especially oil.

The delivered price of coal can be influenced more by transportation costs than by coal production costs, and thus the lack of significant in-state coal reserves has an impact on the economics of coal-fired projects. In addition, coal-fired plants emit more pollutants (on a pounds of pollutant per fuel heating value basis) than natural gas-fired plants. These factors, coupled with California's more stringent air pollution control requirements and the high cost of obtaining off-sets, have had a significant impact on the economics of in-state coal-fired projects.

As of 1992, 17 coal-fired plants with a total capacity of 553 MW were located in California. These plants are in Amador, Contra Costa, Kern, Los Angeles, San Bernardino, and San Joaquin counties. These plants represent 1.0 percent of the total capacity of California's power plants.

No utility-owned coal-fired power plants are operating in California (although California utilities own and operate coal-fired plants in other states.) Each of California's existing coal-fired plants is owned by a third-party power producer and is a qualifying cogeneration facility which produces useful thermal energy for an industrial process in addition to electricity production.

The three major types of coal conversion either commercially available or demonstrated on a commercial scale in California are: conventional pulverized coal-fired boilers, fluidized bed combustion boilers, and integrated coal gasification combined cycles. Another technology that can use coal, Magnetohydrodynamics, is discussed separately in Section B-9.

The U.S. Department of Energy's (DOE) Clean Coal Technology Demonstration Program is a $6.9 billion cost-shared industry/ government technology development effort. The purpose of the program is to demonstrate a new generation of advanced coal-based technologies, with the most promising technologies being moved into the domestic and international marketplaces.

The 45 technologies being demonstrated in the DOE program seek to reduce the emissions of air pollutants and wastes, while achieving energy conversion efficiencies equal to or greater than technologies currently available. Nineteen of the projects are aimed at emission control technologies that can be retrofitted to existing pulverized coal facilities, while six projects involve fluidized bed combustors and another six projects involve integrated gasification combined cycles.

While no California utilities are participating in the program, nor are any of the 45 demonstrations taking place in California, it is possible that advancements from the Clean Coal Technology Program will result in the commercialization of coal technologies that can meet California's stringent air pollution control requirements while being cost-competitive with other fuel options.

CONVENTIONAL PULVERIZED COAL-FIRED BOILERS

Pulverized coal (PC) combustion boilers with steam turbine power generation are currently the principal electric power generation technology in the U.S., accounting for approximately 42 percent of the national generating capacity in 1991 (although there are only a handful of such plants in California.)

The major components of a PC plant typically include: coal handling equipment, steam generator equipment, turbine-generator, flue gas desulfurization equipment, electrostatic or mechanical particulate control, and bottom and fly ash handling equipment. Coal handling equipment includes the facilities needed to receive (typically by rail), store, control fugitive emissions from, convey, and pulverize the coal.

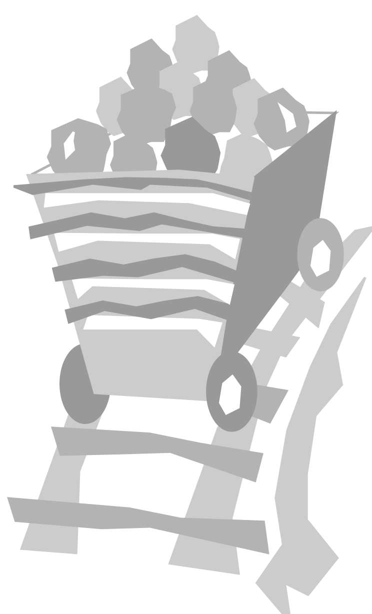
The pulverized coal is then combusted in a conventional boiler, where steam is generated to operate a steam turbine-generator to create electricity. Some of the resulting ash exits the bottom of the boiler in solid form as bottom ash, which is handled by bottom ash handling equipment.

The combustion products which exit the boiler, known as the flue gas, are then routed to an electrostatic or mechanical particulate collection system. The particulate matter collected, called fly ash, is then handled by fly ash handling equipment. Both the bottom and fly ash need to be disposed of as wastes or can be sold. A flue gas desulfurization system is required to remove sulfur oxides, which contribute to acid rain formation.

Conventional pulverized coal technology is losing ground to new coal use technologies such as fluidized bed combustion and integrated gasification combined cycles. Thus, it is unlikely that there will be any new pulverized coal plants proposed in California.

◩ Permitting Issues for Conventional Pulverized Coal-fired Boilers. Some of the major permitting issues associated with conventional pulverized coal-fired boilers include:

- Ability to control fugitive emissions from, and prevent spontaneous ignition of, coal piles
- Ability to control the quantity of air pollutants in the combustion products, particularly nitrogen oxides, sulfur oxides, and particulate emissions
- Disposal of ash, and other wastes from flue gas desulfurization
- Possible classification of waste streams as hazardous materials, thereby restricting the number of allowable disposal sites and raising disposal costs
- Use of large amounts of water for dust control, coal washing, boiler makeup, wet cooling towers (if applicable), ash quenching, and desulfurization of the flue gas
- Biological impacts on the ocean or lake or river water due to thermal discharge (if once-through cooling is used)
- Changes to visual quality due to power plant structures and coal unloading, handling, and storage facilities, as well as emissions from power plant stacks
- Noise impacts from coal delivery, crushing, and handling facilities



- Likely public opposition because of uncertainties over air quality, health and safety, and odor impacts from fugitive coal dust during handling and storage, and waste handling and storage
- Possible poor public opinion due to concerns over acid rain and coal strip mining

FLUIDIZED BED COMBUSTION BOILERS

Fluidized bed combustion (FBC) reduces emissions of sulfur dioxide and nitrogen oxides compared to conventional pulverized coal plants. This is accomplished by controlling combustion parameters and by injecting a sorbent (such as crushed limestone) into the combustion chamber along with the coal. Crushed coal mixed with the crushed limestone is suspended on jets of air (or fluidized) in the combustion chamber. Sulfur released by the coal as it burns is captured by the limestone before it can escape from the boiler. The sulfur combines chemically with the limestone to form a new solid waste product, a mixture of calcium sulfite and calcium sulfate. Some of that solid waste is removed with the bottom ash, while the remaining solid waste is captured by the baghouse or other particulate collection systems.

The operating temperature of FBCs is about half that of conventional boilers, which helps minimize the formation of thermally-induced nitrogen oxides. As a result, less add-on equipment is typically needed to deal with nitrogen oxide emissions.

Some of the advantages of FBCs compared to conventional PC units include:

- The fluid-like motion of the solids in the combustion chamber promotes good mixing.

- The superior mixing permits combustion at substantially lower and more evenly distributed temperatures, thereby reducing the formation of nitrogen oxides.

- All types of coal or coal wastes can be used, including high-ash coals, because FBC can be designed for a wide variety of feedstock.

- The waste generated is a dry, benign solid that can be disposed of easily, or usefully employed (e.g., as material for road or building construction).

The two types of FBC include atmospheric fluidized-bed combustion (AFBC) and pressurized fluidized-bed combustion (PFBC). In AFBC plants, the combustion takes place at atmospheric pressure. Much of the equipment employed by conventional PC plants is used in AFBC plants, except for changes in the boiler configuration and the absence of post-combustion sulfur dioxide scrubbing equipment. AFBC technology is considered to be commercially available. The ACE Cogeneration Company has been operating a 100-MW AFBC plant in Trona (San Bernardino County) since 1990.

In PFBC plants, the combustion takes place at elevated pressures of about 16 times that of atmospheric. This results in the ability to produce electricity from a gas turbine cycle as well as a steam turbine cycle, which results in potentially higher energy conversion efficiencies, more compact plant size, and reduced capital costs compared with AFBCs. However, PFBC technology is still in the demonstration phase, and has yet to demonstrate the favorable capital cost and long-term performance characteristics that are expected of commercial units.

◩ Permitting Issues for Fluidized Bed Combustion Boilers. Some of the major permitting issues associated with FBC boilers include:

- Ability to control fugitive emissions from, and prevent spontaneous ignition of, coal piles

- Ability to control both nitrogen oxide and carbon monoxide emissions

- Disposal of significant amounts of alkaline solid waste (due to both the coal and limestone)

- Possible classification of waste streams as hazardous materials, thereby restricting the number of allowable disposal sites and raising disposal costs

- Use of large amounts of water for dust control, coal washing, boiler makeup, wet cooling towers (if applicable), and ash quenching

- Biological impacts on the ocean or lake or river water due to thermal discharge (if once-through cooling is used)

- Changes to visual quality due to power plant structures and coal unloading, handling, and storage facilities

- Noise impacts from coal delivery, crushing, and handling facilities

- Likely public opposition because of uncertainties over air quality, health and safety, and odor impacts from fugitive coal dust during handling and storage, and waste handling and storage

- Possible poor public opinion due to concerns over acid rain and coal strip mining

INTEGRATED COAL GASIFICATION COMBINED CYCLES

Coal gasification consists of the integration of a coal gasification plant (which converts the coal into a clean fuel gas) and a gas-fired combined-cycle plant (which runs on the gasified coal). The basic components of an integrated gasification combined-cycle (IGCC) plant include: a coal preparation plant, a gasification unit, gas clean-up systems, and a combined-cycle plant.

The coal preparation plant sizes the coal and often mixes it with water to allow slurry injection into the gasifier. The coal is fed into either an air- or oxygen-blown gasifier. If the gasifier is oxygen-blown, an air separation plant is required to produce the oxygen. Water is introduced into the gasifier either in the slurry or via direct steam injection.

The resultant hot, raw, synthetic gas (syngas) is cleaned to remove tars, oils, acids, particulates, and sulfur. If the gas is cooled during the clean-up, steam is often raised for process use or power generation. The clean gas can then be burned in a conventional combined-cycle power plant consisting of one or more combustion turbine-generators, heat recovery steam generator(s), and a steam turbine-generator. The ash and elemental sulfur are often suitable for sale. The tars and oils can be re-injected into the gasifier.

From 1984 to 1989, Southern California Edison (SCE) and the other Cool Water Program participants operated the first utility-scale demonstration IGCC power plant in the U.S. The Cool Water facility demonstrated the ability to achieve low emissions, and it produced a non-leachable ash that was stored at the site. Its continued operation after the end of the five-year demonstration period was denied by the Energy Commission due to its high operating costs and lack of need for the power by SCE.

Several years have elapsed between the end of the Cool Water demonstration and the current round of demonstration projects. The five "second-generation" IGCC projects now underway in the DOE's Clean Coal Technology Program will demonstrate a full range of variations in IGCC process: different gasifiers, different sizes, different coals, different cleanup systems, and different applications (including both "greenfield" and repowering). Three of these projects have either recently begun operation or will begin operation within a year.

The technology is not considered to be commercially available at this time, primarily because the economics of the technology have not been adequately demonstrated, nor has the performance of the second-generation IGCC projects been demonstrated. The technology has the potential to become commercial available about the year 2005.

◩ Permitting Issues for Integrated Coal Gasification Combined Cycles. Some of the major permitting issues associated with IGCC facilities include:

- Ability to control fugitive emissions from, and prevent spontaneous ignition of, coal piles
- Toxic streams produced in intermediate processes that could harm plant personnel in the event of uncontrolled leaks
- Possible classification of waste streams as hazardous materials, thereby restricting the number of allowable disposal sites and raising disposal costs
- Use of large amounts of water for dust control, coal washing, heat recovery steam generator makeup, wet cooling towers (if applicable), and ash quenching
- Biological impacts on the ocean or lake or river water due to thermal discharge (if once-through cooling is used)
- Changes to visual quality due to power plant structures and coal unloading, handling, and storage facilities
- Noise impacts from coal delivery, crushing, and handling facilities
- Likely public opposition because of uncertainties over air quality, health and safety, and odor impacts from fugitive coal dust during handling and storage, and waste handling and storage
- Possible poor public opinion due to concerns over acid rain and coal strip mining

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B-5. FLYWHEEL ENERGY STORAGE

Flywheel energy storage (FES) systems are also known as electro-mechanical batteries (note that electro-chemical batteries are discussed separately in Section B-2 (Battery Storage (Utility-scale)). Like electro-chemical batteries, they are modular energy storage devices that store electricity for use at a later time. Whereas electro-chemical batteries convert electrical energy to chemical energy as a storage mechanism, flywheels convert the electrical energy to mechanical energy (kinetic energy stored in rotational motion).

Flywheels have typically been used as short-term energy storage devices for propulsion applications such as locomotive engines or large road vehicles. Advances in recent years of high strength/light-weight materials, high performance magnetic bearings, and power electronics technology have spurred a renewed interest by the transportation, utility, and manufacturing industries in FES technologies. Several companies are developing flywheels as load-leveling power devices for hybrid electric vehicles. In addition, American Flywheel Systems, Inc. is developing a flywheel as an energy storage system for pure electric vehicles.

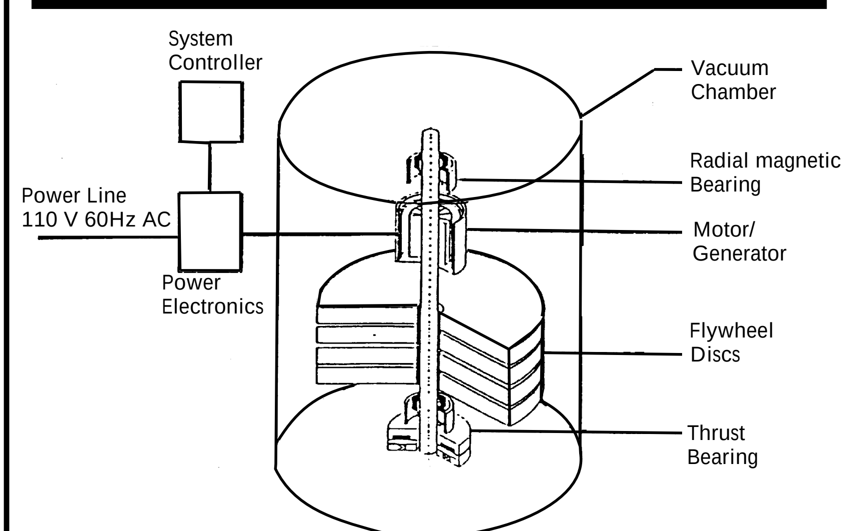
FES units can be used for utility dynamic energy storage (e.g., to improve frequency control, stability, and power quality), uninterruptible power supplies to protect electronic equipment and electrical machinery, and can be used to improve the utilization of intermittent energy sources such as wind and solar. They are especially well-suited for high-power applications with short-duration (minutes) discharge times that cycle frequently. While early studies of flywheel energy storage considered designs with storage capacities up to 10 MWh and peak power outputs of 1 MW (i.e., they could provide 1 MW of power for 10 hours, or a lesser amount of output for longer than 10 hours), more recent studies are focusing primarily on much smaller units ranging from 1 kWh to 300 kWh, with maximum power outputs in the range of 10 kW to several hundred kW (i.e., they could provide 10 kW to several hundred kW for only a matter of seconds or minutes).

One arrangement for a flywheel energy system consists of the flywheel discs and hub, the variable frequency field motor/generator, the bearings and suspension equip-ment, the vacuum chamber/con-tainment structure, and the power electronics and auxiliary systems (see figure entitled *Flywheel Energy Storage System Using Flywheel Discs*). Another arrangement, which is probably more typical of future designs that use composite materials for the flywheel, uses a rim (cylinder) design with the motor/generator inside the rim (see figure entitled *Flywheel Energy Storage System Using 'Rim and Web' Configuration*).

The flywheel (typically made of a high-strength, low-density graphite fiber composite material) is charged from a source using inexpensive off-peak electricity. That electricity runs the motor which turns the flywheel. A flywheel can be spun-up to full "charge" (i.e., its design rotational speed) in a matter of minutes. The magnetic bearings and vacuum chamber are required to minimize the friction losses which would result in self-discharge and a tremendous heat load. The charged flywheel is then discharged when a load is applied, transmitting energy out of the system via the generator. The power electronics serve to regulate the frequency and voltage of the electrical output, since the rotational speed (frequency) of the flywheel changes as energy is discharged from the device.

FES systems are expected to have high "round-trip" energy storage efficiencies of about 85 to 95 percent (i.e., 85 percent to 95 percent of the electrical energy required to charge the flywheel can be retrieved when needed). They can be designed for a 20- to 30-year lifetime. The self-discharge time

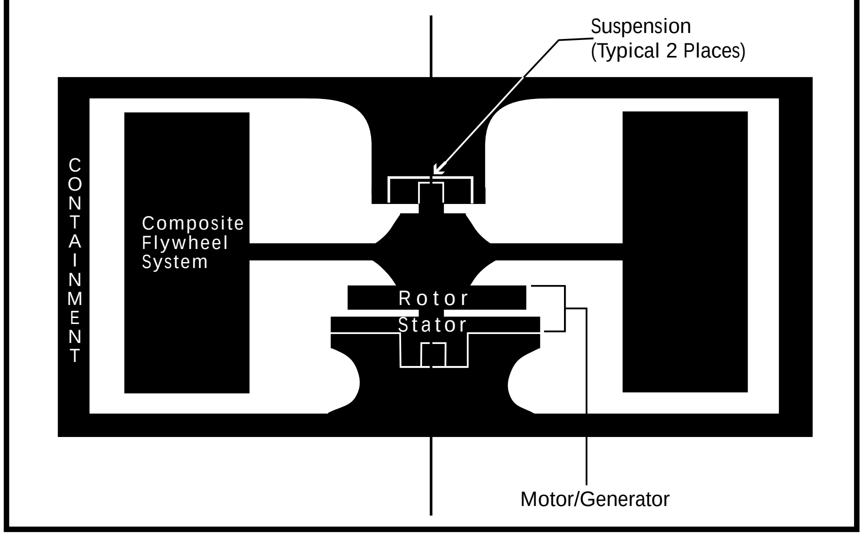
FLYWHEEL ENERGY STORAGE SYSTEM USING FLYWHEEL DISCS



(the time required for the flywheel to slow to a stop when idling) could be potentially on the order of months.

Lawrence Livermore National Laboratory has entered into co-operative research and develop-ment agreements with Trinity Flywheel Batteries Inc. and West-ing-house Electric Corporation to com-mercialize a flywheel de-signed to provide about 100 kW of power for up to 30 seconds. Trinity Flywheel will manufacture the flywheel batteries for use by Westinghouse's "Active Power Line Conditioner" system to smooth electric flows and ride through power outages. Trin-ity Flywheel is taking commercial orders for this design. The entire system is about 14 inches in diameter and 14 inches high.

FLYWHEEL ENERGY STORAGE SYSTEM USING "RIM AND WEB" CONFIGURATION



Many small units could be used in parallel for larger storage needs. Their modular nature and small size make them easy to ship and install in increments, thereby pro-viding a close match between stor-age supply capacity and energy and capacity demands. Several flywheels operating in parallel could be used to defer distribution system upgrades by handling part of the load that might otherwise overload a substation transformer that is operating near its limit during daily load peaks.

In another development effort, Argonne National Laboratory is working with Commonwealth Edison Company (CECo) of Chi-cago on the development of a large-scale flywheel for utility load-following and ramping applica-tions. They are focusing on a flywheel design that could provide one MW of power for up to five hours. Their goal is to demonstrate smaller flywheels in the next few years, leading to full-scale com-mercial demonstration and deploy-ment of up to 2000 units by 1998. The one MW flywheel system would be approximately 10 feet in diameter.

The technology currently suffers from high capital costs. However, it is expected that capital costs will decrease as the economies associ-ated with increasing production volume are realized. In addition to high capital costs, development work is focusing on the develop-ment of vacuum and magnetic bearing technologies in order to reduce friction losses and improve stability, as well as the develop-ment of flywheel materials and housing designs in order to im-prove safety.

Flywheel systems could be sited either in underground or above-ground locations. Underground siting has the advantage of mini-mizing the potential for damage from vehicular impacts. The flywheel could be housed in a thin-wall steel casing in a reinforced concrete bunker with a high-strength lid. An effective above-ground design could incorporate a "crash wall" liner that would con-tain the flywheel in the event of a major failure. Such a crash wall would also be adequate to protect the assembly from outside impacts.

◩ Permitting Issues. Flywheels are relatively benign with respect to environmental impacts. There are no emissions or hazardous materials associated with the flywheel storage technology itself (although there could be emissions and hazardous material usage associated with the generating technologies which supply the electricity stored by the flywheel as kinetic energy.) Visual and land use impacts are limited since the systems are small and could easily be sited at existing or planned substations. Since the unit is oper-ated in a vacuum, the noise trans-mitted to the environment will be minimal. As a result, FES systems can be sited in any industrial or utility setting.

The only significant safety issue is containment of the wheel structure in the unlikely event of mechanical failure during operation (the flywheels can operate at speeds of tens of thousands of revolutions per minute). It is anticipated, however, that the containment structure(s) can be adequately designed to support high-speed failure of the rotor.

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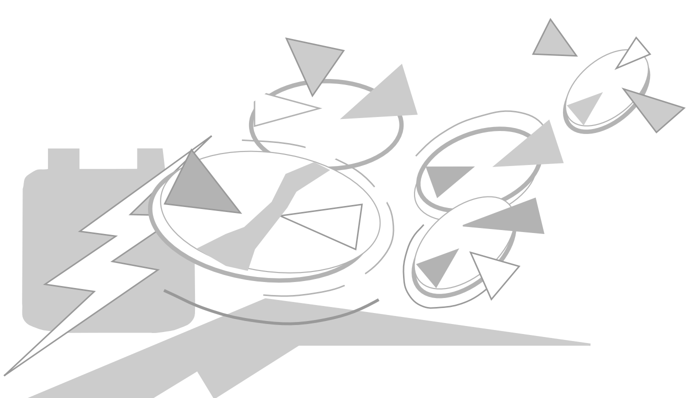

B-6. FUEL CELLS

A fuel cell, like a battery, transforms chemical energy into electrical energy directly, without a combustion process. It essentially consists of a cathode, an anode, and an electrolyte. Unlike a typical battery, a fuel cell requires a continuous supply of fuel and oxygen, but the fuel cell itself does not undergo material transformation. Hence, it never needs to be recharged.

Hydrogen-rich fuel gas (e.g., natural gas or methane) is supplied to the anode side, and oxygen (in the form of air) is supplied at the cathode side. The electrolyte material separating the anode and cathode provides a medium for the exchange of ions. The overall reaction combines hydrogen and oxygen to produce electricity, water, and heat. Since fuel cells produce direct current (dc) electricity, an inverter converts the power to alternating current (ac) before it can enter the utility system (see figure).

A fuel cell supplied with pure hydrogen and oxygen would emit no pollutants. When air is used to supply the oxygen, however, and when a fuel other than hydrogen is used (for example, natural gas, methanol, or gasified coal can be used in conjunction with a fuel reformer), there will be low levels of carbon dioxide emissions and there could be very low levels of hydrocarbons, carbon monoxide, and nitrogen oxides. Since fuel cells also produce water and heat as byproducts, they are well-suited for cogeneration applications.

Fuel cells have many benefits which make them particularly attractive in both utility-scale and distributed use systems. Their modular size makes it easy to match the fuel cell plant capacity to the electric power needed (load). Their unique operating characteristics make them particularly attractive for load following (since they can operate at part load with a minimal loss of efficiency), distribution line voltage control, power quality control capability, and spinning reserve capability.

Fuel cells can easily be sited near electrical load centers in urban areas due to their minimal land use requirements, low emissions, minimal noise, modular nature, and ability to operate unmanned while being monitored remotely. The discharge water which is chemically created by the fuel cell is within sanitary sewer discharge standards and would meet local regulatory requirements. These attractive features make them easy to site at distribution substations, hotels, hospitals, jails, office buildings, and universities.

Several types of fuel cells are currently under development. These fuel cell types are categorized by electrolyte type. They include phosphoric acid, molten carbonate, solid oxide, alkaline, and proton exchange membrane.

Phosphoric acid fuel cells (PAFCs) are considered to be commercially available by the U.S. Department of Energy. More than 50 of International Fuel Cells/ONSI Corporation's 200 kW PAFCs are in use. These units have achieved a total operational time of 439,000 hours with 95 percent availability. They have achieved a chemical-to-electrical conversion efficiency of 40 percent (lower heating value), and they generate about 700,000 Btu/hr of heat (which is enough to meet the thermal needs in many commercial and residential buildings). The overall cogeneration efficiency (electrical plus thermal) is 85 percent (lower heating value). Emissions are so low that the South Coast Air Quality Management District has waived air pollution permitting.

The company's newest model, the PC-25C, is expected to have comparable performance but will be one-third smaller and lighter than its predecessors. The PC-25C (fuel cell only) can fit in a space 10 feet wide by 18 feet long by 10 feet high.

Molten carbonate and solid oxide fuel cells are less far along in the development process. Unlike PAFCs (which operate at about 200˚C), these two types operate at very high temperatures (approximately 650˚C and 1,000˚C respectively). This allows the potential for internal reforming of hydrocarbon fuels (thereby eliminating the need for an external fuel reformer) and also results in high-quality (high temperature) by-product heat being made available for a wider range of cogeneration applications.

The Santa Clara Demonstration Project is the world's first demonstration of a utility-scale molten carbonate fuel cell power plant. The 2 MW facility began operation in April 1996 and will undergo a demonstration period that lasts through 1998. The goals of that project are to demonstrate the low heat rate (high efficiency), acceptable reliability, operability, and maintainability. Energy Research Corporation plans to commercially introduce its Direct Fuel Cell power plants for dispersed generation and other power stations by the late 1990s, based on the results of the Santa Clara Demonstration Project.

M-C Power Corporation has developed its 250-kW molten carbonate fuel cell in conjunction with the U.S. DOE, the Gas Research Institute, and electric and gas utilities which include Southern California Edison, Southern California Gas, and San Diego Gas & Electric. The company is testing one fuel cell at UNOCAL's Fred L. Hartley Research Center in Brea, California. A second 250-kW power plant is located at the U.S. Naval Air Station Mirimar in San Diego. The M-C Power Corporation team plans to develop a 1-MW market-entry fuel cell system, with commercial availability targeted for 1999.

Other utilities are pursuing molten carbonate fuel cells that use gas mixtures produced from landfills or from the type of biomass decomposition occurring in anaerobic compositors.

Alkaline and proton exchange membrane (PEM) fuel cells are currently being developed for transportation, space, and military applications. Several companies are aggressively developing PEM systems for a variety of applications. Potential utility applications for PEM fuel cells are primarily distributed generation uses, for remote areas, as well as for peak power supplies in urban and suburban locales. Systems over 50 kW are most likely to be used initially with transit buses. Once the market for larger systems develops, stationary applications should be cost effective for peaking and distributed generation applications. Fuel reforming and processing must develop in parallel with PEM development in order for PEM systems to be used widely.

In order for fuel cells to become fully commercialized, there are several remaining barriers that need to be overcome. These include high capital cost, improved efficiency, and demonstration of long-term reliability and performance.

◩ Permitting Issues. There are no significant permitting issues associated with commercially-available phosphoric acid fuel cells.

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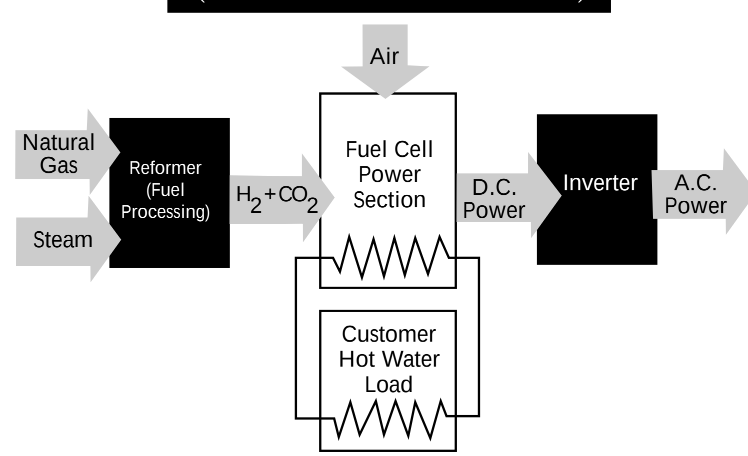
FUEL CELL POWER PLANT
(FUEL CELL SYSTEM SCHEMATIC)



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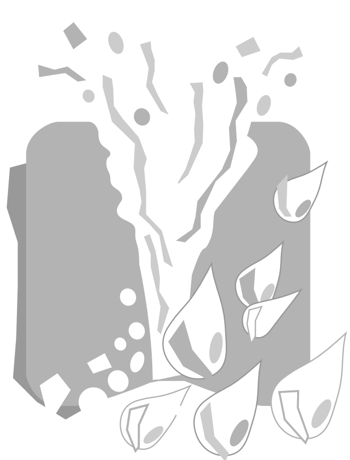
B-7 GEOTHERMAL

Geothermal energy is the naturally-occurring heat from the interior of the earth. Thermal energy within the earth approaches the surface in many different geologic formations: volcanic eruptions, geysers, fumaroles, mud pots, fault zones, and thermal springs. California has the largest geothermal energy potential of any state in the nation. At present, only a small part of California's available geothermal reserves are being used.

As of 1995, there were 6,798 MW of geothermal generating capacity installed worldwide. Of this, 2,817 MW are installed in the U.S., Philippines, Mexico, Italy, Japan, and New Zealand. Predictions call for worldwide generating capacity to reach 9,960 MW in 2000.

Geothermal resources can be classified as hydrothermal, hot dry rock, geopressured, and magma. Hydrothermal resources contain hot water (i.e., are liquid-dominated), steam (i.e., are vapor-dominated), or a two-phase mixture of water and steam. Hot dry rock resources do not have fluids that can transport the energy away from the high-temperature sub-surface rock, and therefore require water from a surface source to be injected into the hot rock region in order to serve as a heat transfer medium. Geopressured geothermal systems (not found in California) are essentially liquid-dominated resources that also contain significant levels of natural gas and hydraulic energy. In a magma system, heat is derived directly from a shallow molten magma body.



While California's hot dry rock and magma development potential is enormous compared to the current and potential future hydrothermal resource development, those two resource types are currently in early stages of development. Promising areas for future development of hot dry rock resources include Glass Mountain and Mono-Long Valley Known Geothermal Resource Areas (KGRAs), and the Geysers-Clear Lake region. Potential magma resource sites in California include the Mono-Long Valley and Coso Hot Springs KGRAs.

Hydrothermal resources are the most abundant source of presently usable geothermal energy. Geothermal power plants using hydrothermal resources are operational in Imperial, Inyo, Lake, Lassen, Mono, and Sonoma Counties.

In a hydrothermal system, water in sub-surface aquifers is heated by geothermal energy. The elevated temperature of the water creates a convection system which transfers the heat energy to the surface. In rare instances, the heat is great enough to vaporize the water, creating a steam reservoir (a vapor-dominated resource). The only vapor-dominated resource in the U.S. is found in California at the Geysers KGRA in Lake and Sonoma counties, where reservoirs contain dry superheated steam with average temperatures of about 390˚F.

In most hydrothermal systems, however, the reservoir is liquid-dominated. Unlike the Geysers steam resource, liquid-dominated systems of varying temperature are quite abundant and are found throughout California. A power plant for a high-temperature liquid-dominated resource above 350˚F typically uses a flash steam cycle. A rotary separator turbine can be used in conjunction with flashed steam technologies for additional power output. A binary cycle is the best choice for power generation for liquid-dominated moderate-temperature resources between about 220˚F and 350 ˚F.

Low-temperature resources (below 220 ˚F) are not suitable for power generation, but can be used in direct heating applications (see Section B-21 entitled Geothermal Direct Use.)

VAPOR-DOMINATED RESOURCES

Electricity generation using vapor-dominated resources at the Geysers KGRA is a standard geothermal technology using conventional steam turbine-generators. The power plants there use dry steam produced from numerous production wells, and the steam from several wells is piped to the steam turbine-generator through extensive collection systems (see Section B-18 entitled Energy Production Wells (oil, gas, and geothermal) for more information on geothermal wells.)

Worldwide, dry steam power plants account for approximately 3,000 MW. Most of this development, 2,098 MW, is constructed at The Geysers. The generating capacity of the facilities in The Geysers range from 12 to 138 MW. The newer units have a typical capacity of 55 and 110 MW, although there are three 20 to 30 MW facilities.

After exiting the steam turbine-generator, the steam is condensed with cooling water and pumped to evaporative cooling towers. About 70 percent to 75 percent of the geothermal steam exits the cooling towers as water vapor, while the remaining 25 percent to 30 percent is injected back into the ground via injection wells.

The geothermal steam contains high concentrations of chemicals and compounds in solid, liquid, and gaseous form. Non-condensable gases (primarily carbon dioxide, along with lesser amounts of hydrogen sulfide (H_2S), sulfur dioxide (SO_2), ammonia (NH_3), methane (CH_4), nitrogen, and others) can range from 0.1 to 5 percent of the steam. These gases must be treated before being discharged to the atmosphere via the cooling towers. Other emissions can include mercury, radon, arsenic, boron, and trace metals. Mitigation measures are employed so that emissions meet air and water quality standards.

Geothermal resources are considered to be renewable only if the rate of geothermal steam or liquid extraction does not exceed the rate at which the resource is renewed by the earth's heat. When the rate of energy extraction to generate electric power exceeds the natural recharge rate, energy production from the reservoir declines.

Although a nearly inexhaustible supply of heat occurs, the supply of water to transfer the heat is limited in the Geysers. The installed capacity at the Geysers was 2098 MW gross; the current generating capacity is around 1285 MW due to the de-cline in steam production. As a result, no new installed capacity is anticipated at the Geysers. The decline of steam to the existing geothermal power plants can usually be delayed by adding more production wells and reworking existing wells.

Some of the major issues associated with the existing Geysers power plants include:

- Long-term availability (and variability of quality) of the resource
- Air pollution from the gases and metals contained in the steam
- Substantial volumes of waste are generated during all phases of geothermal development (well drilling, power plant construction and operation), with the most toxic wastes being generated from operation of air pollution abatement systems
- Potential for unintentional contamination of ground and surface water due to accidental release of geothermal fluid containing arsenic, sulfur, heavy metals, salt, etc.
- Destruction and disturbance of habitat and cultural and paleontologic resources due to steam pipelines, generation facilities, well pads, and access roads
- Changes in visual quality from undisturbed and rural to industrial
- Increase in ambient noise levels as well as the occurrence of major noise-producing events such as the discharge of steam when power plants shut down
- Possible localized subsidence (sinking of the land) around production wells and uplifting around injection wells

LIQUID-DOMINATED RESOURCES — FLASHED STEAM

The geothermal brine is brought to the surface and piped to a separation tank, where the pressure is reduced, causing the fluid to flash into steam. The steam is then passed through a turbine to generate power. The steam exiting the turbine is condensed in much the same manner as with dry steam plants. Less of the resource, however, is lost during evaporative cooling since less than half of the geothermal water that is produced actually flashes to steam. The remaining water that does not flash into steam is then injected back into the reservoir.

Flashed steam technology is used at six power plants operating in the Imperial Valley, with a combined capacity of 310 MW. There are also 272 MW of power plants operating in the Coso Geothermal Field, east of Bakersfield. The remaining potential for electricity generation is estimated to be 3,800 MW.

◩ Permitting Issues for Flashed Steam Technology. All of the issues already mentioned for vapor-dominated resources also apply to flashed steam technologies. In addition, Imperial County has a policy requiring 100 percent injection of the fluids withdrawn from a geothermal reservoir (although they have permitted most power plants with an injection requirement of 80 percent or more.) Such a policy reduces the potential for adverse impacts caused by subsidence, but also has the effect of requiring makeup water for flashed steam plants that use evaporative cooling systems.

LIQUID-DOMINATED RESOURCE — ROTARY SEPARATOR

The rotary separator turbine is a relatively new device that converts two-phase (geothermal liquid and vapor) flow energy into shaft power. In addition to shaft power, the turbine performs separation of the vapor from the liquid, and pressurizes the separated liquid. The turbine can be used in conjunction with traditional flashed steam technology in new applications, or can be retrofit to existing flashed steam power plants.

With conventional flashed steam plants, no power is generated when two-phase flow is flashed into steam and the remaining liquid is separated from the steam (and in fact, power is required to pressurize the remaining liquid brine and pump it back into an injection well). The rotary separator turbine can substitute for the gas-liquid separation tank. By taking advantage of the two-phase flow energy, it produces power while accomplishing the separation process, and eliminates the need for pumps to re-inject the brine. The net result is that the power output of a combined rotary separator-flashed steam system can be approximately ten to thirty percent higher than a conventional flashed steam system using the same geothermal resource.

A wellhead power plant with a Biphase rotary separator turbine (Model 30 RSB) is being constructed at Cerro Prieto, Mexico. This model is sized for application as a topping turbine for use at most geothermal projects that have medium to high pressure resources. The first unit will increase the electricity production due to given well flow by more than 40%.

◩ Permitting Issues for Rotary Separator Technology. For applications where the rotary separator turbines are retrofitted to existing power plants, there are no significant permitting issues associated with the rotary separator turbines.

LIQUID-DOMINATED RESOURCES - BINARY

Binary cycle technology incorporates two distinct closed fluid loops to generate electricity. The first loop passes the hot geothermal brine from the reservoir to a heat exchanger, where the heat vaporizes an organic fluid contained in the second loop. The second loop contains an organic fluid with a low boiling point, such as freon, isobutane, pentane, or other hydrocarbon. The vaporized hydrocarbon is piped to a turbine-generator, condensed, and returned to the heat exchanger in order to be vaporized again. The geothermal brine is injected back into the reservoir after giving up some of its heat in the heat exchanger.

Since the geothermal brine operates in a closed loop, no gases or other pollutants contained in the geothermal fluid are released to the atmosphere. The binary working fluid can be condensed using either air cooling or evaporative cooling (wet cooling towers).

Binary technology is used at five plants operating in the Imperial Valley, with a combined capacity of 96 MW. In Mono County, there are three plants operating with a combined capacity of 35 MW. Lassen County has two binary plants under 2 MW plus a 35 MW geothermal/biomass hybrid plant in operation.

◩ Permitting Issues for Binary Technology. Some major issues are associated with geothermal binary power plants:

- Long-term availability (and variability of quality) of the resource
- Air pollution associated with leaks in the working fluid loop and from wet cooling towers if agricultural wastewater is used for cooling water
- Use of large amounts of cooling water (if wet cooling towers are used)
- Destruction and disturbance of habitat and cultural and paleontologic resources due to generation facilities, well pads, and access roads
- Changes in visual quality from undisturbed and rural to industrial

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B-8. HYDROELECTRIC

Hydroelectric power, a renewable resource, is generated by hydraulic turbines which rotate due to the force of moving water as it flows from a higher to a lower elevation. The water can be flowing in natural streams and rivers or contained in man-made facilities such as reservoirs, pipelines, and canals. There are two main categories of hydroelectric power generation: conventional methods, which produce electricity via water flow in one direction (and are therefore dependent on seasonal runoff), and pumped storage methods, which are both producers and consumers of electricity as the water used to generate electricity can be recycled by pumping it back uphill.

Two types of conventional hydroelectric facilities are dams and run-of-river. Dams raise the water level of a stream or river to an elevation necessary to create a sufficient elevation difference (water pressure, or head). Dams can be constructed of earth, concrete, steel, or a combination of such materials. Dams may create secondary benefits such as flood control, recreation opportunities, and water storage. Run-of-river, or water diversion, facilities typically divert water from its natural channel to run it through a turbine, and then usually return the water to the channel downstream of the turbine.

Such conventional methods offer the potential for low-cost baseload electricity, but their output is dependent on the time of year as well as annual precipitation. In contrast, pumped storage methods are typically used to provide power during peak demand periods on very short notice and are not dependent solely on runoff.

In a pumped storage facility, water is pumped during off-peak demand periods from a reservoir at a lower elevation for storage in a reservoir at a higher elevation. Electricity is then generated during peak demand periods by releasing the pumped water from the higher reservoir and allowing it to flow downhill through the hydraulic turbine(s) connected to generators (see figure).

During the off-peak pumping cycle, the pumped storage facility is a consumer of electricity: in fact, the amount of electricity required to pump the water uphill is greater than the amount of electricity that is generated when the water is released during peak demand periods. However, pumped storage facilities are economical because they consume low-cost off-peak electricity, but generate high-value on-peak electricity.

Pumped storage methods include both typical on-stream conventional and modular off-stream technologies. The major differences between modular pumped storage (MPS) and conventional pumped storage is that MPS systems are much smaller, use closed water systems that are artificially created instead of natural waterways or watersheds, and sites are selected with predetermined elevation differences so that modular pre-engineered equipment can be used. With the exception of evaporative losses, reservoirs are charged only once, either with groundwater or even municipal wastewater.

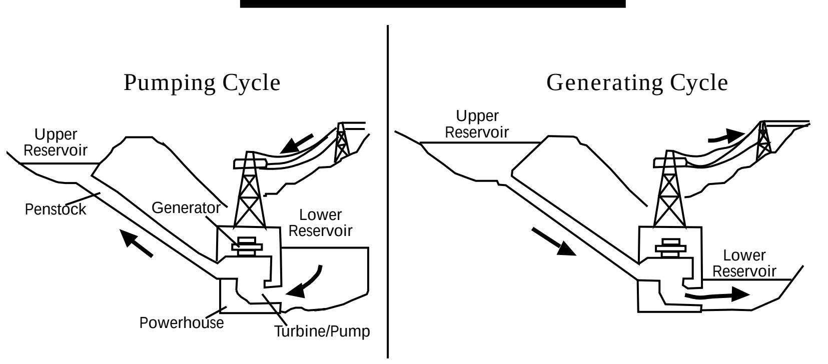
Permitting Issues. Some of the issues associated with conventional hydroelectric power generation and typical on-stream pumped hydroelectric storage facilities include:

- Water resources impacts (hydroelectric facilities may change stream flows, reservoir surface area, the amount of groundwater recharge, and water temperature, turbidity [the amount of sediment in the water] and oxygen content)

- Biological impacts such as the possible displacement of terrestrial habitat with a new lake environment, alteration of fish migration patterns, and other impacts on aquatic life due to changes in water quality and quantity

- Possible damage to, or inundation of, archaeological, cultural or historic sites (primarily if a reservoir is created)

PUMPED STORAGE SYSTEM



During Light Power Load   During Peak Power Load

• Changes in visual quality

• Possible loss of scenic or wilderness resources

• Increase in potential for landslides and erosion

• Recreational resources may be gained

Because MPS systems are not dependent on natural waterways and watersheds, they can be sited in areas that avoid many of the issues described above. In fact, desirable sites are not near rivers, lakes, streams, and other sensitive environmental areas in order to avoid the regulatory complexity and time associated with conventional pumped hydroelectric storage facilities.

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c) *Glenn County Energy Element of the General Plan,* June 1993, pp. 119-127.

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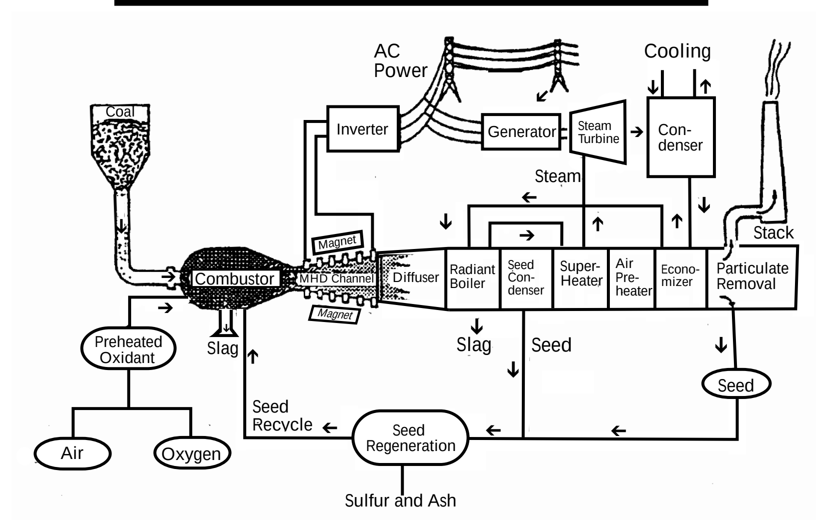
B-9. MAGNETOHYDRO-DYNAMICS

DIAGRAM OF A COMBINED MAGNETOHYDRODYNAMIC/STEAM SYSTEM



Magnetohydrodynamics (MHD) is the process of generating electricity by passing a conductive fluid or plasma through a magnetic field. Even though the MHD process has been recognized since Faraday discovered the properties of magnetism and electricity in 1832, the technologies that make MHD cost-effective are just now starting to become available. There is still much work to be done before a commercial MHD system is in operation.

The MHD generator consists of a channel surrounded by a large, powerful magnet through which hot gases (at about 5000 degrees F) from a fossil fuel combustor flow (see figure). The combustion product gases are seeded with a highly conductive salt, such as potassium carbonate. Also, the combustion air is preheated or enriched with oxygen in order to raise the temperature (and therefore the conductivity) of the gas or plasma. At near sonic speed, these hot gases are forced through the channel to produce a direct current (DC) electrical potential across the many pairs of electrodes. Power conditioning equipment then normalizes the outputs of the electrode pairs, and the inverter converts the DC electricity to alternating current (AC) in order to be compatible with the power grid.

After passing through the magnets, there is a considerable amount of heat remaining in the plasma which can be recovered in a heat recovery steam boiler and steam turbine-generator for additional electricity production. In fact, the high temperature of the combustion products leaving the MHD generator is compatible with the design conditions of many existing steam power plants. Thus, one likely application for MHD is to retrofit an existing coal-fired steam power plant. First-generation MHD power plants may have thermal efficiencies of 40 percent to 50 percent, while mature plant efficiencies may be as high as 60 percent. Mature MHD plants could offer the highest energy conversion efficiency of any advanced coal technology.

The potassium-based seed which was injected into the combustor reacts with sulfur in the fuel, and the products are then removed from the system in the form of potassium sulfate. The potassium sulfate is then regenerated in a process which recovers the original potassium-based seed and separates out the sulfur and ash.

Magnetohydrodynamics can use coal or other combustible fuels. The primary fuel of interest in the U.S. for MHD is coal because MHD can potentially provide important efficiency and pollution control benefits needed for coal technologies (See section B-4 for a discussion of other commercially available and advanced coal technologies.) One company, however, has investigated the possibility of a California MHD project using petroleum coke (the residual material left when crude oil is refined into finished products) as a fuel.

MHD is currently constrained by several technical and economic issues. Among these are: material strength and durability; development of efficient high-pressure combustors, superconducting magnet technology, and electrodes that can withstand the harsh environment of a MHD channel; development of economical inverters and power conditioning equipment; demonstration of adequate downstream heat and seed recovery; and most importantly, integration of these components into a unified generating system.

Thus, MHD technology is considered to be in the early stages of development. The U.S. Department of Energy's MHD Proof-of-Concept program was investigating three key subsystems at three different sites:

1) The topping cycle portion of the MHD/steam combined-cycle power plant (which includes the coal combustor, MHD channel which converts the ionized gas flow into direct current, and the DC-to-AC inverter and other power conditioning equipment)

2) The bottoming cycle portion (which includes the radiant boiler, various steam and air heaters, and pollution control equipment)

3) The seed regeneration process (being tested in California)

That DOE program, however, lost its funding at the end of 1993. Substantial funding will be required to continue development; at present there is no U.S. organization withh sufficient funding and interest to continue such development. Therefore, the date for commercialization of MHD is unknown.

◩ Permitting Issues. Some of the major permitting issues associated with magnetohydrodynamics technology include:

- Ability to control fugitive emissions from, and prevent spontaneous ignition of, coal piles (no additional impact if the MHD project is a retrofit to an existing plant)
- Ability to control the quantity of air pollutants in the combustion products, particulate emissions (Note, however, that as a retrofit technology, MHD has the potential to reduce emissions levels compared to the existing facility.)
- Disposal of ash, sludge, and other wastes
- Possible classification of waste streams as hazardous materials, thereby restricting the number of allowable disposal sites and raising disposal costs
- Use of large amounts of water for dust control, coal washing, boiler makeup, wet cooling towers (if applicable), and ash quenching
- Changes to visual quality due to power plant structures and coal unloading, handling, and storage facilities (not an issue for the retrofit of existing plants)

- Noise impacts from coal delivery, crushing, and handling facilities (no additional impact if the MHD project is a retrofit to an existing plant)
- Likely public opposition because of uncertainties over air quality, health and safety, and odor impacts from fugitive coal dust during handling and storage, and waste handling and storage
- Possible poor public opinion due to concerns over acid rain and coal strip mining

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B-10. MUNICIPAL SOLID WASTE

Municipal solid waste (MSW) is one of three major waste-to-energy technologies (the others are Anaerobic Digestion and Biomass, discussed in Sections B-1 and B-3, respectively). MSW can be directly combusted in waste-to-energy facilities as a fuel with minimal processing, known as mass burn; it can undergo moderate to extensive processing before being directly combusted as refuse-derived fuel; or it can be gasified using pyrolysis or thermal gasification techniques.

Each of these technologies presents the opportunity for both electricity production as well as an alternative to landfilling or composting the MSW. In contrast with many other energy technologies that require fuel to be purchased, MSW facilities are paid by the fuel suppliers to take the fuel (known as a "tipping fee"). The tipping fee is comparable to the fee charged to dispose of garbage at a landfill. Another MSW-to-electricity technology, landfill gas recovery, permits electricity production from existing landfills via the natural degradation of MSW by anaerobic fermentation (digestion) into landfill gas. Anaerobic digestion can also be used on municipal sewage sludge; it is discussed separately in Section B-1.

MASS BURN

Mass burn technology, the most common MSW-to-electricity technology, involves the combustion of unprocessed or minimally processed refuse. The major components of a mass burn facility include:

a) Refuse receiving, handling, and storage systems

b) The combustion and steam generation system (a boiler)

c) A flue gas cleaning system

d) The power generation equipment (steam turbine and generator)

e) A condenser cooling water system

f) A residue hauling and storage system

Incoming trucks deposit the refuse into pits, where cranes then mix the refuse and remove any bulky or large non-combustible items (such as large appliances). The refuse storage area is maintained under pressure less than atmospheric in order to prevent odors from escaping. The cranes move the refuse to the combustor charging hopper to feed the boiler.

Heat from the combustion process is used to turn water into steam, with the steam then routed to a steam turbine-generator for power generation. The steam is then condensed via traditional methods (such as wet cooling towers or once-through cooling) and routed back to the boiler. Residues produced include bottom ash (which falls to the bottom of the combustion chamber), fly ash (which exits the combustion chamber with the flue gas [hot combustion products]), and residue (including fly ash) from the flue gas cleaning system.

The combined ash and air pollution control residue typically ranges from 20 percent to 25 percent by weight of the incoming refuse processed. This ash residue may or may not be considered a hazardous material, depending on the makeup of the municipal waste.

It may be possible to avoid the production of hazardous ash by preventing the sources which create hazardous waste from entering the system. It is also possible to treat the ash. Both of these methods avoid the costs of disposal at a limited number of landfills classified as able to handle hazardous materials. Non-hazardous ash can be mixed with soils for use as landfill cover, or can be sold (or given away) for such beneficial uses as pavement aggregate.

California has three MSW mass burn facilities in operation with a combined capacity of about 70 MW (gross rating). While the gross resource potential of MSW in California is estimated to be as high as 2,000 MW, only one new MSW-to-electricity facility is planned within California, with an estimated start-up date of 1997. At present, the tipping fees in California are generally insufficient to make MSW-to-electricity facilities cost-competitive with other forms of electric generation.

◩ Permitting Issues for Mass Burn Facilities. Some of the major issues associated with mass burn facilities include:

- Ability to meet air quality requirements
- Possible classification of the ash as a hazardous material
- Disposal of ash and other by-products
- Possible conflict with adjacent land uses
- Disturbances to biological resources
- Use of large amounts of water for cooling purposes (if wet cooling towers are used)

- Changes to visual quality due to power plant structures and traffic patterns

- Transportation impacts from numerous truck trips from the refuse source to the mass burn facility (note that collection and transportation would already be occurring, so the mass burn facility would only cause a change in traffic patterns)

- Likely public opposition because of uncertainties over health, safety, odor, and traffic impacts (since it is most economical for the facility to be located near urban centers where the waste is generated)

- Possible conflicts between using MSW for electricity generation and programs/goals for waste reduction techniques and recycling

- Possible hazardous materials leakage that may necessitate site cleanup after facility closure

REFUSE-DERIVED FUEL

Refuse-derived fuel (RDF) typically consists of pelletized or fluff MSW that is the by-product of a resource recovery operation. Processing removes ferrous materials, glass, grit, and other materials that are not combustible. The remaining material is then sold as RDF. Both the RDF processing facility and the RDF combustion facility are located near each other, if not on the same site.

The RDF can then be used in one of several configurations:

1) Dedicated RDF boilers designed with traveling grate spreader-stokers

2) Co-firing of RDF with coal or oil in a multi-fuel boiler

3) Dedicated RDF fluidized-bed boiler

There are currently no commercial RDF facilities in operation in California.

◩ Permitting Issues for Refuse-Derived Fuel Combustion Facilities. The permitting issues discussed above for mass burn facilities also apply to RDF combustion facilities.

PYROLYSIS/THERMAL GASIFICATION

Pyrolysis and thermal gasification are related technologies. Pyrolysis is the thermal decomposition of organic material at elevated temperatures in the absence of gases such as air or oxygen. The process, which requires heat, produces a mixture of combustible gases (primarily methane, complex hydrocarbons, hydrogen, and carbon monoxide), liquids, and solid residues.

Thermal gasification of MSW is different from pyrolysis in that the thermal decomposition takes place in the presence of a limited amount of oxygen or air. The producer gas which is generated can then be used in either boilers or cleaned up and used in combustion turbine/generators. The primary area of research for this technology is the scrubbing of the producer gas of tars and particulates at high temperatures in order to protect combustion equipment downstream of the gasifier and still maintain high thermal efficiency.

Both of these technologies are in the development stage with a limited number of units in operation. The Hyperion Energy Recovery System operated by the City of Los Angeles had a system designed to fire dried sewage sludge in a staged fluidized bed combustor. The resulting gas was then combusted in stages, and the heat was used to turn water into steam, driving a 10 MW steam turbine-generator.

◩ Permitting Issues for Pyrolysis/Thermal Gasification Facilities. Most of the permitting issues discussed above for mass burn facilities also apply to pyrolysis and thermal gasification facilities. It is not economical to transport the gas produced by such facilities over long distances, so the power generation equipment must be sited with the gasification facilities. As with most refuse-to-energy facilities, it is typically only economical to site gasification facilities near urban centers.

Air emissions may be easier to control than with mass burn technology because the gas produced by the pyrolysis or thermal gasification facility can be scrubbed to remove contaminants prior to combustion. However, scrubbing the producer gas at high temperature is currently under research and the technology has yet to be demonstrated on a large scale. In addition, the pyrolysis and gasifier streams may contain organic compounds of concern that are difficult to remove.

LANDFILL GAS RECOVERY

Landfill gas (LFG) is generated by the natural degradation of MSW by anaerobic (without oxygen) microorganisms. Once the gas is produced, the gas can be collected by a collection system, which typically consists of a series of wells drilled into the landfill and connected by a plastic piping system.

The gas entering the gas collection system is saturated with water, and that water must be removed prior to further processing. The typical dry composition of the low-Btu gas is 57 percent methane (natural gas), 42 percent carbon dioxide, 0.5 percent nitrogen, 0.2 percent hydrogen, and 0.2 percent oxygen. In addition, a significant number of other compounds are found in trace quantities. These include alkanes, aromatics, chlorocarbons, oxygenated compounds, other hydrocarbons and sulfur dioxide.

After de-watering, the LFG can be further processed into a medium-Btu gas (suitable for use in boilers for manufacturing processes, as well as for electricity generation via reciprocating engines or gas turbines (although it is relatively inefficient)). The most important part of the scrubbing process is the removal of sulfur dioxide from the gas since it results in corrosion within the combustion equipment.

Further processing into a high-Btu gas requires the removal of carbon dioxide as well as all remaining trace components. The resulting pipeline-quality gas is of high enough quality to be blended with existing natural gas systems; however, since the passage of legislation in 1988 which makes a seller of LFG to a gas utility liable for impacts of toxics in the gas, no LFG has been sold to a gas corporation.

The gas is also suitable for electricity generation applications such as gas turbines and fuel cells. For example, Southern California Edison and Los Angeles Department of Water and Power operate a 40 kW phosphoric acid fuel cell using processed landfill gas at a hotel/convention center complex in the City of Industry.

The 25 landfill gas projects in California that provide electricity have a total of 178 MW of capacity, with the largest of these being the 50 MW facility at Puente Hills. There are, however, ten more plants in California that are temporarily shut down due to mechanical difficulties, low gas production (quantity and quality), or inability to secure contracts for electricity sales. Those plants have a combined capacity of about 38 MW.

Current research in the area of landfill gas recovery involves the recirculation of the leachate generated in the landfill by the anaerobic decomposition process. The recirculation of the leachate through the waste in a lined and covered landfill effectively accelerates and enhances the generation of methane gas. This form of landfill design and operation converts the landfill into a bioreactor. Yolo County is currently involved in this research at their Davis landfill.

◩ Permitting Issues for Landfill Gas Recovery. Since landfill gas recovery facilities are located at existing landfills, there are generally fewer permitting issues associated with them compared to other MSW-to-energy facilities. Some of the issues associated with LFG treatment and power generation equipment include:

- Ability to meet air quality requirements
- Handling and disposal of the condensate from the dewatering process

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h) Smith, D.L. and R.T. Haug, “The Hyperion Energy Recovery System: Innovative Technology for Municipal Sludge Management and Power Generation”, *Proceedings of the American Power Conference,* 1987, Volume 49, pp. 750-755.

i) *1992 Energy Technology Status Report-Final Report,* California Energy Commission, Report no. P500-92-007, December 1992. Fact Sheet 1.3.3 (Fuel Cycles -MSW), 9.1.1 (Mass Burn), 9.1.2.1 (Refuse-derived Fuel, Spreader Stoker), 9.1.2.2 (Refuse-derived Fuel, Co-firing), 9.1.2.3 (Refuse-derived Fuel - Fluidized Bed Boilers), 9.2.1 (Pyrolysis/Thermal Gasification), and 9.2.2 (Landfill Gas Recovery).

j) *1992 Energy Technology Status Report, Appendix A, Volume I: Detailed Electric Generation Technology Evaluations,* California Energy Commission, Report no. P500-92-007A V1, December 1992. Sections 9.1.1 (MSW Mass Burn), 9.1.2 (MSW Refuse-derived Fuel), 9.2 (MSW Gasification), and 9.3 (MSW Landfill Gas Recovery).

B-11. NATURAL GAS AND OIL

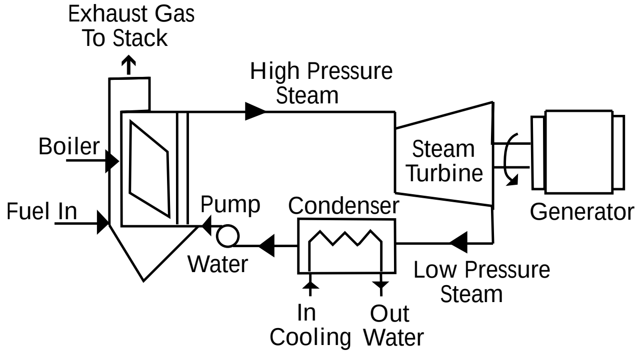
Natural gas- and oil-fired facilities account for a significant portion of California's power plants, both in terms of the number of power plants and total capacity. In 1992, 592 of the 1,341 power plants in California that are 10 kW or larger were natural gas- or oil-fired; those 592 power plants have a combined capacity of 29,875 MW (which represents about 55% of California's installed generating capacity.

While many of the facilities are dual-fuel facilities that can burn either natural gas or oil, natural gas is used primarily due to its cleaner-burning characteristics. Natural gas is one of the cleanest commercial fuels. Unlike other fossil fuels (i.e., coal and oil), natural gas combustion produce less nitrogen oxides and carbon dioxide, and does not produce ash residue. Oil is typically used as a backup fuel for emergencies only since many facilities cannot meet air district emissions requirements when burning oil.

Energy Commission predictions of natural gas supply and price show that supplies for at least the next 20 years are adequate to meet existing and likely additional electricity generation needs, and the price is likely to remain relatively low and stable. Because of its availability (see Section B-23 entitled Pipelines (petroleum, petroleum products, and natural gas)) and price characteristics, and its ability to be used in a variety of configurations (discussed below) to meet a variety of utility and others' needs, natural gas-fired technologies are increasingly being considered for future resource additions by both utilities and non-utility generators.

Natural gas is typically used in thermal power plant arrangements, which convert the thermal energy in the natural gas to electricity via combustion. The methods discussed here include both steam turbine-generator and combustion turbine-generator arrangements, as well as variations and combinations of the two. Fuel cells, which can also be fueled by natural gas, are discussed separately in Section B-6 entitled Fuel Cells.

CONVENTIONAL BOILER WITH STEAM TURBINE-GENERATOR



CONVENTIONAL NATURAL GAS-FIRED THERMAL POWER PLANTS (BOILERS)

Conventional natural gas-fired thermal power plants, or boilers, are steam turbine-based power plants which burn the natural gas to heat a steam boiler. Steam created in the boiler then drives a steam turbine that spins the rotor of a generator. After passing through the turbine, the steam is condensed into water, and that water is then pumped back to the boiler where it is again turned to steam for power generation purposes (see figure entitled *Conventional Boiler with Steam Turbine-Generator*).

Such configurations are known as closed cycle arrangements because the working fluid (the water/steam) undergoes changes as it passes various points in the cycle but is not depleted. At coastal sites, water from the ocean may be used as cooling water. At inland sites, cooling towers are usually required. Such cooling towers typically require large amounts of cooling water that is not recoverable but is discharged (evaporated and lost through drift) from the cooling tower(s). (Air-cooled condensers are available, but they are a more costly option.)

Natural gas-fired boiler plants are a mature technology. They are typically large, on the order of several hundred to over a thousand MW. They are not very efficient compared to the other alternatives discussed below (see Appendix F "Power Plant Generating Efficiency" for more on the efficiency of various gas-fired configurations.) As a result, it is unlikely that future natural gas-fired boilers will be built. The most efficient natural gas-fired boilers are used for baseload duty, while older, less efficient boilers may be used in intermediate or peaking duty applications.

Many of California's natural gas-fired boilers are approaching the end of their useful life of 30 to 40 years and are unable to meet increasingly stringent emissions limits without retrofitting. Such aging, inefficient, relatively high-polluting power plants could be ideal candidates for repowering (discussed below.)

◩ Permitting Issues for Boilers. Some of the major issues associated with natural gas-fired boilers include:

- Ability to meet air quality requirements

- Use of hazardous materials associated with water treatment and air emissions reduction (e.g., ammonia and catalyst use for NOx reduction methods such as selective catalytic reduction [SCR])

- Use of large amounts of water for cooling purposes (if wet cooling towers are used)

- Biological impacts on the ocean or lake or river water due to thermal discharge (if applicable)

- Changes in visual quality due to the power plant structures, including cooling towers (at inland sites) and tall stacks to vent exhaust emissions, plumes of water vapor (from cooling towers)

- Disturbances to biological resources

SIMPLE-CYCLE GAS TURBINES

Simple-cycle gas turbines, or combustion turbines, burn natural gas and compressed air in a combustion chamber to create hot combustion gases that drive a turbine-generator (see figure entitled *Simple Cycle Gas Turbine* below). Note that simple-cycle gas turbines do not require large quantities of water, since the working fluid is air (although large quantities of water or steam may be consumed in the combustion chamber if needed to control NOx emissions.) Gas turbines are open cycle arrangements, since the gas turbine exhaust is not recovered but is discharged directly into the atmosphere (although the heat from the exhaust can be captured and used for other purposes, as discussed below in some of the more complex cycles.)

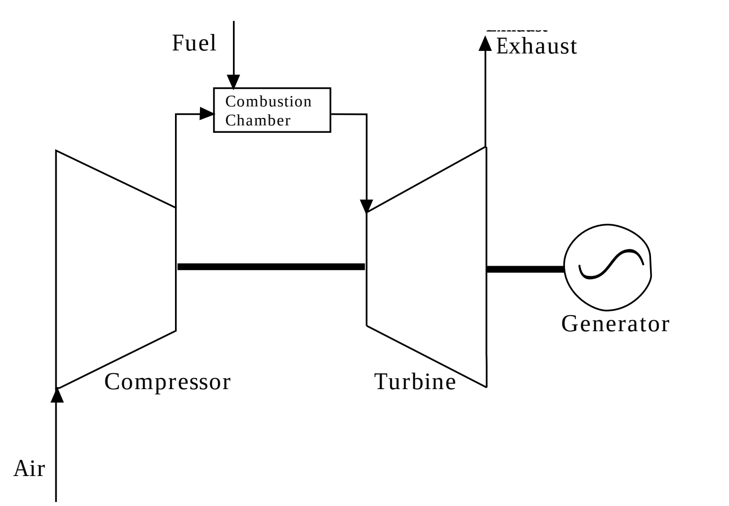
Simple-cycle gas turbines are available in a wide range of sizes, ranging from several hundred kW to over a hundred MW. They are well-suited for peaking duty (less than 1,000 hours of operation per year) because of their quick-start capability and their ability to be operated from a remote location. Their small "footprint", short installation time, low capital cost, and modular nature make them ideal for adding capacity quickly and in appropriate increments. While not highly efficient in stand-alone, simple-cycle arrangements, they form the building blocks for some of the most efficient and flexible power plant configurations.

◩ Permitting Issues for Simple-cycle Gas Turbines. Some of the major issues associated with simple-cycle gas turbines include:

- The ability to meet air quality requirements

- Use of hazardous materials associated with air emissions reduction (e.g., ammonia and catalyst use for NOx reduction methods such as SCR)

SIMPLE CYCLE GAS TURBINE

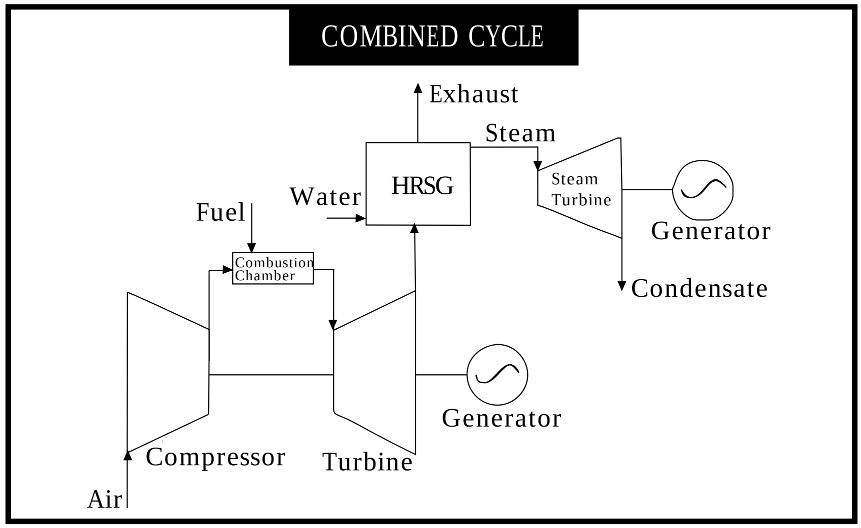


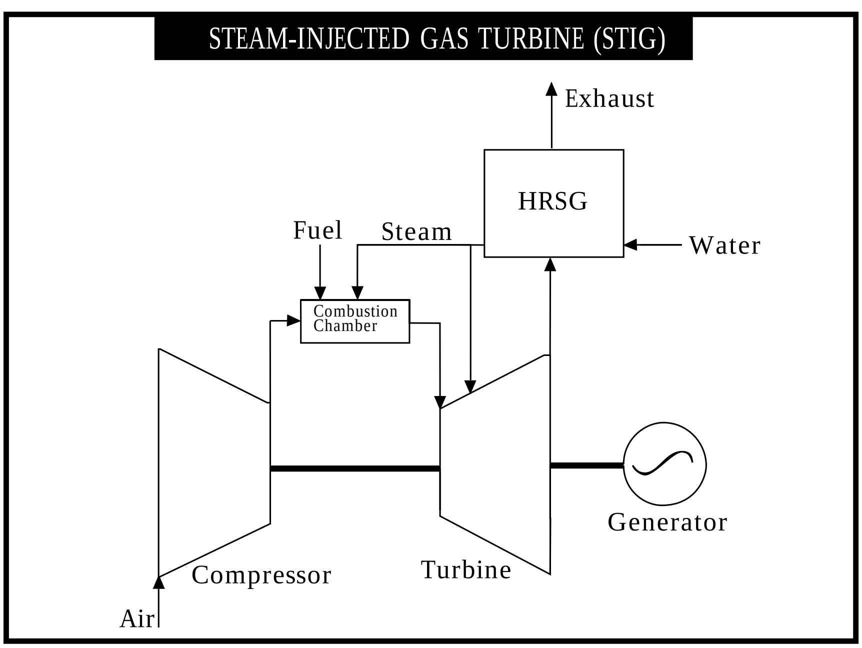
STEAM-INJECTED GAS TURBINES

Steam-injected gas turbines (STIGs), or steam-recuperated gas turbines, use a heat recovery steam generator (HRSG) to capture the heat from the gas turbine's exhaust to turn water into steam. That steam is then injected back into the gas turbine (see figure entitled *Steam-injected Gas Turbine (STIG)* below). The steam injection serves three purposes: it lowers NOx emissions, boosts power output, and raises efficiency compared to a simple-cycle gas turbine. STIG cycles are appropriate for baseload or intermediate duty. They are also attractive in cogeneration applications (discussed below), since they can be designed to generate enough steam both for process needs as well as for injection into the gas turbine. They are typically found in sizes below 60 MW.

◩ Permitting Issues for STIGs. Some of the major issues associated with STIGs include:

- Ability to meet air quality requirements
- Use of hazardous materials associated with water treatment and air emissions reduction (e.g., ammonia and catalyst use for NOx reduction methods such as selective catalytic reduction [SCR])
- Use of significant amounts of high-quality water for injection into the gas turbine for NOx control and power augmentation





COMBINED CYCLES

Combined cycles use both gas turbines and steam turbines. Natural gas or oil is first used to generate electricity in one or more gas turbine-generators (this is the topping-cycle portion of the plant.) The high-temperature exhaust is channeled to one or more HRSGs to produce steam, and the resulting steam is then used to drive a steam turbine-generator (the bottoming-cycle portion of the plant) (see figure entitled *Combined Cycle*). In a typical state-of-the-art combined cycle arrangement, the gas turbine(s) provide about two-thirds of the total electrical output, while the steam turbine provides the remaining one-third.

Combined cycles are efficient, since the additional electric generation by the steam turbine-generator occurs without any additional fuel (beyond that required to fuel the gas turbine-generators.) Although combined cycles require a source of cooling water for the steam turbine portion of the plant, they require much less water than a boiler-steam turbine configuration with the same output as the entire combined cycle (since only one-third of the cycle requires cooling water.) Combined cycles are appropriate for baseload and intermediate duty. They are found in sizes ranging from less than 10 MW to several hundred MW.

◩ Permitting Issues for Combined Cycles. The issues for combined cycles are similar to those for simple-cycle gas turbines and boilers (since combined cycles consist of both gas turbines as the topping cycle and a closed-loop steam bottoming cycle). However, the magnitude of the impacts is less than that for boilers since combined cycles have a smaller "footprint", use significantly less water, and gas turbines are cleaner-burning than boilers of comparable size.

COGENERATION

Cogeneration is the sequential production of electricity and of thermal energy for some industrial process such as petroleum refining, food processing, ice making, or space heating and cooling needs. Electricity produced in excess of that facility's needs can be made available for sale. Cogeneration systems typically use considerably less fuel to deliver the same amounts of electricity and useful thermal energy than separate energy systems.

When energy input to the system is first applied to a useful thermal energy process, and then the waste heat from that process is used to generate electricity, the system is called a bottoming-cycle cogeneration facility. Such generating facilities are usually small, and not as economically competitive as topping-cycle cogeneration facilities, where energy is used first to produce electricity, and the waste heat is then applied to some industrial process.

Topping cycle gas turbine-based cogeneration power plants typically produce useful thermal energy in one of the following configurations:

1) A simple-cycle gas turbine paired with a HRSG

2) A STIG paired with a HRSG

3) A combined-cycle gas turbine/HRSG/steam turbine arrangement in which useful thermal energy in the form of steam is taken either from the HRSG or from a steam turbine extraction point

Cogeneration systems range in size from several kW to several hundred MW. Small-scale cogeneration systems can be designed to meet both the electricity and process energy requirements of facilities such as hospitals, hotels, jails, manufacturing facilities, large office complexes, and large institutions such as universities.

◩ Permitting Issues for Cogeneration. When cogeneration facilities are located at existing industrial sites, the potential visual and biological impacts are likely to be minimal. Other issues are dependent on the cycle configuration, but will likely include:

- The ability to meet air quality requirements

- Use of hazardous materials associated with water treatment and air emissions reduction (e.g., ammonia and catalyst used for NOx reduction methods such as selective catalytic reduction [SCR])

- Use of significant amounts of high-quality water for injection into the gas turbine for NOx control and power augmentation (if based on a STIG) or for cooling of the steam bottoming cycle (if a combined cycle)

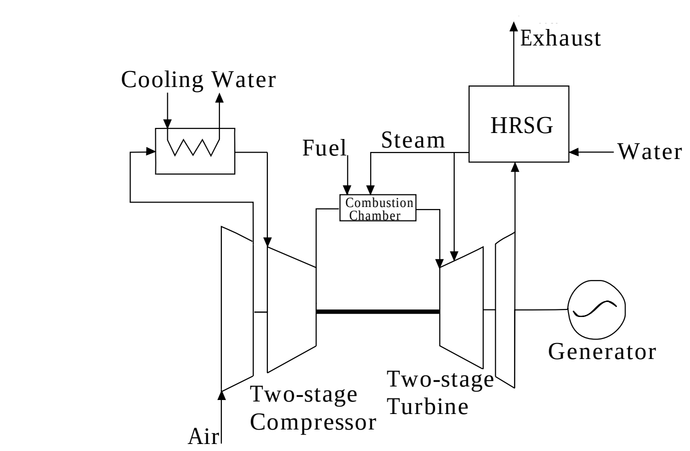
REPOWERING

Repowering refers to the conversion of an existing conventional oil- or natural gas-fired steam boiler plant into a combined cycle power plant. This is often done by retiring in place (or removing completely) the existing boiler and replacing it with one or more gas turbines and HRSGs. The exhaust heat from the gas turbine(s) is used to generate steam in the HRSG(s), and that steam is then used to generate power in the existing steam turbine-generator. The output of the site is typically tripled, due to the addition of the gas turbine(s).

Since the existing aging boiler is likely to be inefficient and relatively high-polluting, there will likely be a net air quality benefit due to repowering even though the repowered output is three times as large. The new configuration may produce more emissions on an annual basis, however, since it will likely operate more that its predecessor due to its very high efficiency.

Repowered combined cycle power plants typically have slightly lower efficiencies than their new combined cycle counterparts. A drop in efficiency of two or three percentage points (compared to the same gas turbine(s) paired with an optimized steam turbine) is typical.

The lower efficiency for repowered projects is due to the fact that the new gas turbine(s) are paired with an existing steam turbine. It may not be possible to provide an exact match between the gas turbine's exhaust heat and the steam turbine's requirements since gas turbines are available only in



INTERCOOLED STEAM-INJECTED GAS TURBINE

discrete sizes. Also, a new steam turbine is likely to be more efficient than an existing steam turbine which could be as much as 30 or 40 years old (although steam turbine refurbishment at the time of repowering could improve the overall efficiency). Repowered combined cycles are appropriate for baseload and intermediate duty.

◩ Permitting Issues for Repowered Facilities. Since repowering with gas turbines and HRSGs occurs at existing sites, the potential visual and biological issues are likely to be minimal. Assuming the boiler being retired had been operating up to the time of the repowering, the net change in air emissions, water use, and hazardous materials may be negative. The repowered plant, however, may be used more often than the old boiler, and thus on an annual basis may require more air offsets, water, and hazardous materials. See the previously discussed issue for combined cycles.

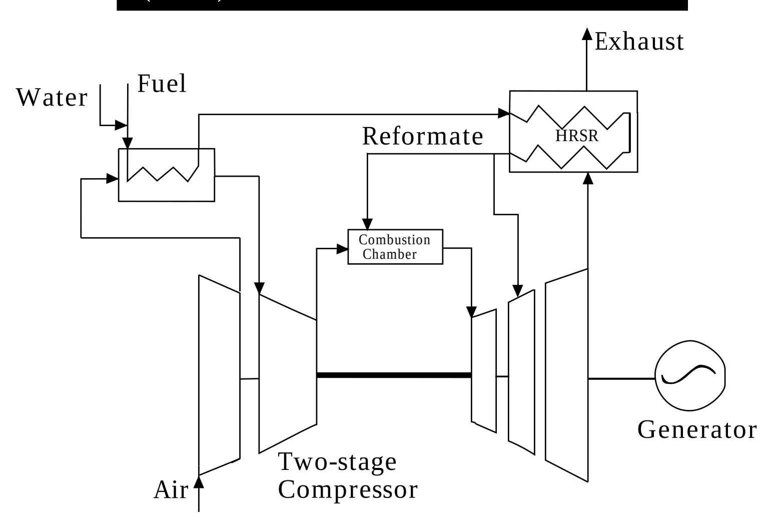
ADVANCED GAS TURBINES

Advanced gas turbines include such advancements as:

• The intercooled aeroderivative (ICAD) gas turbine cycles being investigated as part of the Electric Power Research Institute/PG&E Collaborative Advanced Gas Turbine (CAGT) program, whose participants include nearly all of Calif-ornia's public and private electric utilities. The aeroderiv-ative (aircraft-derived) gas tur-bine has a multi-stage compressor/turbine design that can accommodate the diversion of compressed air from the low pressure compressor discharge to a heat exchanger (where the air is cooled) and its return to the high pressure compressor inlet. Intercooling the partially compressed air reduces the power requirement to the high pressure compressor, which means that more power is avail-able for sale. The figure entitled *Intercooled Steam-Injected Gas Turbine* shows the intercooling concept applied to a STIG.

• The chemically recuperated gas turbine (CRGT), which uses the gas turbine's exhaust heat in a heat recovery steam reformer (HRSR). The exhaust heat provides the thermal energy necessary to accomplish partial steam reformation of natural gas in the reformer. The effluent produced by the reformer is a hydrogen-rich, low-Btu fuel gas that fires the gas turbine. The reformed fuel gas (reformate) offers the possibility of ultra-low levels of NOx and carbon monoxide. The figure below entitled *Chemically-*

CHEMICALLY-RECUPERATED GAS TURBINE (CRGT) WITH INTERCOOLING AND REHEAT



Recuperated Gas Turbine (CRGT) with Intercooling and Reheat shows the CRGT concept with intercooling and reheat.

Permitting Issues for Advanced Gas Turbines. The major issues associated with advanced gas turbines are dependent on the equipment configuration. ICADs and CRGTs would have issues similar to those of commercially-available simple-cycle gas turbines. CRGTs also require the use of water for the steam-methane reformer. Should the CRGT be able to demonstrate the ultra-low NOx levels predicted, there may be no need for the ammonia and catalyst associated with SCR, depending on air quality regulations.

COMPRESSED AIR ENERGY STORAGE

Compressed air energy storage (CAES) uses a gas turbine and an airtight underground reservoir (such as a mined salt dome or a depleted natural gas reservoir.) Air is compressed using off-peak electricity and stored in the underground reservoir. During peak load periods, the stored air is discharged, heated by natural gas combustion, and fed into the turbine/expander (see figure entitled *Compressed Air Energy Storage* below). CAES technology is in the demonstration phase of development. The first such facility in the United States is a 110 MW facility being demonstrated by the Alabama Electric Cooperative since 1991.

Permitting Issues for CAES The major issues associated with CAES facilities include those associated with simple-cycle gas turbines plus structural and geological issues associated with the underground storage reservoir.

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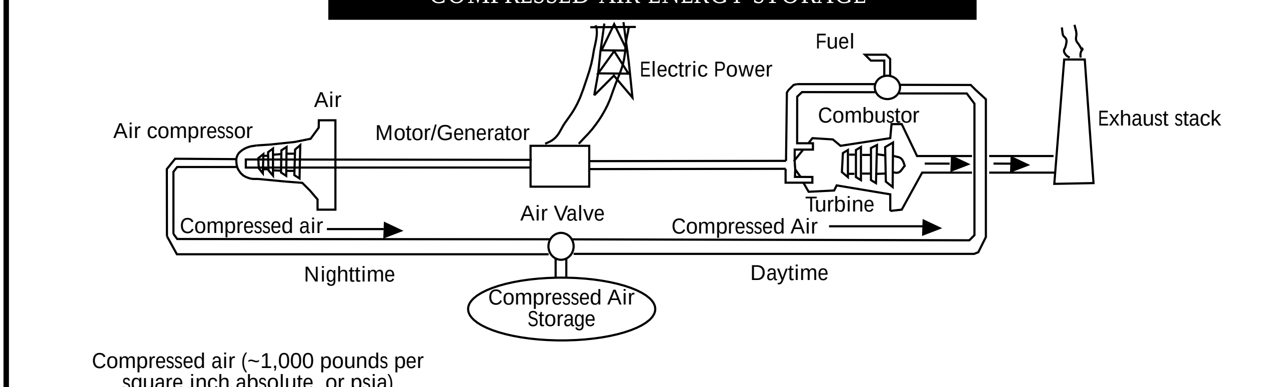
COMPRESSED AIR ENERGY STORAGE



Source: Resource: *"An Encyclopedia of Energy Utility Terms"*, Second Edition. Pacific Gas and Electric Company.

B-12. NUCLEAR

Nuclear technology includes two types: fission and fusion. Nuclear generating technologies based on fission are commercially available, whereas fusion is still in the early stages of research and development, and is at present only a theoretical possibility for controlled power generation. Nuclear fission is the process of splitting the nuclei of atoms, which releases stored energy (in the form of heat) from within those atoms. Nuclear fusion is the process of joining, rather than splitting, such atomic particles with similar releases of energy.

FISSION

Of the several types of fission reactors, the most common type in the United States is light water reactors (so called because regular (light) water is used to cool the reactor core) based on pressurized water reactor (PWR) and boiling water reactor (BWR) technology. PWRs and BWRs use uranium-235, a naturally-occurring radioactive isotope of uranium, as the fuel. As the nucleus of a uranium-235 atom is hit by a neutron, it splits into two smaller atoms of other elements, and releases heat and extra neutrons. Those neutrons hit more atoms of the original uranium-235, creating a fission chain reaction that releases more heat and neutrons.

In a PWR, the power plant's primary circulating system passes water through the reactor core, where the water is heated by the fission process. That water (under high temperature and pressure) is passed through a steam generator, where it releases its heat to the secondary circulating system. Water in the secondary circulating system is allowed to boil, and the resulting steam is used to drive a steam turbine-generator.

In a BWR, there is no need for a steam generator and a secondary circulating system, as the water in the primary circulating system is allowed to boil before exiting the reactor and is then routed directly to a steam turbine-generator.

Two operating nuclear power plants in California are at Diablo Canyon and San Onofre. Pacific Gas and Electric Co. owns the Diablo Canyon Nuclear Power Plant, which consists of two units. Unit 1 is a 1073 MW PWR which began commercial operation in May 1985, while Unit 2 is a 1087 MW PWR which began commercial operation in March 1986. Southern California Edison Co. and San Diego Gas and Electric Co. own the two operating units at the San Onofre Nuclear Generating Station. Unit 2 is a 1070 MW PWR that began commercial operation in August 1983, while Unit 3 is a 1080 MW PWR that began commercial operation in April 1984.

California also has three commercial nuclear power plants that are no longer in operation. These include the 63 MW BWR at the Humboldt Bay Nuclear Power Plant in Eureka (in operation from August 1963 to July 1976); the 913 MW PWR at the Rancho Seco Nuclear Power Plant owned by the Sacramento Municipal Utility District (in operation from April 1975 to June 1989); and the 436 MW San Onofre Unit 1 PWR (in operation from January 1968 to November 1992.)

None of these facilities has been decommissioned (which involves dismantling the reactor and transporting all radioactive materials to a site for disposal.) However, the U.S. Nuclear Regulatory Commission (NRC) staff recently approved the decommissioning plan for the Rancho Seco Nuclear Power Plant. The dismantling process will occur in stages, with "final teardown" scheduled to begin in 2008.

Spent fuel can either be reprocessed to recover usable uranium and plutonium, or it can be managed as a waste for long-term ultimate disposal. Since fuel reprocessing is not commercially available in the U.S., spent fuel is typically being held in temporary on-site storage at reactor sites until a permanent long-term waste disposal option becomes available. Such a long-term storage facility must exist before California law will permit construction of new nuclear power plant facilities.

There are several advanced reactor power plant designs being developed for near-term and mid-term deployment in the U.S. and overseas. These include both advanced light water reactor (ALWR) and advanced modular reactor designs. The ALWR program is focusing on both evolutionary and passive designs, using both BWR and PWR technologies. Each design configuration is seeking certification by the U.S. NRC as a pre-approved U.S. standard design under the U.S. Department of Energy's ALWR Design Certification Program.

The evolutionary ALWRs are advancements of today's light water reactor designs and use conventional safety system concepts. There are two evolutionary ALWR designs that are expected to be ready for commercial operation by the year 2000: the 1356 MW Advanced Boiling Water Reactor (ABWR) and the 1350 MW Advanced Pressurized Water Reactor (System 80+). Two ABWR units are being built in Japan. As of July

1996, the first unit is ready to begin commercial operation. The second unit is scheduled to begin operation in 1997. In June 1996, Tawain ordered two ABWR units. The System 80+ PWR received its ginal design approval from the NRC in July 1994.

The passive ALWR designs are greatly simplified and employ primary passive means for accident prevention and mitigation. There are two passive ALWR designs that have been considered: 600 MW Advanced Pressurized Water Reactor (AP600) and the 600 MW Simplified Boiling Water Reactor (SBWR). The AP600 Advanced PWR is expected to receive its final design approval from the NRC in September 1996. It could be ready for commercial operation by the year 2003. The future of the SBWR is uncertain at this time.

The Advanced Modular Reactor Program is focusing on the development of small (165 MW to 217 MW) reactors that can be grouped together as modules of a larger power station. The two advanced modular reactor designs, which are also seeking design certification, are the 1500 MW Advanced Liquid Metal Reactor (ALMR) and the 700 MW Advanced High Temperature Gas Cooled Reactor (MHTGR). These designs are expected to be ready for commercial operation by the year 2010.

◪ Permitting Issues for Fission Power Plants. Some of the issues associated with commercial nuclear power plants include:

- Need for a long-term high-level waste disposal facility and a decommissioning plan
- Use of large amounts of water for cooling purposes (if wet cooling towers are used)
- Biological impacts on the ocean due to thermal discharge (if seawater cooling is used)
- Designing for seismic safety
- Public safety concerns regarding catastrophic events
- Transportation issues associated with the development of an emergency evacuation plan
- Changes in visual quality due to the power plant structures, including the reactor vessel containment structure, and cooling towers (if applicable)
- Potentially significant amounts of land
- Potentially significant public opposition

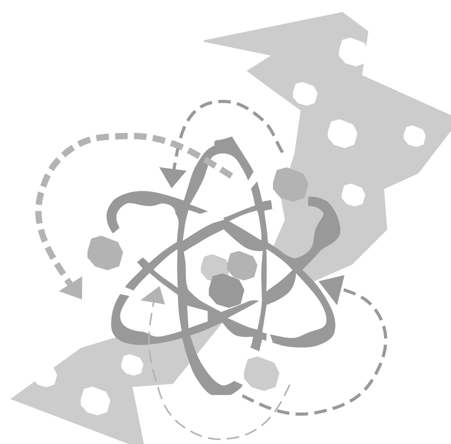
FUSION

A fusion reaction occurs when nuclei of light elements, specifically hydrogen and its isotopes (deuterium, or "heavy water", and tritium), are forced together at extremely high temperatures and densities until they fuse into nuclei of heavier elements and release enormous amounts of energy. If fusion is to yield net energy, the fuel must be heated in the form of plasma (a highly ionized gas) to a very high temperature and the plasma must then be held together for a sufficiently long time such that the number of fusion reactions occurring releases more energy than was required to heat the fuel.

The Princeton Plasma Physics Laboratory's Tokamak Fusion Test Reactor (TFTR) recently demonstrated fusion of deuterium-tritium plasma at 510 million˚C. That experiment produced heating equal to one-third of that needed for the fusion reaction to become self-sustaining. Thus, there is still significant research that must be accomplished before fusion achieves a net energy output, and then even more development work to develop commercial power plant applications. It is estimated that commercial availability of fusion is at least 20 years away.

To generate commercial energy, the neutron energy would be converted to heat in a surrounding blanket of coolant, probably containing solid lithium compounds, with the heat converted to electricity in a conventional steam generator cycle. Although the fusion reaction does not produce radioactive fission products, the high energy neutrons do irradiate the surrounding reactor vessel and associated components. The irradiated material poses radioactive disposal problems similar to those for the irradiated reactor vessels of fission reactors. Thus, many of the permitting issues that apply to fission reactors would also apply to fusion reactors.

The term "cold fusion", as reported in the popular press in recent years, refers to the process of fusing hydrogen nuclei at room temperature. It was allegedly demonstrated in a simple laboratory apparatus in 1989 by Fleischman and Pons. Several experiments have been conducted to try to replicate their



work, with limited success. The phenomenon of cold fusion cannot be reproduced on demand and cannot be explained by conventional nuclear physics. Therefore, its commercial potential as an electric generating technology is uncertain.

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B-13. OCEAN WAVE

Generating technologies for deriving electrical power from the ocean include tidal power, wave power, ocean thermal energy conversion, ocean currents, ocean winds, and salinity gradients. Of these, the three most well-developed technologies are tidal power, wave power and ocean thermal energy conversion. Tidal power requires large tidal differences which, in the U.S., occur only in Maine and Alaska. Ocean thermal energy conversion is limited to tropical regions, such as Hawaii, and to a portion of the Atlantic coast. Wave energy has a more general application, with potential along the California coast. The western coastline has the highest wave potential in the U.S.; in California, the greatest potential is along the northern coast.

Wave energy conversion takes advantage of the ocean waves caused primarily by interaction of winds with the ocean surface. Wave energy is an irregular and oscillating low-frequency energy source that must be converted to a 60-Hz frequency before it can be added to the electric utility grid.

Although many wave energy devices have been invented, only a small proportion have been tested and evaluated. Furthermore, only a few have been tested at sea, in ocean waves, rather than in artificial wave tanks.

There are currently more than 12 generic types of wave energy systems. Some systems extract energy from surface waves. Others extract energy from pressure fluctuations below the water surface or from the full wave. Some systems are fixed in position and let waves pass by them, while others follow the waves and move with them. Some systems concentrate and focus waves, which increases their height and their potential for conversion to electrical energy.

A wave energy converter may be placed in the ocean in various possible situations and locations. It may be floating or submerged completely in the sea offshore or it may be located on the shore or on the sea bed in relatively shallow water. A converter on the sea bed may be completely submerged, it may extend above the sea surface, or it may be a converter system placed on an offshore platform. Apart from wave-powered navigation buoys, however, most of the prototypes have been placed at or near the shore.

The visual impact of a wave energy conversion facility depends on the type of device as well as its distance from shore. In general, a floating buoy system or an offshore platform placed many kilometers from land is not likely to have much visual impact (nor will a submerged system). Onshore facilities and offshore platforms in shallow water could, however, change the visual landscape from one of natural scenery to industrial.

The incidence of wave power at deep ocean sites is three to eight times the wave power at adjacent coastal sites. The cost, however, of electricity transmission from deep ocean sites is prohibitively high. Wave power densities in California's coastal waters are sufficient to produce between seven and 17 MW per mile of coastline.

As of 1995, 685 kW of grid connected wave generating capacity is operating worldwide. This capacity comes from eight demonstration plants ranging in size from 350 kW to 20 kW. None of these plants are located in California, although economic feasibility studies have been performed for a 30 MW wave converter to be located at Half Moon Bay. Additional smaller projects have been discussed at Fort Bragg, San Francisco and Avila Beach. There are currently no firm plans to deploy any of these projects.

Wave energy conversion is not commercially available in the U.S. The technology is in the early stages of development and is not expected to be available within the near future due to limited research and lack of federal funding. Research and development efforts are being sponsored by government agencies in Europe and Scandinavia.

Many research and development goals remain to be accomplished, including cost reduction, efficiency and reliability improvements, identification of suitable sites in California, interconnection with the utility grid, better understanding of the impacts of the technology on marine life and the shoreline. Also essential is a demonstration of the ability of the equipment to survive the salinity and pressure environments of the ocean as well as weather effects over the life of the facility.

Permitting Issues. Some of the issues that may be associated with permitting an ocean wave energy conversion facility include:

- Disturbance or destruction of marine life (including changes in the distribution and types of marine life near the shore)

- Possible threat to navigation from collisions due to the low profile of the wave energy devices above the water, making them undetectable either by direct sighting or by radar. Also possible is the interference of mooring and anchorage lines with commercial and sport-fishing.

- Degradation of scenic ocean front views from wave energy devices located near or on the shore, and from onshore overhead electric transmission lines

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B-14. SOLAR PHOTOVOLTAIC

Photovoltaic (PV) cells (also called solar cells) convert the sun's electromagnetic energy (not its heat) directly into electrical power. (Note: solar thermal technologies, which use the sunlight's heat, are discussed separately in section B-15.) PV cells are non-mechanical semiconductor devices, typically made of silicon, that produce direct current (dc) electricity.

Groups of cells mounted on a plate and connected electrically make up a PV module. Connected modules attached to a frame form a PV array, and arrays connected and electrically matched constitute a PV system. Inverters are used to convert the dc electricity into alternating current (ac) for compatibility with transmission and distribution systems. Since clouds, rain, fog and darkness can reduce or prevent electrical output, future PV systems may include storage capacity, although storage methods are currently not cost-effective.

PVs have many benefits including negligible air and water quality impacts, quiet operation and minimal need for maintenance due to the lack of moving parts. The modular design of PV systems makes them attractive for both utility-scale systems as well as distributed use systems. New materials, manufacturing processes, and designs are being demonstrated, showing promise for bringing down costs and improving solar conversion efficiencies.

Of the three major categories of PV collector modules (flat-plate crystalline silicon, flat-plate thin film, and concentrators), concentrating systems which track the sun have the highest current and future predicted conversion efficiencies. Today's generations of PV have the following typical annual average conversion efficiencies: 11-13 percent for flat-plate crystalline silicon modules, 4 percent to 6 percent for flat-plate thin film modules, and 14-17 percent for concentrator modules. Near-term efficiency goals (late 1990s) are: 15 percent for commercial flat-plate crystalline silicon modules, 10 percent for commercial flat-plate thin film modules, and 20 percent for commercial concentrator modules.

Utility-scale PV power can help meet peak energy demand in areas where there are significant air conditioning loads, since solar insolation levels are often at their highest during peak demand periods. Central station PV plants for utility bulk power applications are not generally cost-effective, due mainly to their high capital cost and need for improved conversion efficiencies. In certain applications, however, the benefits could outweigh the costs. With today's technology, a 10 MW PV plant would require approximately 100 acres of land.

The largest operating PV system in the world is the Sacramento Municipal Utility District's grid-connected 2 MW PV1/PV2 power plant. PV1 and PV2 are rated at 1 MW each and were put on line in August 1984 and March 1986, respectively.

Distributed PV systems include remote or stand-alone applications and grid-connected "distributed utility" applications. Remote PV systems can be cost-effective in applications where they compete with the high cost of utility power line extensions (for example, at remote facilities such as emergency call boxes along freeways and parkways, and vacation cabins, or where power lines must be undergrounded or pass over difficult terrain.)

Grid-connected distributed utility applications can be cost-effective in certain applications where they can defer the need for costly transmission and distribution upgrades. An example of this is the 500 kW PV at PG&E's Kerman distribution substation, where the output of the PV has allowed PG&E to defer upgrading the distribution transformer that was exceeding its operating limits.

Other potential locations and uses for PVs include: residential or commercial building rooftops, in existing parking lot unused air space, and building-integrated systems, where PVs may be integrated as skylights, window, wall or roof components, shade devices and other building components. The primary issue associated with such applications is solar access, since the PV arrays must be free of shading by trees or buildings.

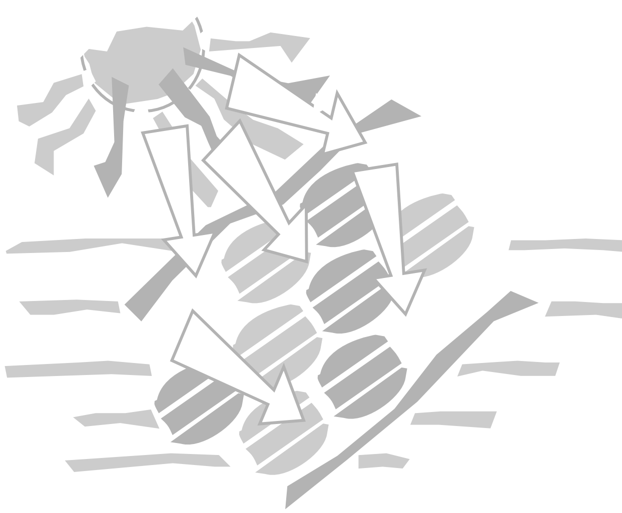
The Photovoltaics for Utility Scale Applications (PVUSA) Project is a national public-private partnership that is assessing and demonstrating the viability of utility-scale PV systems. PVUSA participants include the U.S. Department of Energy, the California Energy Commission, the Electric Power Research Institute, the Sacramento Municipal Utility District Pacific Gas and Electric Company, and 10 utilities and other energy-related agencies.

PVUSA offers utilities hands-on experience needed to evaluate and utilize maturing PV technology; provides manufacturers with a test bed for their products; and encourages technology improvement and cost reductions in PV modules and balance-of-system components. The project also establishes the communication channels between utilities, government laboratories and the PV industry that will be needed for successful development and commercialization of utility PV systems.

PVUSA consists of two types of demonstrations: emerging module technologies (EMTs, which are unproven but promising state-of-the-art PV technologies in 20-kW (nominal) arrays); and utility-scale (US) systems, which represent more mature PV technologies in 200-to-500-kW (nominal) turnkey systems. PVUSA's primary test site in Davis, California, is the location of eight EMT arrays and three US systems.

◩ Permitting Issues. Some of the issues associated with utility-scale PV systems include:

- Use of large tracts of land that are incompatible with other land uses (approximately ten acres per MW output)
- Changes in visual quality
- Disturbances to wildlife habitat



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B-15. SOLAR THERMAL

Solar thermal systems use the sun's heat to create electricity and include both solar thermal electric concentrating systems and salt-gradient solar ponds (also known as salt ponds). Solar thermal electric technologies are typically found in utility-scale size ranges. (Note: solar photovoltaic systems, which convert the sun's radiation directly into electrical power and are typically found in much smaller size ranges, are discussed separately in section B-14.)

SOLAR THERMAL ELECTRIC CONCENTRATING SYSTEMS

Concentrating systems use mirrored surfaces to concentrate solar energy typically to:

a) Heat a transfer fluid which conveys the heat to the working fluid of a heat engine

b) Directly heat the working fluid of a heat engine

The heat transfer fluid is either a high temperature oil-based fluid or a higher temperature molten salt, which is a mix of nitrate salts similar to nitrate fertilizers. The working fluid, which expands under heat to drive the heat engine, is steam for steam turbine-generators, and hydrogen or helium for another type of engine called the Stirling.

Most of California's existing solar thermal power plants are located in desert areas. A survey conducted on behalf of the Energy Commission of parcels of marginal or fallow agricultural land larger than 1500 acres located in areas of high solar insolation found that 80 percent of the siting possibilities are outside of the desert. In such areas the biological, cultural, and paleontologic resources impacts may be minimal or non-existent.

In addition, solar thermal power plants placed on land formerly used for agriculture may serve to mitigate water problems, since solar thermal power plants which use steam as the working fluid use only about 17 percent of the water needed by agriculture. Some of the major issues associated with solar thermal facilities are highly dependent on the site chosen and whether or not the land has been previously disturbed.

Three primary categories of solar thermal concentrating systems are: parabolic troughs, parabolic dishes, and central receivers.

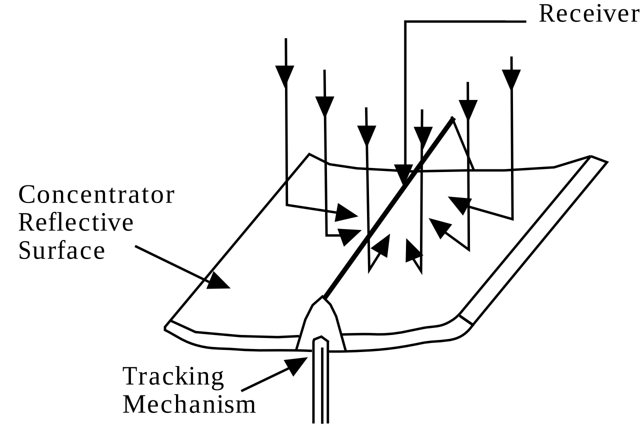
◪ Parabolic Trough. Parabolic trough systems use a concave-shaped trough collector with a highly reflective surface to focus solar energy on a heat collecting pipe (receiver) located at the line of focus of the trough. In the Luz Solar Electric Generating Station design, the heat transfer fluid (a synthetic oil) circulates through the tube receivers, and the hot oil is then routed to a heat exchanger, where steam is formed for driving the turbine-generator.

The parabolic trough design is the only solar thermal technology that is currently economically feasible and is considered to be commercially available is some cases. The most recent design is 80 MW in size and is natural gas-assisted, using natural gas to create steam for electricity production during periods of low solar insolation or during the night.

◪ Permitting Issues for Parabolic Troughs. Some of the issues associated with parabolic troughs may include:

- Use of large tracts of land (approximately four to five acres per MW output); the use is incompatible with other land uses
- Disturbances or destruction of wildlife habitat, especially to rare and/or endangered species' habitat (in the desert)
- Disturbance or destruction of cultural and paleontologic resources (if on previously undisturbed land)
- Water requirements for the steam cycle and cooling towers; water supply as a concern, particularly on undisturbed land in the desert;

PARABOLIC TROUGH



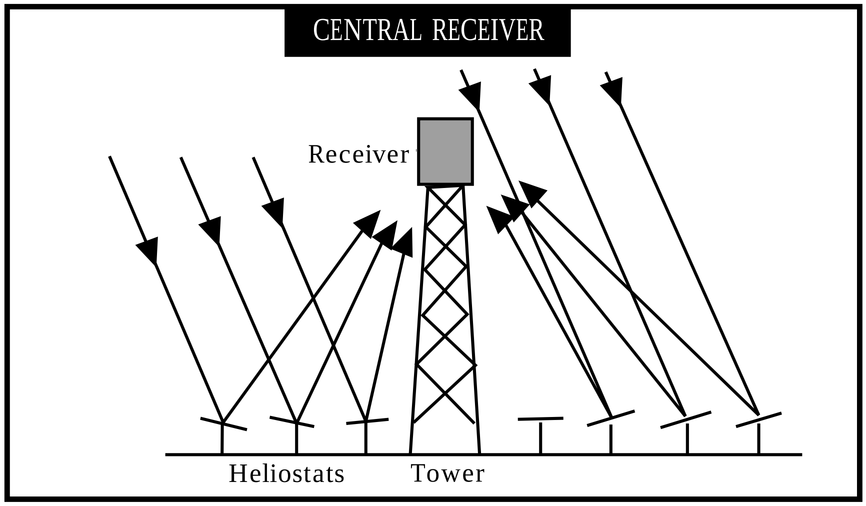
• Changes in visual quality

• Public health and safety issues associated with the storage, handling, and disposal of oil-based heat transfer fluids, including the potential for accidental releases

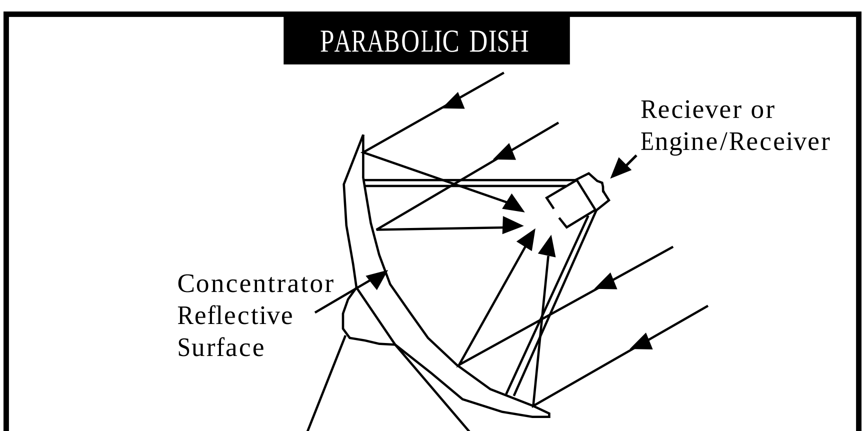
• Air emissions associated with operation of a natural gas-fired backup system (if applicable)

◩ Parabolic dish. Parabolic dish systems collect and concentrate solar energy via a large, sun-tracking dish. At the dish's focal point, the thermal energy is transferred to a working fluid for subsequent conversion into electrical energy by a heat engine mounted on the dish. Structural limitations result in dish sizes that produce from 25 to 50 kW per dish. Parabolic dish technology is not commercially available, as there are several research and development goals which must be met, including demonstration of improved efficiency, component reliability, and lower cost for the Stirling engine.

◩ Permitting Issues for Parabolic Dishes. Parabolic dish systems, like parabolic trough systems, may involve the use of natural gas firing of the Stirling engine for periods of low solar insolation. Some of the issues associated with parabolic dishes are similar to the issues associated with parabolic troughs, except that neither water nor heat transfer fluid are used. Parabolic dishes have slightly higher land use requirements (approximately six to nine acres per MW output) than parabolic troughs. Parabolic dish systems share with photovotaic systems the characteristics of modularity and stand-alone/unsupervised operation. Thus, they may be used in small numbers, in market niche applications, and in remote areas.



◩ Central Receivers. Central receivers use a field of computer-guided heliostats (mirrors) to focus sunlight onto a tower-mounted receiver. The circulating heat transfer fluid is typically a molten salt which is transported from the top of the tower to a ground level storage tank. The hot molten salt can be stored in the tank for use later (such as during cloudy periods or at night), and is eventually routed to a heat exchanger where its heat is used to turn water into steam for driving a steam turbine-generator. The thermal storage capability of this central receiver design eliminates the need for a natural gas-fired backup system.



Solar Two, a 10-MW central receiver project developed by the U.S. Department of Energy and several utilities, was dedicated on June 5, 1996 in Barstow, California. It is the successor to Solar One, the world's first-utility-scale central receiver system, which operated from 1982 to 1988 at the same site. Solar Two uses 1,926 heliostats to reflect the sun's energy to the receiver at the top of a 300-foot tower. Solar Two can continue producing electricity for up to three hours after sundown.

◩ Permitting Issues for Central Receivers. Some of the issues associated with central receivers include:

- Use of large tracts of land (approximately nine to 10 acres per MW output); the use is incompatible with other land uses

- Disturbances or destruction of wildlife habitat, especially to rare and/or endangered species' habitat (in the desert)

- Disturbance or destruction of cultural and paleontologic resources (if on previously undisturbed land)

- Water requirements for the steam cycle and cooling towers; water supply as a concern on undisturbed land in the desert

- Changes in visual quality

SALT PONDS

Salt ponds are bodies of water with greater salinity at the bottom than at the surface. The bottom storage layer retains its heat because its high salt concentration increases the density gradient enough to suppress the natural tendency for heated water to rise to the surface. As a result, the temperature in the bottom layer can be maintained at about 180 degrees F. Heat from the bottom layer is used to heat a working fluid, which drives a heat engine or turbine-generator.

Salt pond technology is not commercially available in the U.S. because of insufficient technical maturity and high capital cost. The technology requires the existence of a shallow, salty body of water, or of land with economic access to salt.

Permitting Issues for Salt Ponds. Some of the issues associated with salt ponds include:

- Use of large amounts of land/ water surface (approximately 10 to 50 acres per MW output)

- Disturbance of large areas of surface vegetation and biological resources

- Possibility of waterfowl becoming encrusted with salt in briny waters where evaporation ponds are used

- Potential for contamination of groundwater due to the highly concentrated brine solution and a hydrocarbon working fluid in a binary cycle turbine

- Changes in visual quality

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a) *Resource: An Encyclopedia of Energy Utility Terms,* Pacific Gas and Electric Company, 2nd edition, 1992, pp. 421-423.

b) *Small But Powerful -- A Review Guide to Small Alternative Energy Projects for California's Local Decisionmakers,* Association of Bay Area Governments, September 1987, pp. 12, 13, 31-35.

c) *1992 Energy Technology Status Report — Final Report,* California Energy Commission, Report no. P500-92-007, December 1992. Fact Sheet 12.1.1 (Central Receivers), 12.1.2 (Parabolic Dishes), 12.1.3 (Parabolic Troughs), and 12.2 (Salt Ponds).

d) *1992 Energy Technology Status Report, Appendix A, Volume II: Detailed Electric Generation Technology Evaluations,* California Energy Commission, Report no. P500-92-007A V2, December 1992. Section 12.0 (Solar Thermal Electric).

e) *Technical Potential of Alternative Technologies — Final Report,* prepared for the California Energy Commission by Regional Economic Research, December 2, 1991.

f) "Generator is a Beacon to Supporters," The Arizona Republic

g) "A Hot Recipe For Power," Sacramento Municipal Utility District *Customer Connections,* June 1996.

B-16. WIND

Wind power plants are turbines which use the energy in the motion of the wind to make mechanical energy, which is then converted to electrical energy.

The components of a utility-scale "windfarm" include wind turbines, an underground power transmission system, control and maintenance facilities, and a substation that connects the farm with the utility power grid. Utility-scale wind turbines are classified by size as follows: small (less than 50 kW); intermediate (50 to 500 kW); and large (above 500 kW). Small and intermediate turbines make up the bulk of the installed turbine base, although research and development continues to focus on the large and intermediate categories.

Utility-scale windfarms are generally located in areas with average annual wind speeds of at least 13 miles per hour. Wind power is more available during certain seasons because climatic conditions affect wind speed. In California, wind speeds are highest in the hot summer months, and approximately three-fourths of all annual wind power output is produced during the spring and summer.

Another application of wind is in distributed use systems, which provide on-site power in either stand-alone or grid-connected configurations. Most such systems range in size from one to 25 kW. Distributed wind systems are applicable to industry, water districts, rural residences, agricultural use, and a wide variety of isolated power uses located in good wind resource areas.

Wind power for utility-scale applications is considered to be commercially available under most conditions. The technology is considered to be mature, and there are several system suppliers.

Wind power for distributed applications is considered to be commercially available under limited conditions. Distributed wind systems can be a cost-effective option in remote locations where a utility connection would not be economically feasible.

While the power produced by many of California's existing wind turbines is non-competitive with other forms of electricity generation, some of the newest wind turbine designs may be able to match or beat the power prices from many coal and nuclear plants. One design has blades that are 100 feet in diameter, approximately twice as long as many installed turbines. The 400 kW machine can operate in a wider range of wind speeds and is more efficient than previous models.

While the power is currently more expensive than that produced by natural gas-fired plants, the price of wind power is not affected by fuel price increases or supply disruptions. In addition, there is currently an attractive federal tax credit for wind generation.

Other advantages of wind power include the following:

- It forestalls or replaces the need to build potentially more polluting con-ventional power plants
- It produces virtually no pollution of air, water, or soil
- It is renewable (non-depletable). There is enough wind in the U.S. to power the entire country
- Because of its modular nature, it is easy to add capacity as needed
- Installing wind turbines is relatively quick

◩ Permitting Issues. Some of the potential issues associated with windfarm development include:

- Use of large tracts of land (the average windfarm requires 17 acres of land to produce one MW of electricity. However, simultaneous land uses such as agriculture and cattle grazing occur often)
- Erosion in desert areas
- Changes in visual quality (since windfarms tend to be located at or just below ridge lines)
- Disturbances to wildlife habitats

• Avian mortality due to collisions with wind turbines and associated wires (research is on-going to reduce bird deaths)

• Noise (wind turbines generate both audible and low frequency [deep base vibration] sound waves)

• Grass or brush fires caused by shorts in the electrical cables in the unlikely event that they become stretched or twisted when the turbines turn to catch the wind

REFERENCES

a) *Resource: An Encyclopedia of Energy Utility Terms,* Pacific Gas and Electric Company, 2nd edition, 1992, pp. 490-492.

b) *Small But Powerful — A Review Guide to Small Alternative Energy Projects for California's Local Decisionmakers,* Association of Bay Area Governments, September 1987, pp. 18-23.

c) "Power Firm Races Into the Wind," *San Francisco Chronicle*, August 29, 1994.

d) Gipe, Paul, *Wind Power for Home & Business: Renewable Energy for the 1990s and Beyond,* Chelsea Green Publishing Company, 1993.

e) *1992 Energy Technology Status Report — Final Report,* California Energy Commission, Report no. P500-92-007, December 1992. Fact Sheet 11.1 (Wind-Utility Scale Applications) and 28.3 (On-site Electricity Production — Distributed Wind Systems).

f) *1992 Energy Technology Status Report, Appendix A, Volume II: Detailed Electric Generation Technology Evaluations,* California Energy Commission, Report no. P500-92-007A V2, December 1992. Section 11.1 (Utility Scale Wind Systems).

B-17. ELECTRICAL TRANSMISSION AND DISTRIBUTION SYSTEMS

The traditional electrical power delivery system is typically described as starting at a generating station. Power is produced at the generating station and is transported through the generating station switchyard to the transmission system. The transmission system transports the power in large quantities over long distances to local distribution centers, called substations. From substations, power travels via distribution systems to local power consumers (see Figure).

Transmission system facilities include high-capacity transmission lines that are typically supported on metal towers. The voltage on these lines generally ranges from 161 to 500 kilovolts (kV). The power lines require long, narrow, continuous land corridors.

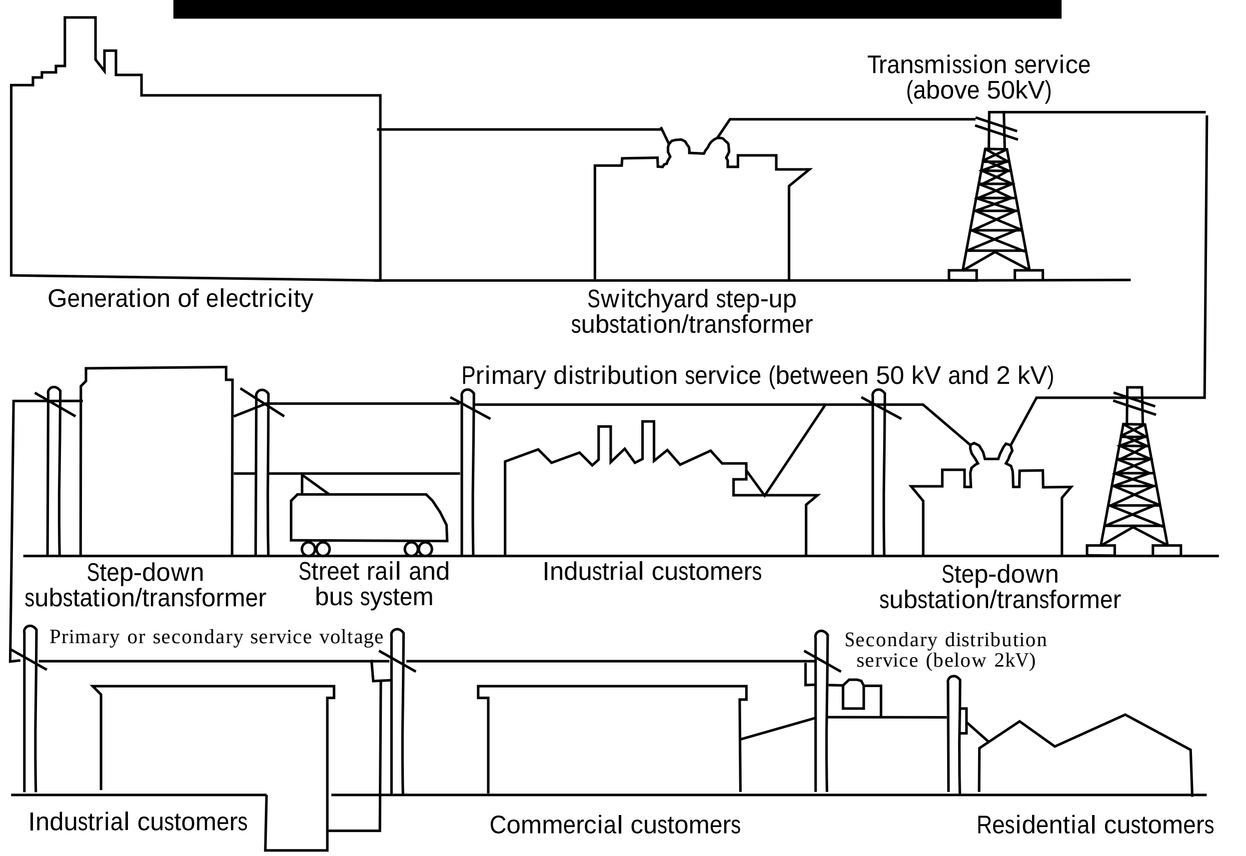
The transmission system also requires parcels of land for facilities such as transmission system substations. At transmission substations, the incoming transmission voltage is reduced to levels of 50 to 161 kV. This voltage level is called sub-transmission. The outgoing sub-transmission system is similar in appearance to the transmission system.

The transmission system carries large amounts of power from the generating station's switchyard to the transmission substation, while the sub-transmission lines branch out from the transmission substation, carrying less power along each line but in several directions. The ending points of the sub-transmission system are either large industrial or commercial consumers, or distribution substations which further reduce the voltage.

From distribution substations, which require parcels of land, the power is then carried over low-voltage distribution lines requiring long, continuous land easements. These lines, which are typically wires supported by wooden poles or underground cables, deliver power to small consumers such as homes and offices.

◩ Permitting Issues. Some of the issues that may be associated with permitting transmission and sub-transmission lines and transmission substations include:

TYPICAL ELECTRICAL TRANSMISSION AND DISTRIBUTION SYSTEM



SOURCE: "Resource: *An Encyclopedia of Energy Utility Terms*", Second Edition. Pacific Gas and Electric Company.

• Use of long continuous corridors of land (lines only, not substations). Sim-ultaneous land uses, such as agriculture and cattle grazing, can occur if such uses do not conflict with the operation and maintenance of the transmission lines

• Changes in visual quality

• Disturbances to and destruction of vegetation and wildlife habitat during construction

• Avian collisions with transmission lines and electrocution from transmission lines and transformers

• Potential health effects from electric and magnetic fields

The issues associated with lower-voltage distribution lines and substations are similar. Distribution lines and substations, unlike many high-voltage transmission lines and substations, are typically located closer to population centers. While the biological impacts may be lesser because distribution lines tend to be located on developed land, the visual impact and public nuisance issues may be more significant.

Some of the issues that may be associated with permitting underground distribution lines include:

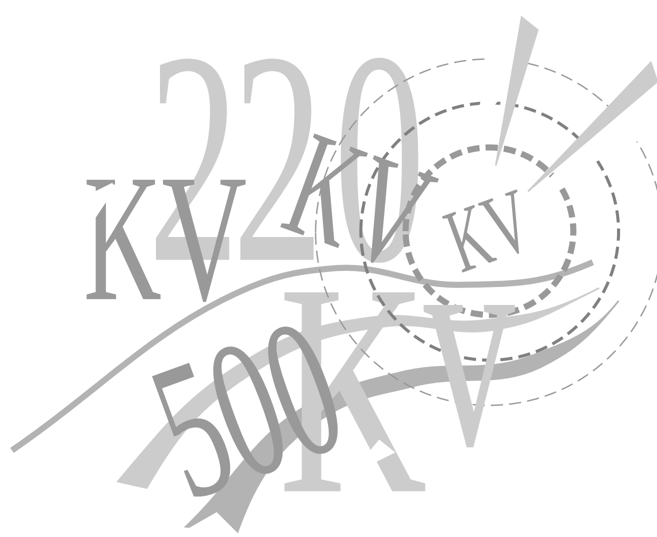
- Use of long right-of-way corridors
- Disturbances to and destruction of vegetation and wildlife habitat during construction
- Potential health effects from electric and magnetic fields (although the magnetic field strength is typically reduced compared to overhead lines)

REFERENCES

a) *Resource: An Encyclopedia of Energy Utility Terms,* Pacific Gas and Electric Company, 2nd edition, 1992, pp. 169-170, 186-187, and 441.

b) Draft *Lassen County Energy Element,* prepared for the Lassen County Board of Supervisors by Michael Clayton & Associates, March 10, 1993, pp. 98-102.

c) *Evaluation of Power Facilities: A Reviewer's Handbook,* prepared by the Berkshire County Regional Planning Commission, April 1974.



B-18. ENERGY PRODUCTION WELLS (OIL, NATURAL GAS, AND GEOTHERMAL)

Energy production wells include the wells and other facilities needed to extract and produce subsurface oil, natural gas, and geothermal resources. The locations of these resource types varies across the state (see box entitled *California Counties with Oil, Gas, or Geothermal Production*, as well as the map with oil, gas, and geothermal resource areas contained in Chapter 3).

The general processes involved in identifying and developing oil, natural gas, and geothermal fields are similar. First, a particular area that has the potential for recoverable resources is identified. This identification process can involve seismic testing and other forms of geologic analysis. Second, the area is explored by drilling test wells (also called prospect or exploratory wells) in order to determine the existence and/or the extent of the reserves. Assuming favorable results from the second step, the field is developed and operated, which involves drilling development wells (and injection wells where applicable), and installing the necessary pipelines, tanks, and processing facilities (where applicable) to extract and produce usable crude oil, natural gas, or geothermal resources. Finally, the field and the individual wells must be properly abandoned (e.g., when the resource is depleted or it is no longer economical to operate the well.)

As discussed in Appendix C, the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources supervises the drilling, operation, maintenance, and abandonment of oil, gas, and geothermal wells. Their role is to prevent waste and damage to oil and gas deposits; prevent damage to property and natural resources; protect freshwater resources from contamination due to oil or gas operations; and ameliorate land subsidence over or adjacent to oil or gas pools when this land surface is subject to inundation from the sea.

OIL AND NATURAL GAS WELLS

Crude petroleum is generally found in porous layers of sedimentary rocks located as much as several miles below the earth's surface. Natural gas usually co-exists in nature with petroleum, and the two are often produced from the same well simultaneously (see box entitled *The Origin and Accumulation of Petroleum.*) Natural gas produced from a reservoir that contains petroleum is termed associ-

CALIFORNIA COUNTIES WITH OIL, GAS, OR GEOTHERMAL PRODUCTION

Oil and Gas Production	Gas Production Only	Electrical Generation from Geothermal Energy	Commercial Low-Temperature Geothermal Use
Alameda	Butte	Imperial	Alpine
Contra Costa	Colusa	Inyo	Colusa
Fresno	Glenn	Lake	Contra Costa
Kern	Humboldt	Lassen	Imperial
Kings	Madera	Mono	Inyo
Los Angeles	Merced	Sonoma	Kern
Monterey	Sacramento		Lassen
Orange	San Joaquin		Modoc
San Benito	Solano		Monterey
San Bernardino	Stanislaus		Mono
San Luis Obispo	Sutter		Napa
San Mateo	Tehama		Plumas
Santa Barbara	Yolo		Riverside
Santa Clara			San Bernardino
Tulare			
Ventura			

Source: *1994 Annual Report of the State Oil & Gas Supervisor,* California Department of Conservation, Division of Oil, Gas, & Geothermal Resources Report No. PRO6, 1995, p. 62.

ated gas if it exists as free gas in a gas cap above the petroleum layer, or dissolved gas if it is in solution with the petroleum.

Natural gas can be formed from sources other than those from which oil is derived, such as peat deposits or coal fields. Gas produced from a reservoir that does not contain crude oil (i.e., from a gas well) is referred to as non-associated gas because it is not directly associated with oil underground.

In addition to the oil and natural gas deposits found beneath the land, California also has several offshore oil and gas wells. These include wells in state tidelands (defined as the area under state control from the shore to three miles offshore) as well as federal outer continental shelf (OCS) waters (defined as from three miles offshore to 200 miles offshore).

At the end of 1994, California had 214 active oil fields (which includes nine active federal OCS fields). These fields had 39,696 producing wells on them at that time (which includes 397 federal OCS producing wells). The total oil produced from these wells in 1994 was 344.5 million barrels. Onshore production accounted for 77 percent of California's production in 1994, while state offshore production accounted for 6 percent and federal offshore accounted for 17 percent. In addition to petroleum, these wells also produced 197.8 billion cubic feet of associated natural gas.

California also had 87 active dry gas fields (which includes one active federal OCS field) at the end of 1994. These fields had 1,058 producing wells on them at that time (which includes 17 federal OCS producing wells). The total natural gas produced from these wells in 1994 was 311.4 billion cubic feet.

THE ORIGIN AND ACCUMULATION OF PETROLEUM

Petroleum and natural gas are derived from dead organic (plant and animal) material which was buried below ancient seas in a geologic process called sedimentation. The most widely accepted theory for the transformation of organic substances into crude petroleum is the combined effect of severe conditions of pressure and temperature over extremely long time periods. The movement of crude petroleum from the place of origin to the traps where accumulations are now found most likely occurred in an upward direction. The oil continually rose by water displacement until its slow migration was halted by an impermeable barrier called "cap rock". Natural gas, which is often dissolved under natural pressure in crude petroleum, sometimes rises above the oil when gas is present in large enough amounts. The natural pressure from both the natural gas above the oil and the salt water below the oil is used beneficially in transporting oil to the surface when drilled. For this reason, both natural gas and salt water are commonly extracted together with oil from the well.

Source: D'Acierno, J. and A. Hermelee, Physical Aspects of the U.S. Oil and Gas Systems, Brookhaven National Laboratory Report No. BNL 51076, November 1979.

DEVELOPING OIL AND GAS FIELDS

Surface exploratory methods bring in equipment for a short time while the study is being conducted, and then the equipment is removed. Most exploratory methods do not have a permanent impact on the land, but they can create significant, short-term impacts.

In California, exploratory and development wells are typically drilled using the rotary method (see figure entitled *Rotary Drilling Equipment*). During the drilling operation, drilling mud (generally a mixture of clay and water chosen for its physical and chemical properties) is pumped down the drill pipe and out through the drill bit. The mud cools the drilling bit and, after jetting through the holes in the bit, picks up the rock cuttings and returns to the surface through the space between the drill pipe and the wall of the hole. Upon reaching the surface, the mud travels through a screen that removes the cuttings and then into a mud pit from which it is pumped and circulated back down the drill pipe to pick up more cuttings.

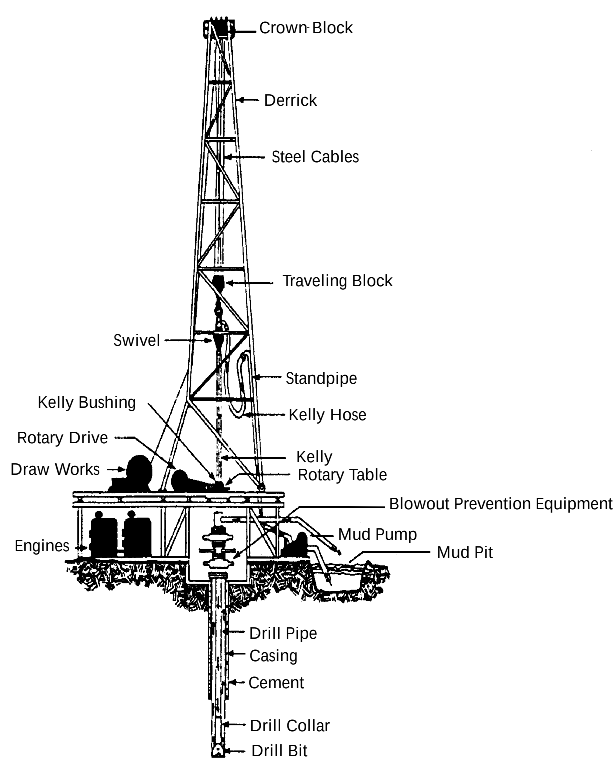
When a drill bit becomes dull, all drill pipe must be removed from the hole so the drill bit can be changed. As drill pipe is removed, it is stacked vertically against the derrick, usually in lengths of 60 or 90 feet, depending on the derrick size. When the old bit is brought to the surface and replaced, the pipe is screwed back together as it is run back into the well bore, often over two miles deep (the deepest producing well in California is over three miles deep.) The process of changing drill bits occurs many times as the well is drilled.

An alternative to the conventional rotary drilling method is coiled tube drilling. Coiled tube drilling involves the use of a continuous flexible steel tube instead of drill-string sections that can take days to replace a drillbit. The coiled tube drillstring does not have to be rotated since the drillbit is driven by a downhole motor. There are still some problems with the technology such as buckling of the drillstring and sometimes poor reliability of downhole motors in slimhole sizes. The tubing diameter can be up to almost three inches.

Coiled tube drilling is being used in Shell's McKittrick field, where 68 wells out of 115 planned steam injection wells (used with enhanced oil recovery methods, discussed later in this section) are being drilled using the technology with two-inch tubing. Well depths are less than 1,000 feet, and the access there is difficult from the surface because of the numerous pipelines, which makes the use of coiled tube drilling technology a particular advantage since it works well in confined spaces. In the McKittrick field the technology is saving drilling and rig costs, although it is generally chosen by field developers more because of the need to advance the technology's status and because of its future potential to save money when the technology is mature.

Most wells are drilled vertically (i.e., the well is directly over the oil or gas zone.) Wells, however, can also be directionally drilled, where the well is drilled at an angle (as much as 80 degrees from vertical in some cases). Directional drilling is used in urban areas, where it is not possible (either physically or economically) to locate the well directly over the targeted oil or gas zone. It can also be used to reach off-shore oil from an on-shore location, or to reach several areas from a single stationary off-shore platform or island.

ROTARY DRILLING EQUIPMENT



Source: *California Oil, Gas, and Geothermal Resources: An Introduction,* California Department of Conservation, Division of Oil and Gas, third edition, 1983, p.36.

The California Department of Conservation, Division of Oil, Gas, and Geothermal Resources requires the installation of blowout prevention equipment on wells during drilling operations to prevent blow-outs (uncontrolled gushers). Installed early in the drilling process, all successive drilling occurs through the blowout prevention equipment. As a result, blowouts are a rare occurrence in California, and the few that have occurred were typically the result of human error.

Before penetrating oil or gas reservoirs, most wells pass through freshwater and saline aquifers. Large diameter metal pipe called casing is set with cement into the hole during drilling to protect these aquifers. For their mutual protection, aquifer and reservoir fluids must not be allowed to migrate outside the casing and infiltrate other strata. Such intermingling could destroy aquifer quality and impair well production.

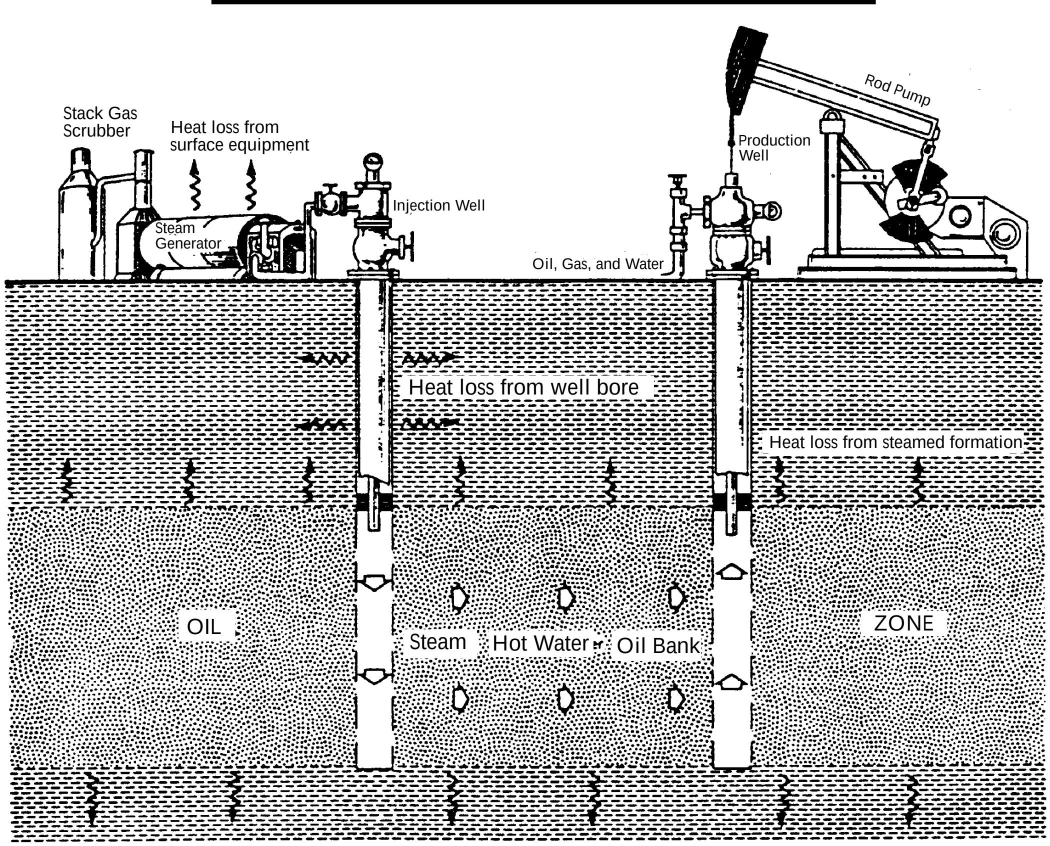
If the oil or gas zone has sufficient pressure to be brought to the surface without pumping, a series of valves, attached to the permanent casing, can be installed above the well to regulate the rate of oil or gas flow. Most natural gas zones have sufficient pressure for such a wellhead arrangement. However, many oil wells require an artificial lift system to bring the oil to the surface (either immediately upon resource extraction or after the natural reservoir pressure declines after a period of extraction). The most common method is to use a rod pump at the bottom of tubing. The pumping unit has a motor and gears that move the beam and the attached rods up and down, operating the pump (see figure entitled *Enhanced Oil Recovery Via Steam Injection*).

Only about five percent to 30 percent of the original oil-in-place can be produced from California fields using these conventional production methods. For additional production, enhanced oil recovery (EOR) methods are required. EOR methods either make the oil less viscous or they increase the sub-surface pressure in order to push the oil, or they do both. EOR methods include steam injection, natural gas injection, waterflooding, chemical injection, and others. The most important EOR method used in California is steam injection, because of the state's abundance of heavy (viscous) crude oil. Heavy crude oil has the consistency of cold molasses. The heat from the steam lowers the viscosity (thickness) of the oil so that it will flow more easily.

The figure entitled *Enhanced Oil Recovery Via Steam Injection* shows a thermally enhanced oil recovery (TEOR) process using steam generators. Note that this arrangement requires a separate well, called an injection well, for the steam injection. It should also be noted that TEOR methods can also be accomplished very efficiently using cogeneration facilities. Waste heat from a thermal power plant can be captured and used to raise steam for the TEOR process. See the Cogeneration portion of section B-11 "Natural Gas and Oil".

The oil and associated gas leave the well through a pipeline attached to a device called a separator, where the gas is separated from the oil and water, and the sediment and water are separated from the oil. The wastewater is then injected back into the ground via injection wells. The oil is stored in field storage (stock) tanks. Pipelines carry most of California's crude oil from the field storage tanks to refineries (see section B-23, "Pipelines (Petroleum, Petroleum Products, and Natural Gas) and section B-24 "Refineries"). Natural

ENHANCED OIL RECOVERY VIA STEAM INJECTION



Source: *California Oil, Gas, and Geothermal Resources: An Introduction,* California Department of Conservation, Division of Oil and Gas, third edition, 1983, p.50.

gas from the separation process is routed into a line leading to a gas plant where the "wet fractions" are removed. The wet fractions consist of natural gasoline, butane, propane, and other gases. Once the wet fractions are removed, the dry gas goes into the commercial natural gas pipelines (see section B-23 Pipelines (Petroleum, Petroleum Products, and Natural Gas).

When non-associated gas is produced from gas wells, the proportion of liquid to gas is generally low enough to permit gathering pipelines to transport the gas either to a gas processing plant or directly to a utility company's collecting line without the use of a separator.

It can take about a month to drill and complete an on-shore oil well to a depth of 5,000 feet (completion includes casing the well and installing the necessary production and processing equipment.) Deeper wells and other situational factors such as directional drilling and the composition of the rock strata can result in drilling times of several months.

Once the useful life of production and injection wells has expired, the wells must be properly abandoned by filling the wells with cement to seal access to the well and to protect the different layers beneath the well, especially fresh water aquifers. In addition, removal of all above-ground facilities and other restoration activities may be required (see section 5.7 "Energy Facility Closure/Abandonment).

◩ Permitting Issues for Oil and Gas Wells. An Executive Order by former President Bush placed a moratorium on new leases in federal waters until the year 2000. Although there are currently almost 70 existing undeveloped leases in federal waters that could be developed, none are currently being pursued by the leaseholders. Thus, it is unlikely that there will be any exploratory or new development activities in the near future. The only activity expected is completion of platforms on existing leases and new wells to be drilled from existing platforms. Efforts are underway to assess the potential for future development in federal waters. A study being conducted jointly by the Minerals Management Service and the industry that will focus on developing offshore oil with minimal environmental impacts should be complete by mid-1997.

In addition, a recent (September 1994) law forbids future drilling in the three miles of water off the coast that are under state control, along the entire 840-mile California coastline.

As a result of these actions, the permitting issues described below refer only to onshore oil and gas wells.

Some of the major issues associated with onshore oil and gas wells include:

- Possible soil erosion during exploration and drilling activity
- Ground subsidence during operation of the field may impact nearby infrastructure such as sewer, water, and gas mains
- Special disposal sites may be required for drilling mud
- Possible surface and groundwater contamination from accidental spills during drilling
- Possible contamination of fresh water aquifers from pumping extracted wastewater through injection wells
- Ability of oil and gas field equipment to meet emissions requirements
- Possible incompatibility with adjacent land uses (if located in an urban area)
- Significant water use by TEOR processes
- Biological resources impacts due to the degradation of air, water, noise, and soil quality around the field
- Temporary and permanent changes in visual quality due to tall derricks, drilling equipment, rod pumps, processing facilities, and associated tanks and pipelines
- Short-term increases in noise during exploratory activity (such as the use of "thumper trucks" and possibly explosives) and around-the-clock drilling
- Long-term increases in noise during well production
- Proper closure and abandonment of wells at the end of their productive life

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a) *California Oil, Gas and Geothermal Resources - An Introduction,* California Department of Conservation, Division of Oil and Gas, third edition, 1983.

b) *1994 Annual Report of the State Oil & Gas Supervisor,* California Department of Conservation, Division of Oil, Gas, & Geothermal Resources Report No. PR06, 1995.

c) D'Acierno, J. and A. Hermelee, *Physical Aspects of the U.S. Oil and Gas Systems,* Brookhaven National Laboratory Report No. BNL 51076, November 1979.

d) March 30, 1995 telephone conversation with Kaleeq Siddiqui, Minerals Management Service, (805) 389-7724.

e) "New Law Permanently Bans Drilling Off Coast", *San Francisco Chronicle,* September 29, 1994.

f) *Glenn County Energy Element of the General Plan,* Final Draft, June 30, 1993.

g) *1992 Energy Technology Status Report, Appendix A, Volume I: Detailed Electric Generation Technology Evaluations,* California Energy Commission, Report no. P500-92-007A V1, December 1992. Sections 1.1.1.1 (Conventional Oil Extraction), 1.1.1.2 (Enhanced Oil Recovery), and 1.1.1.2.1 (Enhanced Oil Recovery - Thermal).

h) *Energy Infrastructure of the United States and Projected Siting Needs: Scoping Ideas, Identifying Issues and Options,* Draft Report of the Department of Energy Working Group on Energy Facility Siting to the Secretary, December 1993.

i) "High Hopes for Coiled Tube Drilling," *Petroleum Economist,* October 1994, pp. 16-17.

GEOTHERMAL WELLS

Geothermal energy is natural heat generated deep inside the earth. Such heat is generally not usable unless it is near the earth's surface and heats rocks and under-ground water. Hydrothermal resources are the most abundant source of presently usable geothermal energy (see section B-7 "Geothermal" for a discussion of other types of geothermal resources). In a hydrothermal system, water in subsurface aquifers is heated by geothermal energy. In rare instances, the heat is great enough to vaporize the water, creating a steam reservoir. In most hydrothermal systems, however, the reservoir is liquid-dominated and of lower temperature than vapor-dominated resources. Geothermal reservoirs vary greatly in depth, volume, temperature, fluid salinity, and non-condensible gas content. (See box entitled *What Are Geothermal Resources?*.)

After performing preliminary resource assessment work in an area, the next phase of development is actual drilling to confirm and produce the resource. This takes the form of test or exploratory wells initially, followed by fully-completed production and injection wells. Injection wells are used to inject spent geothermal fluids back into the producing aquifer. Such a practice provides an efficient and environmentally acceptable disposal method while also contributing to the resource's long-term productivity.

The total geothermal field development project consists of the geothermal production and injection wells, resource transportation lines, production equipment, roads, and other facilities which are necessary to supply geothermal energy to any particular heat utilization equipment for its productive life. The steam collected can then be used for power generation or direct use applications (see sections B-7 "Geothermal" and B-21 "Geothermal Direct Use," respectively.)

In geothermal power plant applications, steam from several geothermal production wells is delivered to the power plants through steam-gathering pipelines. The wells can be a mile or more from the power plant. For low-temperature geothermal projects, only one or two

WHAT ARE GEOTHERMAL RESOURCES?

Geothermal resources are defined as "... the natural heat of the earth, the energy in whatever form below the surface of the earth present in, resulting from, created by, or from which may be extracted natural heat, and all minerals in solution or other products in whatever form obtained from naturally heated fluids, brines, associated gases and steam, excluding oil, hydrocarbon gas or other hydrocarbon substances." (Title 14, California Code of Regulations, section 1920(e)).

production wells may be required, with perhaps one injection well if the geothermal water quality is poor enough that subsurface disposal is necessary.

Drilling techniques for both production and injection wells are similar. Low-temperature wells can be drilled with standard water well drilling equipment and may take only a week or two to drill and complete. High-temperature wells are drilled with equipment similar to that used for oil and gas development, and may take several months to drill and complete.

Although much of the drilling technology for geothermal resources is adapted from the oil and gas industry, many geothermal reservoirs, particularly high-temperature systems, are generally composed of harder, more corrosive rock structures and fluids. Thus, the drilling and completion technology requirements are often more demanding. In areas where the rock formations do not cave in readily and formation pressures are not very high, it may be possible to use air as the circulating medium rather than mud. For example, wells drilled at The Geysers geothermal field were supplied with air from large air compressors that was used to keep the bit cool and to remove the cuttings from the hole.

◩ Permitting Issues. In general, the number and severity of environmental impacts increases with increasing resource temperatures. Thus, the environmental impacts associated with the drilling of a single production well from a 100 degree F resource that will operate a residential heat pump are significantly different from the impacts associated with the drilling of multiple production and injection wells from a 300 degree F resource that will be used for power production. (See sections B-7 "Geothermal" and B-21 "Geothermal Direct Use" for more on the permitting issues associated with these types of end uses.)

Depending on the geothermal resource, some of the major permitting issues associated with geothermal wells include:

- Land use incompatibility, including access to the site
- Possible soil erosion during exploration and drilling activity
- Potential for contamination of surface and ground water from production and injection wells
- Ability of geothermal field equipment to meet emissions requirements
- Possible air emissions of non-condensible gases such as hydrogen sulfide (which may be present in the geothermal fluid in lethal quantities)
- Special disposal sites may be required for drilling mud (if applicable) and residue from the hydrogen sulfide abatement process
- Temporary and permanent changes in visual quality due to tall derricks, drilling equipment, processing facilities, and associated tanks and pipelines
- Short-term increases in noise during exploratory activity and around-the-clock drilling
- Possible ground subsidence (localized sinking around production wells and uplifting around injection wells)
- Possible induced seismicity from the withdrawal and injection of geothermal fluids (note that many geothermal reservoirs are located in regions with a high frequency of naturally-occurring seismic events)
- Biological resources impacts due to the degradation of air, water, noise, and soil quality around the field
- Proper closure and abandonment of wells at the end of their productive life

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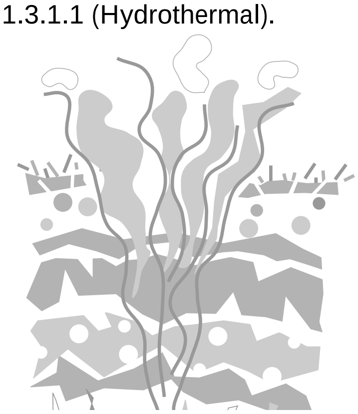

B-19. ETHANOL AND METHANOL PRODUCTION FACILITIES

Ethanol (CH_3CH_2OH) and methanol (CH_3OH) are the most common alcohols used in motor fuel mixtures, and both are used in the United States. Both alcohols are also employed for a variety of non-fuel uses such as plastics, solvents and coatings. Ethanol is presently produced from the yeast-based fermentation of sugar and starches in agricultural crops such as sugarcane, corn and sorghum. Methanol is produced by the thermochemical reforming of natural gas, although it can also be made from petroleum and coal. At present there are no commercial methanol production facilities situated in California, and only three plants produce ethanol, primarily as a byproduct from food processing wastes.

Emerging technologies for producing both ethanol and methanol from cellulosic biomass (e.g., non-food crops and agricultural waste, MSW and wood waste) may lead to the construction of alcohol production facilities in California, especially in view of the wide variety of biomass resources that exist here.

Biomass-to-ethanol production technology is based on the hydrolysis of cellulose and hemicellulose into simple sugars that can then be biologically fermented to produce ethanol. The ethanol is then purified by distillation and the residual water remaining after distillation is removed using molecular sieves. The remaining material from the biomass consists principally of lignin and can be used as boiler fuel for process heat or further utilized as a crude chemical feedstock.

Strong potential also exists to produce methanol from biomass using one of a variety of innovative thermochemical gasification technologies. Carbonaceous material such as chipped wood or crop waste is gasified at high temperatures to produce a synthesis gas which is then readily converted to methanol using widely available commercial process technology.

◩ Permitting Issues. It is possible that facilities to produce methanol from natural gas using conventional synthesis technology may be sited in California, although none now exist in the state. The air quality concerns center on NOx from the gasifier or other process heat facilities and fugitive organic emissions from alcohol handling and storage tanks.

Wastewater discharge from fermentation-based ethanol production must be properly treated before discharge. Pollutants of concern can include high concentrations of brine and biochemical oxygen demand (BOD) from dissolved organic wastes. There are no extraordinary discharge treatment requirements as compared to other industrial processes such as food processing or publicly owned treatment works (POTWs).

In terms of land impacts, it is likely that ethanol production facilities will be relatively small in scale, as compared with a petroleum refinery, due to the modular nature of the production process and the dispersed nature of the feedstocks. In addition, since biomass feedstocks are typically bulky and have a low energy density, the plants will be located close to the sources of feedstock in order to keep transportation costs down. Regions with a strong agricultural or forest products base may make good sites for these plants.

Conventional methanol production facilities will be sited near sources of low cost natural gas and are likely to be larger than biomass-to-methanol plants due to established economies of scale. These plants tend to be very clean compared to similar processing plants such as oil refineries. Biomass to methanol plants, however, will be located in much the same fashion as ethanol production facilities and will probably have a relatively small footprint. Although it is poisonous to humans and animal life, methanol is more biodegradeable and dissipates into the natural environment more rapidly than petroleum-based fuels.

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c) *Biofuels for Transportation: The Road from Research to the Marketplace.* National Renewable Energy Laboratory, Golden, Colorado, February 1995.

B-20. ALTERNATIVE FUEL CHARGING/FUELING STATION

In the near future, local planners will see a new kind of energy facility to be integrated into community plans: vehicle energy stations that dispense alternative fuels and/or electricity for a new generation of low and no-emission autos and trucks. Alternate fuel vehicles (AFV) will need special fueling and/or charging facilities that are only now being conceptualized and planned at the state level. The following pages contain descriptions of:

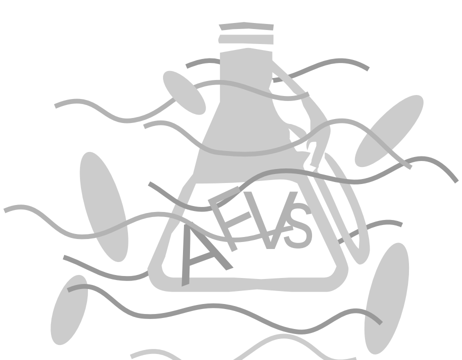
a) Electric Vehicle Charging Stations

b) Liquified Petroleum Gas Fueling Stations

c) Methanol and Ethanol Fueling Stations

d) Natural Gas Fueling Stations

The Energy Commission has prepared the Calfuels plan that outlines future needs for AFV commercialization. According to the Energy Commission, the timing and extent of commercialization for various AFVs is uncertain, with the exception of electric vehicles (EVs). The California Air Resources Board (CARB) will contract with original equipment manfacturers to produce aminimum number of EVs over three years, beginning in 1998. In 2003, CARB has a mandate that ten percent of all vehicles sold in California must be zero-emission vehicles.



Currently, the existing refueling net-work for AFVs is extremely limited. Customer service and training have been minimal, and work in the areas of technology standardization and code revisions is in the early stages. Key barriers that need to be eliminated, in part through local planning, were identified as follows in the Energy Commission Calfuels plan:

- All AFVs

  a) Lack of training for vehicle technicians and emergency personnel

  b) Need for increased public awareness about AFVs

- Electric vehicles

  a) Lack of standard charging connector

  b) Need for the state to adopt national code revisions and to disseminate code information to local enforcement agencies

(Note: The State Building Standards Commission adopted the new codes in 1995. The codes take effect August 1996.)

- Methanol vehicles

  a) Limited fuel supplies

  b) Cost of production facilities

  c) Limited fueling network

- Ethanol vehicles

  a) High fuel prices

  b) Limited fueling network

- Natural gas vehicles

  a) Limited fueling network

  b) Cost of natural gas compression and fueling systems.

  c) Need for the state to adopt national code revisions and to disseminate code information to local enforcement agencies

- Hydrogen vehicles

  a) Need for additional research, development, and demonstration

  b) Perception of high safety risks

Local governments can help reduce or eliminate many of these barriers by considering AFV fueling and/or charging needs when updating local transportation plans and land-use development standards. For technical assistance, interested community planners should contact their local natural gas and electric utilities, or the Energy Commission's Energy Technology Development Division.

B-20.a ELECTRIC VEHICLE CHARGING STATIONS

Electric vehicles (EVs) are an emerging technology with approximately 2900 EVs currently in use in California. The adoption of the Low Emission Vehicle and Clean Fuel Regulations by the California Air Resources Board has accelerated EV development in recent years. Beginning in 2003, the regulations require that ten percent of the new vehicles sold in California must be zero-emission vehicles.

EVs are expected to be charged predominantly at private home base locations, such as residential or company garages. Because EVs currently have limited driving ranges, the availability of public charging facilities for full or partial charges away from the home base — called "opportunity" charging — will help build consumer confidence and increase use of, and the early market for, EVs. Likely locations for opportunity charging include parking facilities for shopping areas, the workplace, park and ride lots, and airports. Fleet or commercial users may also need access to public charging facilities away from their home base.

The EV Industry has developed three standard energy levels for charging EVs:

Level 1:
Charging that can be done from a standard, grounded 120 Volt, three-pronged outlet available in all homes.

Level 2:
Charging at a 240 Volt/40 Amp EV charging station functioning at 240 Volt/40 Amps with special consumer features to make it easy and convenient to plug in and charge EVs at home or at an EV charging station on a daily basis.

Level 3:
A high-powered charging technology currently under development that will provide a charge in five-10 minutes, making it analogous to filling the tank of an internal combustion engine at a local gasoline station.

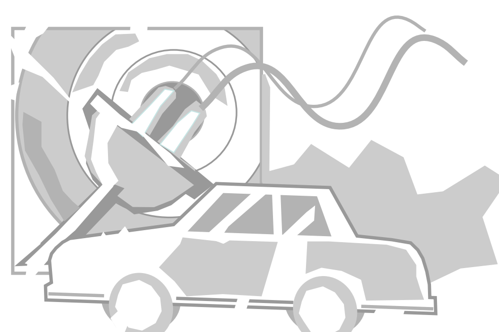
Of the three charging levels established, Level 2, a 240 Volt/40 Amp circuit is expected to be the consumers' preference at both private and public facilities. Operating at a rate up to five times faster than Level 1, Level 2 will meet the typical driver's daily needs in three-five hours of charging — at home, work, or special public charging facilities.

The EV Industry is developing two different kinds of systems to charge vehicles. One system, conductive charging, uses standard plug technology. The other, inductive charging, allows AC power to pass magnetically from the power source to the vehicle. The industry has nearly completed standardization of both charging interfaces.

California's five major utilities have extensive electricity generating capacity. Augmenting this capacity, each utility has access to, and routinely uses, power generated by other utilities to meet their customers' demands. Through the use of load management and on-line system capacity, California's utilities can meet the incremental demand for electricity needed to serve EVs without adding generation capacity. Some upgrades are expected on local distribution systems to meet EV demand.

◩ Permitting Issues. The EV Industry is working to revise model electrical codes to adequately address the safety needs of EV charging sites without creating overly burdensome restrictions. Additional work is being focused on model building codes that will address issues related to both batteries and charging. To ensure that codes will be in place in California to time to prepare for the 1998 introduction of EVs, the state is initiating a revision to its building codes. The revised state code will be consistent with industry efforts to change the model codes.

Throughout this process, the state is supporting the transfer of information between local regulatory officials and industry to ensure that safety concerns are adequately addressed. Some cities such as Los Angeles, West Hollywood, and Sacramento are already moving forward to include EV charging facilities in their city plans. For instance, they are setting goals for providing EV charging ports at parking facilities and developing local building code requirements.



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c) *Alternative Fuel Information,* U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, 1994.

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g) *Natural Gas Fuels Magazine* "Construction of NGV Facilities: A Practical Guide to Working with the Fire Department," March 1994, by Ralph Kerwin, Gage-Babcock & Associates.

B-20.b LIQUIFIED PETROLEUM GAS FUELING STATIONS

Liquified petroleum gas (LPG) is one of the most popular alternative vehicle fuels in use today. LPG has been in widespread use as a motor fuel for several decades; some 330,000 vehicles in the United States employ this fuel. It is distributed at approximately 1400 public refueling stations in California, including many existing gas stations.

The on-road vehicles using it are virtually all conversions of existing original equipment manufacturer (OEM) vehicles, although OEMs are now producing selected models with an LPG option. Vehicle conversions are accomplished by making fuel intake changes and replacing or adding fuel tanks to the vehicle. Vehicle fueling is done by service station personnel rather than by the customer and takes a little longer than dispensing gasoline.

LPG is widely distributed in the United States and in California. It is often used for heating and cooking purposes in rural areas not served by natural gas lines, as well as for agricultural processing such as crop drying. It is commonly delivered to fueling stations and end-user storage tanks via tank trucks. Bulk transport occurs primarily in railroad cars and (in certain areas) by pipeline.

LPG is commonly a mixture of propane (C_3H_6) and higher hydrocarbons, principally butane (C_4H_8). It is a gas at room temperature and is stored under pressure as a liquid. It is non-toxic, and spilled LPG readily evaporates, hence it poses no threat of contaminating water or soil. Its vapors are denser than air and can collect in low-lying areas and pool along the ground; this can be hazardous in the event of a leak, since ignition sources distant from the leaking storage vessel can trigger a fire. LPG is obtained either as a condensible fraction of produced natural gas (approximately 70 percent of supply) or as a byproduct from the refining of petroleum (approximately 30 percent).

◩ Permitting Issues. No storage tank permits are required, since all storage is typically in pressurized above-ground tanks. Because of the above-ground storage, certain building set-back and secondary containment (berming) requirements must be met. Current fire codes (e.g., National Fire Protection Association (NFPA) 58) cover these stations.

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g) *Natural Gas Fuels Magazine* "Construction of NGV Facilities: A Practical Guide to Working with the Fire Department," March 1994, by Ralph Kerwin, Gage-Babcock & Associates.

B-20.c METHANOL AND ETHANOL FUELING STATIONS

An increasing number of methanol-fueled cars are operating in California, and at least two of the automobile manufacturers — Ford Motor Company and Chrysler — have indicated that they will be increasing production. These cars operate on both straight gasoline and fuel methanol (or M85, an 85 percent blend of methanol and gasoline). As of 1995, about 12,500 of these fuel flexible vehicles (FFVs) are operating in the state. The number of ethanol cars operating in California is minor at present, although OEMs are producing volumes of these cars for use in the Midwestern U.S.

A methanol fueling facility looks and operates exactly the same as a conventional gasoline station, and the equipment used (including the dispensers, pumps, hoses and underground storage tanks) are the same, with a few minor changes. Major retailers in cooperation with the Energy Commission have established approximately 50 publicly accessible fueling stations in California. Additional stations are likely to be sited in both Northern and Southern California by independent fuel retailers in cooperation with the local Air Quality Management Districts.

The California Air Resources Board (CARB) has established regulations which require that fuel retailers operating over a certain volume of fuel sales in the state must make an alternative fuel available at their stations once the number of vehicles using that fuel exceeds certain thresholds.

The first level of the Clean Fuels "trigger" is 20,000 vehicles using any particular one of a number of designated clean alternative transportation fuels. This number of vehicles is determined as the sum of the alternative fueled vehicles that are either already registered with the state Department of Motor Vehicles (DMV) and/or officially projected by the car makers to be sold within a given year.

Once the first tier of 20,000 cars is reached, the fuel retailers must establish a total of 90 stations in the South Coast Air Basin region of Southern California. Subsequent increments in the number of vehicles trigger additional "make-available" requirements.

Requirements for the use of ethanol are virtually the same as for methanol. At present, the market for neat (100 percent alcohol) or near-neat ethanol fuel blends is not yet established in California.

◪ Permitting Issues. The permitting issues for these fuel stations are the same as for any conventional petroleum fuel station. Underground storage tank permits, air emissions permits and other requirements must be met. Current fire codes (e.g., NFPA 30 and 37) cover these stations.

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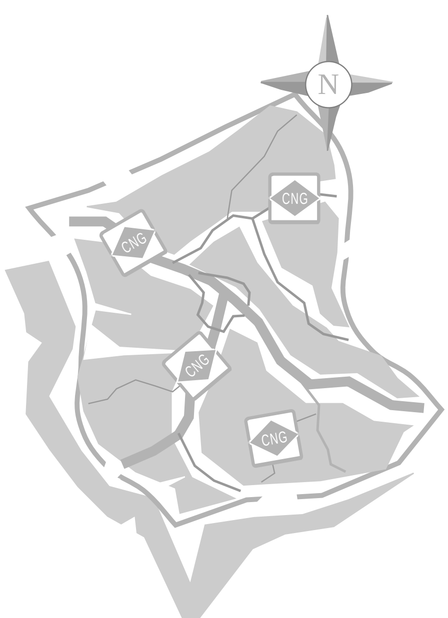
e) NFPA 30 and 30A, *Flammable and Combustible Liquids Code*, National Fire Protection Association, Quincy, MA.

f) NFPA 37 — *Automobile and Marine Service Station Code*, National Fire Protection Association, Quincy, MA.

B-20.d NATURAL GAS VEHICLE FUELING STATIONS

Natural gas vehicles (NGVs) have gained a substantial share of the alternative-fuel vehicle market over the past three years. Original equipment manufacturers, such as Ford, Chrysler and General Motors, are producing vehicles designed to operate on natural gas (dedicated vehicles) or on a combination of natural gas and either gasoline or diesel (bi-fuel vehicles). Currently, about 6,000 NGVs are operating in the state, relying on 120 public and private natural gas fueling stations.

Natural gas fueling facilities generally consist of one or more gas compressors, compressed gas storage tanks, and gas dispensing equipment. Natural gas can be dispensed by either "fast-fill" or "time-fill" systems at both public and private access stations. Fast-fill systems can fuel a vehicle in about the same time as a conventional liquid-fuel dispenser. Fuel is supplied to these systems through an underground pipeline and then compressed and stored in an aboveground tank until the gas is needed.



Time-fill systems compress the natural gas and dispense it directly into NGVs, eliminating the need for storage vessels. These systems require six to eight hours to fuel an NGV and are commonly used by fleets with vehicles that return to a central location and park overnight. The number of vehicles that can be fueled from a time-fill station depends on the size of the compressor, the gas storage capacity of the vehicles, and the desired fill time. NGVs can also be fueled at residential sites with small compressor appliances. The appliance fills the vehicle with gas at a rate that is about the equivalent of one gallon of gasoline per hour.

Two common alternatives to developing permanent fueling facilities are to distribute natural gas to fleets via mobile fueling trucks or tube trailers. Mobile fueling trucks fill directly from the pipeline using an on-board compressor dispensing the gas either directly into vehicles or into stationary storage vessels for subsequent time- or fast-fill into vehicles. Tube trailers are filled with compressed natural gas at a natural gas fueling station and then driven to other locations for dispensing fuel. Tube trailers can also fast-fill vehicles using a small compressor to increase gas pressure.

In general, natural gas supplies are abundant and pipelines for fuel transport and distribution are extensive and adequate. Even under conservative conditions, it is estimated that the recoverable gas resources in the lower 48 states are sufficient to serve the current demand for gas for another 60 - 70 years.

- Permitting Issues. The approval process for installing a natural gas fueling facility varies from city to city with interpretations of standards and codes sometimes inhibiting or delaying facility installation. Local code enforcers base their approval decisions on their local codes, which are modeled after state and national codes. Codes of interest for natural gas stations include fire, electrical, and plumbing codes. Chapter 4 of NFPA 52 serves as a key reference document for fueling station installations.

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a) *Calfuels Plan: Developing an infrastructure Plan for Alternative Fuel Vehicles*, California Energy Commission, September 1994, Publication No. P500-94-002.

B-21. GEOTHERMAL DIRECT USE

Geothermal resources can be used for industrial, agricultural, commercial, and residential direct-use applications such as water heating, space heating, and cooling as well as to generate electricity (see figure entitled *The Approximate Temperature Required for Various Geothermal Uses*). As discussed in Section B-7 (Geothermal), moderate- and high-temperature geothermal resources can be used for power generation, while low-temperature resources are unsuitable for power generation. Both moderate- and low-temperature resources can be used for direct-use applications. In addition, after high-temperature resources are used to produce electricity, the lower-temperature waste heat resulting from the electricity generation process can be cascaded for direct-use applications.

The overall potential for direct-use applications is believed to outnumber electrical-grade prospects by as much as ten to one. In California, 46 of 58 counties have lower-temperature resources which could support direct-use applications. The figure entitled *California's Low- and Moderate-Temperature Geothermal Resource Areas* shows the areas in California that have low- and moderate-temperature geothermal resources that are suitable for direct-use applications. High-temperature geothermal resources, which are located within the shaded areas of the figure, are shown separately on the Major Energy Resources map in Chapter 3, page 3.14.

Two of the most common geothermal direct-use applications are space heating and water heating. Space heating applications range from full geothermal district heating systems (such as developed in the cities of San Bernardino and Susanville) to greenhouses and individual residences. Water heating is the simplest and, in many situations, the most cost-effective application of low- and moderate-temperature geothermal resources, and existing systems can often be converted for such use. Another application for low-to moderate-temperature resources is agricultural drying operations.

Since geothermal fluids typically contain impurities which can degrade the components of heating systems, heat exchangers are used to transfer the heat from the geothermal fluid to a secondary fluid (typically potable water or a refrigerant). The secondary fluid is then circulated through the heating system so that the internal system components are isolated from potentially damaging geothermal fluids.

Geothermal direct-use systems require production wells, and may necessitate injection wells. However, discharge of fluids to surface waterways occurs (such as in San Bernardino and Susanville) when the temperature and chemistry of the geothermal fluids meet standards which protect the environment. If injection is necessary, 100 percent of the fluids are returned into the subsurface, since such direct uses extract only heat from the geothermal resources. Issues relating to geothermal wells are discussed in Section B-18 [Energy Production Wells (oil, gas, and geothermal)].

◩ Permitting Issues. In general, direct-use geothermal projects have fewer environmental impacts than high-temperature projects which produce electricity. They typically use only the heat from the geothermal fluid, not the fluid itself, and therefore do not need to treat impurities in the geothermal fluid. If injection is necessary, heat remaining in the geothermal fluid that is not transferred to a secondary fluid for beneficial uses is injected back into the ground with the geothermal fluid, so there is no need for cooling facilities as with electricity production. If surface discharge of geothermal fluids to surface water channels is permitted, it does require a permit, typically valid for five years, and is renewable for like increments of time. Monitoring of discharges is always a permit condition.

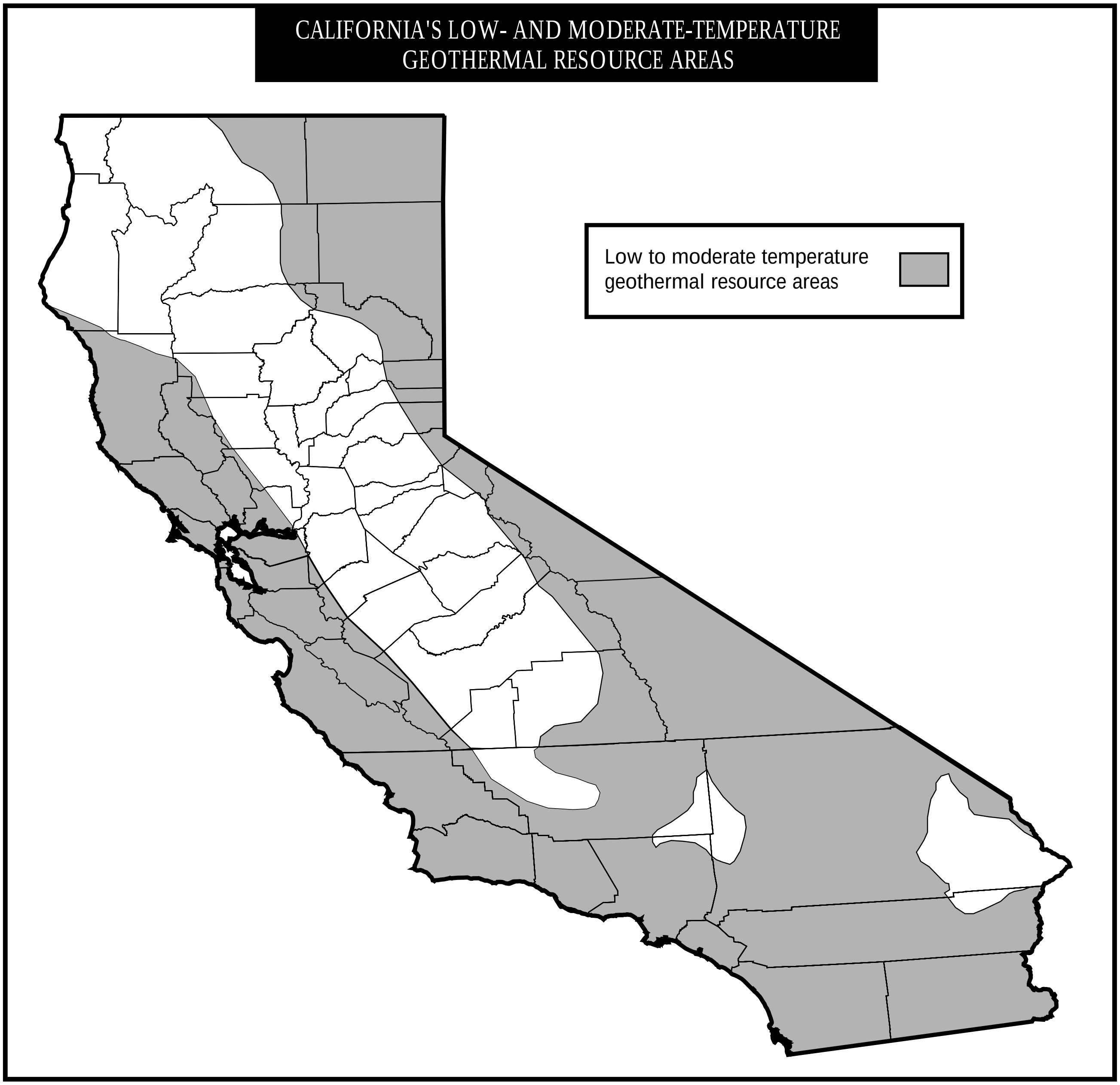
Direct-use applications are generally smaller, and require fewer wells per development, shallower drilling depths, lower temperatures and flow rates, and fewer surface-disturbing activities than for electricity production applications. As with geothermal electricity production, an issue that must be considered is the protection of ground water aquifers from contamination by geothermal waters, which is typically accomplished by casing the geothermal wells to separate geothermal fluids from the surrounding environment.

Whereas high-temperature geothermal resources for electricity production are typically located in undeveloped rural areas, low- and moderate-temperature resources are more widely distributed throughout the state. Because the desired end use must be located close to the geothermal resource in order to be practical and cost-effective, direct-use applications are likely to be on or near land that is already being used for agricultural, industrial, commercial, or residential purposes.

THE APPROXIMATE TEMPERATURE REQUIRED FOR VARIOUS GEOTHERMAL USES

˚F	˚C	
392	200	
374	190	
356	180	Evaporation of highly concentrated solutions Refrigeration by ammonia absorption Digestion in paper pulp, Kraft
338	170	Heavy water via hydrogen sulphide process Drying of diatomaceous earth
320	160	Drying of fish meal Drying of timber
302	150	Alumina via Bayers process
284	140	Drying farm products at high rates Canning of food
266	130	Evaporation in sugar refining Extraction of salts by evaporation and crystallization
248	120	Fresh water by distillation Most multiple effect evaporations, concentr. of saline sol. Refrigeration by medium temperatures
230	110	Drying and curing of light aggreg. cement slabs
212	100	Drying of organic materials, seaweeds, grass, vegetables, etc. Washing and drying of wool
194	90	Drying of stock fish intense de-icing operations
176	80	Space heating Greenhouses by space heating
158	70	Regrigeration by low temperature
140	60	Animal husbandry Greenhouses by combined space and hotbed heating
122	50	Mushroom growing
		Balneological baths
104	40	Soil warming
86	30	Swimming pools, biodegradation, fermentations Warm water for year-around mining in cold climates De-icing
70	20	Hatching of fish; fish farming

Temp. range of conventional fuel power production



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d) *1992 Energy Technology Status Report, Appendix A, Volume I: Detailed Electric Generation Technology Evaluations*, California Energy Commission, Report no. P500-92-007A V1, December 1992. Section 1.3.1.1 (Hydrothermal).

e) *1992 Energy Technology Status Report, Appendix B, Volume II: Detailed End-Use Technology Evaluations*, California Energy Commission, Report no. P500-92-007B V2, December 1992. Section 27.2 (Geothermal Direct Use).

B-22. PETROLEUM AND PETROLEUM PRODUCT STORAGE FACILITIES

PETROLEUM

Petroleum storage facilities in California are located at refineries and tank farms. Refinery petroleum storage tanks typically contain about seven days of petroleum supply. Statewide, the volume of petroleum stocks at refineries are approximately 13 million barrels.

Tank farms are facilities which have the capacity to store 20,000 barrels or more of petroleum and which are not located at a refinery. By definition, tank farms do no contain lease storage, which is storage of petroleum from producing properties before first sale or shipment. Tank farms are owned or operated by firms other than refiners and must report information on shipments to the Energy Commission if they store more than 30,000 barrels of petroleum at any time during the current or preceding year.

It is unlikely that additional petroleum storage facilities will be constructed in the near future. While refinery working storage capacity for petroleum changes from one year to another, actual storage volumes are significantly lower than available capacity. At the end of 1993, crude oil inventories were approximately ten million barrels below storage capacity.

PETROLEUM PRODUCTS

Storage of petroleum products occurs at refineries and bulk terminals located throughout California. Bulk terminals are used for wholesale marketing of products and have storage capacities of 50,000 barrels of product or more. Large end users, such as electric utilities, also maintain inventories of products, primarily residual fuel oil.

California refineries have between nine and 12 million barrels of gasoline stored at any given time. Wholesale marketers also have significant gasoline storage capacity at bulk terminals and maintain levels of gasoline inventories similar to those held by refiners. The petroleum industry also maintains several million barrels of distillate fuel, aviation fuel and residual fuel inventory.

Stored products are designated as being either primary or secondary. Refineries represent primary storage and terminals are secondary storage.

◪ Permitting Issues for Petroleum and Petroleum Product Storage Facilities. The petroleum industry has invested in additional storage capacity and modified storage tanks in response to federal and state reformulated gasoline and diesel fuel requirements. Some refiners have added storage capacity to compensate for the increased types of fuels that are now being produced or are soon to be produced. Other refiners have modified existing tanks to be drained dry to prevent mixing of different gasolines produced by the refinery.

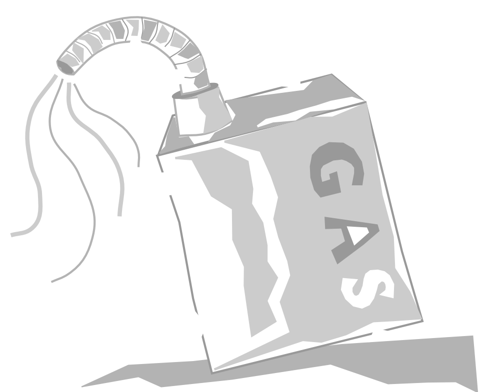
These changes were necessary since California supplies fuel to neighboring states that are not subject to California's more stringent specifications. Since these additions and modifications have been permitted, it is unlikely that additional modifications will be initiated.

REFERENCES

a) *Petroleum Industry Information and Reporting Act Handbook*, January 1994, California Energy Commission, Publication No. P300-92-007. This handbook contains all the forms required to be submitted by the petroleum industry and the Petroleum Industry Information and Reporting Act regulations which contain definitions for various types of storage.

b) *Quarterly Oil Report, Fourth Quarter 1993*, April 1994, California Energy Commission, Publication No. P300-94-003. This report describes petroleum fuels market trends, price trends, refinery activity, petroleum production trends and petroleum company financial performance. It also contains aggregated petroleum statistics for California based on industry submittals to the Commission.

c) *Regional Petroleum Product Reserve Feasibility Study,* December 1993, California Energy Commission, Consultant Report, Publication No. P300-93-019F. This report examined the feasibility of establishing a petroleum product reserve for use during energy emergencies. It contains information on petroleum product pipeline corridors and their vulnerability during an earthquake.



B-23. PIPELINES (PETROLEUM, PETROLEUM PRODUCTS, AND NATURAL GAS)

PETROLEUM PIPELINES

California's refineries receive approximately 40 percent of their petroleum supply from pipelines. These pipelines vary widely in type and size. Pipelines can be heated or unheated, proprietary or common carrier, and carry 20,000 to 300,000 barrels per day. Proprietary lines are those owned and operated by individual oil companies. Common carrier lines can be used by various interests that pay a fee for their use.

The pipelines in California transport petroleum in five broad directions and range in diameter from eight inches to thirty inches. Pipelines run from Bakersfield to Los Angeles, Bakersfield to San Francisco, Southern California to West Texas, Ventura to Los Angeles and from the Pacific Coast to Bakersfield.

The All American line is a 30-inch, common carrier pipeline and carries various blends of California petroleum and Alaska North Slope petroleum to West Texas. Four Corners lines are common carrier and transport Alaska North Slope and various blends of petroleum from Bakersfield to Los Angeles and to neighboring states. Mobil has proprietary lines between Bakersfield and Los Angeles, Carpinteria and Ventura and San Ardo and Estero Bay. Unocal and Chevron own and operate pipelines from Bakersfield to San Francisco as well as several others. Texaco also owns a line from Bakersfield to San Francisco, but it is operated as a common carrier line. Shell owns a line between Ventura and Los Angeles.

In 1996, an additional petroleum pipeline is expected to be carrying petroleum from the Bakersfield area to Los Angeles refineries. The pipeline is designed to carry up to 110,000 barrels per day and will be owned by several interests including Chevron, Texaco, and Pacific Pipeline System, Inc. It will be an underground line as are others in the state.

◩ Permitting Issues for Petroleum Pipelines. Some of the issues that have been associated with the construction of new petroleum pipelines include:

- Use of long corridors of land
- Disturbances to vegetation, cultural and paleontologic resources, and wildlife during construction
- Safety of the line during earthquakes and the potential soil and water contamination from spills from line breakage and related health effects

Even though these are concerns with constructing petroleum pipelines, government agencies have favored pipeline movement of petroleum when the alternative has been tanker transport. Agencies and environmental groups have endorsed pipeline movement because spills are less likely to occur from pipelines and easier to contain than tanker spills. The petroleum industry has favored marine tanker use because pipeline transport is the higher cost transportation method.

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PETROLEUM PRODUCTS PIPELINES

California petroleum product pipelines are located primarily in northern and southern California with no pipeline linkage between these regions. Pipelines range in size from three inches to 22 inches in diameter and are connected to other product pipelines, refineries and product terminals. Pipelines run from Bakersfield to the San Francisco area and to Sacramento and Reno, Nevada. Pipelines from the Los Angeles area also transport product to Arizona and New Mexico. One line from Southern California also transports product to Las Vegas.

Product transporters reporting to the Energy Commission must own or operate a product pipeline transporting 20,000 barrels of petroleum products during any month. Pipeline shipments can reflect product entering the pipeline from refinery storage facilities or from other terminals or other pipelines. Most exports of product from California occur by pipeline.

◩ Permitting Issues for Petroleum Products Pipelines. Same as petroleum pipelines.

NATURAL GAS PIPELINES

California has thousands of miles of transmission pipelines and nearly a hundred thousand miles of distribution pipelines in the ground. Most of the tranmission lines are owned and operated by the state's three major local distribution companies (LDCs): Pacific Gas and Elctric Company (PG&E), Southern California Gas Company (SCG), and San Diego Gas and Electric Company (SDG&E). Other pipelines, within California state boundaries, owned and operated by interstate pipeline companies include Kern River Gas Transmission Company and Mojave Pipeline Company in the Mojave Desert and Kern County, and Tuscarora Gas Transmission Company in the northeast corner of the state.

California receives approximately 85 percent of its natural gas requirements form supply regions outside the state (Canada, the Southwest U.S., and the Rocky Mountains). The remaining portion comes from in-state producers. The interstate pipelines supplying natural gas to California and their respective capacities are shown below.

Gas pipelines are usually underground with above ground compressor stations which push gas into and through the pipelines. Typical residential customers might receive their gas through a small distribution line only one inch in diameter while the line in the the street serving a community might be two inches. Commercial and industrial customers often receive gas from four to 12 inch diaameter pipelines and the major transmission pipelines are three feet or more in diameter.

The local distribution utility system distributes gas at pressures and quantities appropriate to meet its individual customer needs from very low pressures sserving residential users to more than 60 punds per square inch(PSI) serving some commercial and small industrial users. Major transmission pieplines flow gas at pressues up to 800 psi.

Natural gas storage is also an important part of the natural gas pipeline system, as it allows LDCs and customers with storage access to place additional natural gas supplies in inventory with the intent of using that inventory for load balancing and meeting peak demand days. In general, gas is placed (injected) on storage during the summer and withdrawn during the winter when heating rewuirements are high. Storage facilities in the state include those managed and operated by PG&E and SCG. One independent storage facility is presently operating in the state,while two others are currently considering developing additional facilities.

INTERSTATE PIPELINE CAPACITIES TO CALIFORNIA

Pipeline	Gas Supply Region	Capacity (MMCF/D)
El Paso Natural Gas	Southwest U.S.	3290
Kern River Gas Transmission	Rocky Mountains	1775
Pacific Gas Transmission	Western Canada	1065
Transwestern Pipeline	Southwest U.S.	700
Total		6830

The construction of new and expanded interstate pipelines to the state combined with the implementation of open access transmission services has increased market competition since 1992. According to an analysis performed by Crossborder Services, increasing access to multiple supply regions has increased market competition and open access on natural gas pipelines, producing nearly $3.0 billion in benefits to California consumers between 1992 and 1994. The Energy Commission expest these befenefits t0 continue to be realized in the near and long-term.

Permitting Issues for Natural Gas Pipelines

The issues are similar to those for petroleum and product pipelines, with the addition of noise or vibration potential from compressor stations. An interstate natural gas pipeline must get a license to construct from the FEderal Energy Regulatory Commission (FERC) while an intrastate pipeline must obtain a Certificate of Public Convenience and Necessity (CPNC) from the CPUC. After these authorizations, the largest concerns are usually environmental issues over rights of way and construction, which are taken up with local jurisdictions.

REFERENCES

a) Petroleum Industry Information Reporting Act submittals from the petroleum industry to the California Energy Commission.

b) *The Bakersfield Californian,* March 11, 1994. Article entitled "Oil Expected to Flow from Kern to L.A. by 1996", Robert Price.

c) *Regional Petroleum Product Reserve Feasibility Study*, December 1993, California Energy Commission, Consultant Report, Publcation No. P300-93-019F. This report examined the feasibility of establishing a petroleum product reserve for use during energy emergencies. It contains information on petroleum product pipeline corridors and their vulnerability during an earthquake.

d) Santa Fe Pacific Pipelines System Map.

e) *Santa Barbara County Crude Oil Transportation Analysis,* Arthur D. Little, Inc., February 1990. This report describes California petroleum pipelines and provides maps of pipeline routes by region.

f) *Fuels Report,* California Energy Commission, December, 1995, Publication No. P300-95-017. The *Fuels Report* describes emerging trends and long-range forecasts of the demand, supply and price of petroleum, petroleum products, natural gas, coal and synthetic and other fuels. It is the state's principal fuels policy document.

g) *The California Gas Report* (CGR), prepared annually by the California gas and electric utilities is available from each utility directly. The CPUC, Energy Commission and others in the gas industry use this as a reference for historical information as well as forecasts. Each gas utility makes its own long-range plan for natural gas supply to meet anticipated demand. These are summarized in a single document.

h) *1995 Natural Gas Market Outlook*, October 1995, California Energy Commission Publication No. P 300-95-0. This biennial report presents an independent analytical forecast for the supply availability, demand, and price of natural gas for California over the next twenty years. Analyses performed by the Energy Commission staff incorporate data from the CGR, numerous documents which independent gas marketers and utilities file with the Energy Commission, annual reports from the state Division of Oil, Gas, and Geothermal Resources, and a variety of other sources. This report presents assumptions, analyses and detailed information on the forecast price and supply of natural gas to meet projected consumer demand.

B-24. REFINERIES

California's refineries are located in the San Francisco Bay area, Los Angeles area and the Central Valley. Statewide, refiners rely on Alaska for 45 percent of their petroleum supply and California for about 50 percent. Foreign sources provide the balance. Each day approximately two million barrels of petroleum are processed into a variety of products with gasoline representing about half of the total product volume. (A list of refineries, their location and capacity is shown in the attached table.)

Refineries can be classified as topping, hydroskimming or complex. Topping refineries are the least sophisticated and contain only the atmospheric distillation tower and possibly a vacuum distillation tower. The topping refiner's ability to produce finished products depends on the quality of the petroleum being processed. A hydroskimming refinery has reforming and desulfurization process units in addition to basic topping units. This allows the refiner to increase the octane levels of motor gasoline and reduce the sulfur content of diesel fuel. Complex refineries are the most sophisticated refinery type and have additional process units to "crack" the heavy gas oils and distillate oils into lighter, more valuable products.

Using a variety of processes including distillation, reforming, hydrocracking, catalytic cracking, coking, alkylation and blending, the refinery produces many different products. The four basic groups are motor gasolines, aviation fuel, distillate fuel and residual fuel. On a statewide average, about 12 percent of the product from California's refineries is aviation fuel, 13 percent is distillate fuel and 9 percent is residual fuel.

Complex refineries have the highest utilization rate at approximately 95 percent. Utilization rate is the ratio of barrels input to the refinery to the operating capacity of the refinery. Complex refineries are able to produce a greater proportion of light products, such as gasoline, and operate near capacity because of California's large demand for gasoline.

◩ Permitting Issues. It is unlikely that new refineries will be built in California. In fact, in the last 10 years 10 California refineries have closed, resulting in a 20 percent reduction in refining capacity. Further refinery closures are expected for small refineries with capacities of less than 50,000 barrels per day. The cost of complying with environmental regulations and low product prices will continue to make it difficult to continue operating older, less efficient refineries.

To comply with federal and state regulations, California refiners have invested approximately 5.8 billion dollars to upgrade their facilities to produce cleaner fuels, including reformulated gasoline and low-sulfur diesel fuel. These upgrades have received permits since low-sulfur diesel fuel regulations went into effect in 1993. Requirements to produce federal reformulated gasoline took effect at the beginning of 1995 and more stringent state requirements for reformulated gasoline went into effect statewide on June 1, 1996.

REFERENCES

a) Petroleum Industry Information Reporting Act submittals from the petroleum industry to the California Energy Commission.

b) *Fuels Report*, California Energy Commission, February, 1994, Publication No. P300-93-109. The *Fuels Report* describes emerging trends and long range forecasts of the demand, supply and price of petroleum, petroleum products, natural gas, coal and synthetic and other fuels. It is the state's principal fuels policy document.

c) *Quarterly Oil Report, Fourth Quarter 1993,* April 1994, California Energy Commission, Publication No. P300-94-003. This report describes petroleum fuels market trends, price trends, refinery activity, oil production trends and petroleum company financial performance. It contains aggregated petroleum statistics for California based on industry submittals to the Commission including refinery utilization rates.

d) *1994 Annual Report*, Western States Petroleum Association.

CALIFORNIA REFINERY LOCATIONS AND CAPACITIES

CLASSIFICATION OF REFINERS BASED ON
CRUDE OIL CAPACITY (BARRELS PER DAY)

LARGE REFINERS			INDEPENDENT AND SMALL REFINERS		
COMPANY	LOCATION	CAPACITY	COMPANY	LOCATION	CAPACITY
ARCO	Carson	237,000	Tosco	Martinez	160,000
Chevron	El Segundo	230,000	Ultramar	Wilmington	68,000
	Richmond	230,000	Santa Maria Refining Co.	Santa Maria	10,000
Exxon	Benicia	128,000	Kern	Bakersfield	21,400
Mobil	Torrance	130,000	Huntway	Benicia	8,600
Shell	Martinez	148,900		Wilmington	5,500
Texaco	Bakersfield	56,000	Lunday	South Gate	8,100
	Wilmington	64,000	Paramount	Paramount	46,500
Unocal*	Wilmington	105,600	San Joaquin	Bakersfield	24,300
	San Francisco	73,100	Sunland	Bakersfield	12,000
	Santa Maria	42,000	Ten By	Oxnard	4,000
		TOTAL 1,444,600			TOTAL 368,400

Note: Data on this table represents total crude oil capacity, not distillate production or diesel fuel capacity. Diesel production potential varies.

*Unocal has 115,000 barrels per stream day (BPSD) of idle atmospheric distillation capacity acquired from its purchase of the Shell Wilmington refinery. At the present time Unocal is running the two facilities as a single unit.

Source: "Table 38 Capacity of Operable Petroleum Refineries by State as of January 1, 1995," Energy Information Administration/Petroleum Supply Annual 1994, Volume 1, pages 84-86.

B-25. TERMINAL FACILITIES

California's nearly 100 terminals receive petroleum and petroleum products by tanker, barge, pipeline, rail or truck. Most of California's terminals are marine terminals. At these facilities petroleum or product is transferred from or to tankers or barges. Tankers loaded with Alaska North Slope petroleum, for example, enter marine terminals at northern and southern California, where the petroleum is then sent to refineries by pipeline for processing. An example of pipeline receipts of petroleum at a terminal is heavy California petroleum produced in the Bakersfield area that is pipelined to a terminal at Martinez. From there it can be loaded onto tankers for export to Pacific Rim countries.

Terminals also serve as refiner's wholesale distribution points for products. Product, such as gasoline, is sold to distributors (jobbers) who then sell to consumers through the distributors' own retail stations. The distributor may also resell the gasoline to other station dealers. Gasoline can also be sold directly to station dealers from the terminal. The marketing structure differs depending on the type of product being sold.

A terminal can be linked with several refineries and storage facilities and be supplied by privately-owned pipelines or a common carrier line. Total capacity at a terminal can range from a few thousand barrels to a few million barrels. The most apparent equipment at a terminal are the tanks used for storage and separation of different product grades. The number of tanks can range from a few to more than 70. Other equipment found includes piping, pumps, valves, and meters needed for bulk receipts and for loading racks used for small deliveries to trucks. Marine terminals have vessel length and water depth limits that dictate the size of tankers that can off-load at the facility.

◩ Permitting Issues. Some of the environmental and safety issues associated with permitting petroleum and petroleum product terminals include:

- Changes in visual quality
- Disturbances to vegetation and wildlife
- Emissions from floating roof tanks
- Potential water and soil contamination from earthquake-damaged tanks
- Increased tanker traffic and potential for spills at marine facilities

REFERENCES

a) *U.S. Petroleum Refining, Meeting Requirements for Cleaner Fuels and Refineries,* Volume I, National Petroleum Council, August, 1993. This document is a comprehensive assessment of how environmental regulations impact the petroleum refining industry and U.S. consumers.

b) *Petroleum Terminal Encyclopedia*, Seventh Edition, 1994, Stalsby/Wilson Press. This document contains a complete listing of terminals in California and other states including information on the type of terminal, its capacity and operating hours, the terminal operating company, how it receives product or crude oil and what methods of out-loading are used.

c) *Fuels Report,* California Energy Commission, December, 1995, Publication No. P300-95-017. The *Fuels Report* describes emerging trends and long range forecasts of the demand, supply and price of petroleum, petroleum products, natural gas, coal and synthetic and other fuels. It is the state's principal fuels policy document.

APPENDIX C: FEDERAL & STATE AGENCY DESCRIPTIONS

This section provides an overview of the federal, state and public agencies that can be involved in permitting an energy facility, their jurisdiction, and their permitting responsibilities, where applicable. It is noteworthy that a key factor in successfully permitting a new energy facility is local involvement and participation in the permitting process, from beginning to end.

Although the following inventory of interested or affected federal and state agencies might seem overwhelming, each agency listed in this section may not be involved in every power plant project. Conversely, a specific project may involve an agency that is not discussed here, although this list is fairly comprehensive. The involvement of specific agencies depends on many factors, including the ownership status of the land, and the environmental resources and public facilities affected.

The purpose of this list is to inform local governments of the roles and responsibilities of potential participants in the permitting process. It is not meant to imply that every agency must be consulted as a permitting authority. This compilation also suggests ways for local government to become involved in the permitting process.

FEDERAL AGENCIES

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is responsible for licensing hydroelectric facilities, including related electric power lines; regulating the interstate sale and transmission of electricity and the transport of oil and natural gas, including the review of interstate electric power rates and interstate power sales contracts; and administering the Public Utility Regulatory Policies Act (PURPA) of 1978. FERC has rate jurisdiction over electricity sales and transmission in interstate commerce by investor-owned utilities (IOUs), including sales to publicly owned systems. This jurisdiction directly affects the publicly-owned utilities' decisions on whether to purchase power from the IOUs or to acquire their own resources. FERC also establishes rates for the transportation of oil and natural gas by pipeline, and the valuation, or actual value, of such pipelines.

Gas pipeline companies must apply to FERC for certificates of approval to construct and operate new interstate pipeline facilities, to maintain existing facilities, make connections, provide new services or modify existing service, abandon facilities, and transport natural gas for industrial users. FERC also regulates the rates that oil pipeline companies charge to transport oil in interstate commerce. Tariffs, the licenses that permit oil pipeline companies to charge specific rates, must be filed with FERC for review.

FERC is the lead agency and performs environmental reviews under the provisions of the National Environmental Policy Act (NEPA), issuing licenses to construct and operate non-federal hydroelectric power projects, and license exemptions for small hydro projects. FERC also certifies "qualifying facilities" (QFs) owned by independent power producers. QFs are non-utility power producers that qualify to supply generating capacity and electric energy to electric utilities. The utilities must purchase this power at a price approved by state regulatory agencies.

Local governments can participate in FERC's review of energy projects through this agency's role in Environmental Assessment (EA) and Environmental Impact Statement (EIS) proceedings under the mandates of NEPA. This includes participating in public hearings and workshops, and providing written comments on development proposals.

Bureau of Indian Affairs

The Bureau of Indian Affairs (BIA), Sacramento Area Office (SAO) and its respective Agencies are responsible for managing approximately 470,000 acres of federally owned (individually owned/tribal/government owned) land in California. These lands are defined as follows:

Individually owned land means land or any interest therein held in trust by the United States for the benefit of individual Indians and land or any interest therein held by individual Indians subject to Federal restrictions against alienation or encumbrance.

Tribal land means land or any interest therein, title to which is held by the United States in trust for a tribe, or title to which is held by any tribe subject to Federal restrictions against alienation or encumbrance, and includes such land reserved for Indian Bureau administrative purposes. The term also includes lands held by the United States in trust for an Indian corporation chartered under Section 17 of the Act of June 18, 1934, 948 Stat. 988; 25 U.S.C. 477).

Government-owned land means land owned by the United States and under the jurisdiction of the Secretary which was acquired or set aside for the use and *Individually owned land* or *Tribal land*.

The BIA's programs provide for the protection, orderly development and use of these lands and resources in conjunction with tribal governments, individual Indian landowners and, when necessary, city, county, state and local entities. Tribal and individual Indian involvement is obtained prior to the BIA taking any action on behalf of its clientele.

For energy facilities, the BIA is the lead agency under NEPA, the federal equivalent of CEQA, if the project crosses BIA-administered land. Other federal agencies and/or other private entities or state and local governments are responsible for administering projects which cross their respective land. The BIA issues a Grant of Easement for Right-of-Way over Indian Lands for energy facilities including wells, pipelines, electric transmission lines (Act of February 5, 1948; 62 Stat. 17, 18; 25 U.S.C. 323-328; 25 CFR part 169).

The regulations contained in 25 CFR 169 do not cover the granting of rights-of-way upon tribal lands within a reservation for the purposes of constructing, operating, or maintaining dams, water conduits, reservoirs, powerhouses, transmission lines or other works which shall constitute a part of any project for which a license is required by the Federal Power Act. The Federal Power Act provides that any license which shall be issued to use tribal lands within a reservation shall be subject to and contain such conditions as the Secretary of the Interior shall deem necessary for the adequate protection and utilization of such lands (16 U.S.C. 797 (e)). In the case of the tribal lands belonging to a tribe organized under the Act of June 18, 1934 (48 Stat. 984), the Federal Power Act requires that annual charges for the use of such tribal lands under any license issued by the Federal Power Commission shall be subject to the approval of the tribe (16 U.S.C. 803(e)).

Depending upon the potential impact of a particular energy project, other federal agencies, city, county and local governments and the general public can participate in the BIA's review of energy projects through graphic Environmental Assessment (EA) and/or Environmental Impact Statement (EIS) proceedings under the mandates of NEPA. This includes providing comments on development proposals and determining the scope of input from other entities.

Bureau of Land Management

The Bureau of Land Management (BLM) is responsible for managing approximately 17.5 million acres of federally-owned land in California. The BLM's programs provide for the protection, orderly development and use of these public lands and resources. Virtually all development on or requiring access across lands under BLM management requires one or more use or authorization permits from this agency.

For energy facilities, the BLM is the lead agency under NEPA, if the project crosses BLM-administered land, and there are no other federal agencies with a greater degree of involvement. The BLM issues a right-of-way grant (rather than an easement) for energy facilities including wells, pipelines, electric transmission lines, and power plants (43USC 1701: Title V of the Federal Land Policy and Management Act of 1976). With respect to oil and gas pipelines, BLM is the lead agency under the Mineral Leasing Act of 1920 as amended (30 U.S.C. of 185) issuing the right-of-way grant if the project crosses any federal lands with the exception of those lands in the National Park Service, lands held in trust for an Indian or Indian tribe and lands on the Outer Continental Shelf.

As part of the review for the right-of-way grant, the agency must consider the direct and cumulative effects of the entire proposed new energy facility and its ancillary facilities rather than focusing on only those effects to BLM administered lands. For example, BLM-considers the impacts associated with the entire length of a electric transmission line under its jurisdiction including those to non-federal lands and the existing electrical system.

Local governments can participate in the BLM's review of energy projects through EIS proceedings under the mandates of NEPA. This includes participating in public hearings and workshops, and providing written comments on development proposals.

U.S.D.A. Forest Service

The U.S. Department of Agriculture — Forest Service (USFS) is responsible for managing approximately 20.5 million acres in 18 national forests in California. Usually, the USFS acts as a reviewing agency for the NEPA lead agency. The USFS is, however, the NEPA lead agency if the energy project crosses a large amount of USFS-administered land, and there are no other federal agencies with a greater degree of involvement (such as in cases when the Mineral Leasing Act applies).

Energy facilities are the subject of USFS special use authorizations if these activities include: archaeological reconnaissance, access roads, electronic sites, or right-of-way grants (electric power line easements) for electric power lines or any other use occupying National Forest System lands. Oil and gas and geothermal steam resources may be leased from the U.S. Department of the Interior. The USFS regulates the surface uses associated with these leases.

Local governments can participate in USFS review of energy projects through EIS proceedings under the mandates of NEPA. This includes participating in public hearings and workshops, and providing written comments on development proposals.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) protects the waters of the U.S. The Corps is required to maintain the quality of navigable waters by regulating development that would affect wetlands, marshes, and swamps; protect rivers, streams and wetlands from unreasonable alteration or destruction; and control dumping of dredged material into the nation's waters. The Corps issues permits for the discharge of dredged or fill materials into the waters of the U.S. The Corps also issues permits for activities in or affecting the navigable waters of the U.S.

Regarding energy facilities, the Corps requires a Rivers and Harbors Act Section 10 permit if the proposed power project will obstruct or alter navigable waters, including wetlands. The Corps mandates a Clean Water Act Section 404 permit if dredged or fill material will be discharged into navigable waters. This Section 404 permit application also requires a Waste Discharge Requirement permit (or waiver) or a Section 401 Water Quality Certification from the applicable California Regional Water Quality Control Board. In addition, the Corps is required by federal law to consult with state and federal wildlife agencies regarding any project impacts on aquatic habitats and on federal endangered species.

Local governments can participate in the Corps' review of energy projects through EIS proceedings under the mandates of NEPA. This includes participating in public hearings and workshops, and providing written comments on project proposals.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) is responsible for conserving, protecting and enhancing fish and wildlife habitats and plants. Its jurisdiction covers wild birds and mammals, federally-listed endangered animal and plant species, certain marine mammals, inland sport fisheries, and specific fishery and wildlife research activities.

Regarding energy facilities, the USFWS is concerned with the impact of proposed projects on fish and wildlife habitat and plants under the federal Endangered Species Act. The USFWS consults either formally or informally with the project developer and other interested parties to determine project impacts. The USFWS issues a "Jeopardy Opinion" on the proposed project if the finding is made that the continued existence of a species is in jeopardy. The Jeopardy Opinion discusses the project's potential impact on federally-listed endangered species, mitigation measures and species conservation recommendations.

If no federal agencies are involved with the proposed project through per-mitting or funding, but a federally-listed endangered species may be subject to an incidental taking or removal as defined by the Act, a conservation plan is developed under the Act's Section 10 permit process. This includes the voluntary participation of state and local agencies, and usually requires habitat compensation and enhancement measures such as setting aside an area of protected, undeveloped land as a permanent preserve.

Local governments can participate in USFWS' review of energy projects through EIS proceedings under the mandates of NEPA. This includes participating in public hearings and workshops, and providing written comments on development proposals.

U.S. EPA

The U.S. Environmental Protection Agency (EPA) has responsibility to protect the environment and oversee programs on air and water pollution, solid waste, and hazardous substances. The EPA administers the Clean Air Act, which established air quality standards for key pollutants to be attained in all regions of the country. The EPA also administers national programs on water pollution control and groundwater protection. It regulates hazardous waste injection wells, sets standards for land disposal of hazardous wastes, and administers the federal Superfund to clean up toxic waste sites.

Most important to energy facility permitting is the EPA's role in maintaining air quality. EPA requires that the state have a program to attain and maintain the national air quality standards. The state's program is overseen by the California Air Resources Board (CARB) and implemented by regional Air Pollution Control Districts (APCD) or Air Quality Management Districts (AQMD) for the following air quality issues:

a) Prevention of Significant Deterioration (PSD) review and facility permitting for power plant construction. PSD review applies to criteria pollutants whose ambient concentration levels are lower than corresponding National Ambient Air Quality Standards (NAAQS).

b) New Source Review (NSR) facility permitting for power plant construction. NSR applies to criteria pollutants whose ambient concentration levels are higher than the corresponding NAAQS.

c) National standards of performance and a comprehensive permit program for major stationary sources.

d) National emission standards for hazardous air pollutants.

Not all districts have the authority to issue PSD permits. Some states are delegated the authority to issue the permits and some issue the permits through their rules which are part of their State Implementation Plans. For those districts which do not have the authority to issue such permits, EPA is the permitting agency.

The EPA's activities to regulate and preserve water quality are also important to energy facility permitting. EPA administers the federal Clean Water Act in conjunction with the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB). The EPA imposes pretreatment standards for introduction of pollutants into publicly-owned treatment works (POTWs), and prohibits the discharge of oil or hazardous substances into or upon the navigable waters of the U.S.

Local governments can be involved in EPA's review of energy projects through proceedings initiated at the local or state level. For example, regarding air quality impacts, EPA submits comments to the local AQMD or APCD during the Authority to Construct permit process, and to the California Energy Commission during the Application for Certification process. EPA does not hold its own independent hearings or invite public comment on these proceedings except in cases where it is the permit authority, i.e., when the local air district does not have PSD authority. The same is true for water quality impacts, where EPA submits comments to the RWQCB or the SWRCB during those agencies' proceedings.

National Park Service

The National Park Service's (NPS) statutory mandate is to conserve scenery, natural and historic objects and wildlife, and to provide for the enjoyment of those resources in a manner that will leave them unimpaired for the enjoyment of future generations. The NPS has jurisdiction over all federally-designated national parks and a large variety of other types of parks, monuments, preserves, and memorials. It also administers a variety of federal reservations in the District of Columbia.

Energy facilities are the subject of NPS permits under certain limited circumstances. In general, new energy project development is not allowed in units of the National Park System, unless authorized by the law establishing the park unit. This is considered a consumptive use of resources, which is prohibited by the laws governing the management of the National Park System. Energy and communications transmission lines and pipelines for water can by granted a "right-of-way" permit if there is adequate mitigation, no resource damage, and no prudent alternatives to using park property. Pipelines for oil or gas can be permitted only if this type of development is specifically authorized in the legislation for the park unit involved.

If energy facilities have already been developed in an area where a new park is to be created, those activities might be allowed to continue until the existing permit expires. This depends upon the nature and terms of the existing permit. If the land is in private ownership, the value of these existing facilities could be considered in determining the appraised value of the property to be paid if the property is acquired by the United States for park purposes.

Local governments can be involved in NPS review of energy projects through EIS proceedings under the mandates of NEPA. This includes participating in public hearings and workshops, and providing written comments on development proposals.

U.S. Bureau of Reclamation

The Bureau of Reclamation (Reclamation) is authorized both administratively and congressionally to construct water resources projects throughout the 17 Western states, including hydroelectric power facilities.

Reclamation and the Federal Energy Regulatory Commission (FERC) work together to ensure timely development of renewable hydroelectric power resources at existing Reclamation facilities. Reclamation reviews FERC applications and associated exhibits, studies, and environmental documents for hydroelectric projects covered by the Federal Power Act and recent amendments.

Reclamation is authorized to grant leases of power privilege to non-Federal entities for the development of hydroelectric power plants under its jurisdiction where Federal hydroelectric facilities are authorized. Lease of power privilege is a contractual right given to a non-Federal entity to utilize, consistent with project purposes, water power and storage from Reclamation projects for electric power generation.

Reclamation is agreeable, under certain conditions, to the development of hydropower by non-Federal entities at Reclamation projects provided that it is compatible with the authorized purpose of the project and provided the Federal hydroelectric facilities have not been authorized for development. Reclamation issues permits or easements for the overhead crossing of Reclamation facilities by transmission lines, also called a facility crossing license. This license is usually issued to investor-owned utilities or municipal utilities.

Western Area Power Administration

The Western Area Power Administration's (WAPA) has no siting authority. It's primary function is to market and transmit energy generated by federal government power projects. In the western states, these power sources are U.S. Bureau of Reclamation and U.S. Army Corps of Engineers hydroelectric facilities. WAPA also constructs or upgrades power lines, and operates and maintains more than 16,000 miles of electric power lines in the West. Its major customers include municipal utilities, rural irrigation districts, and some federal facilities such as military bases.

When WAPA develops electric power lines it obtains permits from other affected agencies. Normally, WAPA is the NEPA lead agency when it proposes an electric power line project, since it usually has the greatest degree of federal involvement. In this situation, it is responsible for overall project approval or rejection. When other utilities or agencies need to cross existing WAPA lines, WAPA will evaluate and issue a crossing permit if one of its transmission or distribution lines will be crossed by a private or municipal utility line.

Local governments can be involved in WAPA's review of energy projects through EIS proceedings under the mandate of NEPA. This includes participating in public hearings and workshops, and providing written comments on development proposals.

STATE AGENCIES

California Energy Commission

The California Energy Commission is the state's principal energy planning organization. The Energy Commission has jurisdiction over proposed thermal power plants with a generating capacity of 50 MW or more, including transmission lines from the power plant to the point where the line joins with a utility's inter-connected transmission system, related pipelines, and other appurtenant structures.

The Energy Commission issues one permit or certificate which encompasses all state, regional, and local agency permits. The Energy Commission's Notice of Intention (NOI) and Application for Certification (AFC) project evaluation and permitting process is the functional equivalent of the CEQA process. Other interested or affected agencies participate in the NOI/AFC process in lieu of the CEQA process.

In some circumstances, the Energy Commission will issue a Small Power Plant Exemption (SPPE), which exempts a proposed power plant and related electric power lines from the Energy Commission's siting jurisdiction and the NOI/AFC process. In order to qualify for the exemption, the proposed project must be 50-100 MW in size, pose no substantial adverse environmental impacts, and be in conformance with the Energy Commission's most recent adopted forecast of electricity demand. The SPPE is the equivalent of a Negative Declaration of environmental impacts under CEQA. If a SPPE is granted, the project is referred to local agencies and follows their permit processing procedures.

If the project is a thermal power plant with a generating capacity of 50 MW or more and is proposed by an investor-owned utility (IOU), the Energy Commission is the lead agency but the California Public Utilities Commission (CPUC) must also issue a Certificate of Public Convenience and Necessity (CPCN) to approve the project. In this case, the CPCN is limited to a review of cost effectiveness and reasonableness. The Energy Commission and CPUC procedures run simultaneously, but a CPCN is normally granted if the facility is certified by the Energy Commission. The CPUC's role in regulating IOUs is discussed further below.

If a project is proposed in the California coastal zone, the Energy Commission is required to coordinate its review with the California Coastal Commission (CCC). Similarly, if the project is proposed in the San Francisco Bay zone, the Energy Commission will coordinate its review with the San Francisco Bay Conservation and Development Commission (BCDC).

Local governments can be involved in the Energy Commission's review of energy projects through either the NOI/AFC or SPPE processes. The Energy Commission staff consults closely with local agencies to ensure that proposed power-plants comply with local ordinances, regulations, and standards. Staff and Commissioners conduct numerous public hearings and workshops throughout these proceedings, actively soliciting public comment on all proposals under consideration. Local governments may also seek formal intervenor status in the Energy Commission process.

◩ California Public Utilities Commission

The California Public Utilities Commission (CPUC) regulates the rates, safety and standards of service of privately owned and operated natural gas, electric, steam, pipeline, and transmission line utilities. These utilities are known as investor-owned utilities, or IOUs. The CPUC does not regulate municipal or district-owned utilities. The CPUC's primary objective is to ensure adequate facilities and services for the public at reasonable and equitable rates, consistent with a fair return to the utility on its investment. It is also required to promote energy and resource conservation through its various regulatory decisions.

In the absence of Energy Commission jurisdiction, energy facilities proposed by the IOUs are often the subject of CPUC permits. The CPUC conducts a CEQA review, with some minor additional steps. The agency prepares an Environment Impact Report (EIR) and solicits input from affected local agencies. Final project approval authority rests with the CPUC. If the CPUC finds that the project is necessary and in the public interest, the CPUC issues a Certificate of Public Convenience and Necessity (CPCN) to approve the project.

If the proposed project is under the Energy Commission's jurisdiction, i.e., a thermal power plant with 50 MW or more net generating capacity, the Energy Commission is the lead agency, issuing its own Certificate. The CPUC also issues a CPCN on the project, but the CPCN is limited to cost effectiveness and reasonableness. The Energy Commission and CPUC procedures run simultaneously, but a CPCN is normally granted if the facility is certified by the Energy Commission.

Local governments are involved in CPUC review of energy projects through the CPCN proceeding. Local agencies can participate in workshops and hearings, and provide written comments on proposals throughout the CPCN process.

◩ State Lands Commission

The State Lands Commission has jurisdiction over public lands of two distinct types — sovereign and school lands. Sovereign lands include the beds of navigable rivers, lakes, streams and sloughs as well as tidal and submerged lands out to three miles. Sovereign lands are held in trust and they may not be sold. School lands include what remain of nearly 5.5 million acres throughout the state, originally granted to the state by the federal government to support public education. The state retains surface and mineral ownership of approximately 570,000 acres and mineral rights to an additional 760,000 acres.

Specific to energy facilities, anyone proposing to use such state-owned lands must obtain a Land Use Lease from the SLC. These leases are required for energy facility projects such as oil terminals, oil and gas pipelines, and electric transmission lines. In addition, SLC authorization is required for dredging, mining, and oil, gas or geothermal exploration activities. Anyone proposing to explore for geothermal resources on state-owned lands, or public lands in which the state holds the mineral rights, must obtain a Geothermal Exploration or Prospecting Permit or lease from the SLC.

An Exploration Permit is used for information-gathering only. It does not give the applicant any preferential right to a geothermal development lease. The Prospecting Permit differs from the Exploration Permit. The Prospecting Permit is exclusive and conveys preferential rights to the applicant for later geothermal leases upon discovery of geothermal resources in commercial quantities.

Geothermal exploration and development are treated separately for CEQA purposes. An exploratory well is defined as one which is not closer than one-half mile from a well deemed capable of producing geothermal resources in commercial quantities. The Department of Conservation, Division of Oil, Gas and Geothermal Resources (DOGGR), discussed below, serves as the lead agency under CEQA in all counties except Imperial (where CEQA authority rests with the county) for any project which proposes to drill up to six exploratory wells. As a responsible agency, the SLC's Mineral Resources Management Division comments on both exploration and development environmental documents and works with the applicant or lessee to resolve or mitigate environmental impacts.

Local governments participate in SLC review of energy projects through both the CEQA process and individual lease or permit applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

If more than six wells are drilled, they are considered development wells and CEQA lead agency authority is vested with the county in which the activity is taking place.

◩ Department of Conservation, Division of Oil, Gas and Geothermal Resources

The Department of Conservation, Division of Oil, Gas and Geothermal Resources (DOGGR) supervises the drilling, operation, maintenance and abandonment of oil, gas and geothermal wells. DOGGR's role is to prevent waste and damage to oil, gas, and geothermal deposits; prevent damage to property and natural resources; protect freshwater resources from contamination due to oil, gas, and geothermal operations; and to ameliorate land subsidence over or adjacent to oil or gas pools when this land surface is subject to inundation from the sea or geothermal operations in Imperial County.

Specific to energy projects, anyone proposing to drill, rework, or plug and abandon an oil, gas or geothermal well must obtain written approval from DOGGR. Applicants proposing gas storage and underground injection projects associated with oil, gas, and geothermal operations must also obtain well permits. The Division issues three types of permits: a permit to drill a new well; a permit to plug and abandon a well; and a permit to deepen or alter the casing in an existing well. In addition, an injection project approval letter must be submitted for all injection projects.

A geothermal field development project differs from a geothermal exploratory project; a field development project consists of all facilities necessary for the production and use of geothermal resources. DOGGR is the lead agency under CEQA for geothermal exploratory projects. These projects consist of not more than six wells drilled to evaluate geothermal resources which are at least 1/2 mile (surface distance) from an existing geothermal well deemed capable of commercial production. DOGGR is usually not the lead CEQA agency for geothermal field development projects or any oil and gas wells. Local agencies normally prepare these environmental documents.

Local governments can participate in DOGGR's review of energy projects through both the CEQA process and individual permit applications. In both instances, responsible agencies and other interested parties are invited to

comment. For exploratory projects requiring an EIR, local governments and the public may comment during public hearings.

California Air Resources Board

The California Air Resources Board (CARB) is charged with coordinating efforts to attain and maintain ambient air quality standards; conducting research into the causes of and solutions to air pollution; and addressing the environmental problems caused by motor vehicles.

Specific to energy facilities, CARB has no permitting role in the siting of energy facilities, but the agency oversees the activities of the local Air Pollution Control Districts and Air Quality Management Districts (APCD/AQMD). Under state law, local and regional air pollution control districts have the primary responsibility for controlling air pollution from all sources other than vehicles. Control of vehicular sources is the responsibility of the CARB. CARB also sets the state's policy for control of stationary sources and sets suggested control measures for the 33 local districts. Individual districts may strengthen these control measures in order to enhance their local pollution control programs.

CARB is the air pollution control agency for California for all purposes set forth in the federal Clean Air Act (CAA). It has primary responsibility for preparing the State Implementation Plan (SIP) required of all states by the CAA, and is responsible for attainment of the ambient air quality standards established by the U.S. EPA. CARB divides the state into air basins and adopts standards of air quality for each basin. The Board inventories sources of air pollution in each air basin, monitors air pollutants, and adopts test procedures to measure compliance with its nonvehicular emission standards and those of the districts. CARB also helps develop emission standards for nonvehicular sources and approves all rules before they are implemented by local air pollution districts.

Local governments can participate in CARB's review of energy projects through proceedings initiated at the local level. Regarding the air quality impacts of stationary sources such as energy facilities, CARB submits comments to the local AQMD or APCD during the Authority to Construct permit process, and to the Energy Commission during the Application for Certification process. CARB does not hold its own independent hearings or include public comment in these proceedings.

State Water Resources Control Board

The State Water Resources Control Board (SWRCB) allocates new water rights and administers water appropriation laws to ensure maximum beneficial use of the state's waters and protection of the public's interest in water development. Anyone proposing to divert water (except for small domestic use) from a surface stream or other body of water, or from a subterranean stream flowing through a known and definite channel, for direct use on non-riparian land, or who proposes to store water seasonally in a reservoir, must first obtain a Permit to Appropriate Water from the SWRCB. This permit establishes the developer's right to use water and the priority of that right in relation to other water users. Small domestic water users must obtain a Registration of Small Domestic Use Appropriation.

Specific to energy facilities, obtaining a Permit to Appropriate Water is a mandatory prerequisite to constructing any hydroelectric facility. This water rights permit is not required for the use of purchased water, for pumping water which freely percolates through a groundwater basin, for the proper exercise of a riparian right, or for the continued use of an appropriative right initiated prior to December 14, 1914. For the latter two claims of right, however, a user must file a Statement of Water Diversion and Use with the SWRCB. This is an informational record which allows the SWRCB to notify water users of applications by others that might affect their water supply.

Granting a water rights permit is subject to CEQA except in instances where FERC has a preemption regarding environmental requirements on the project. With the exception of public agencies such as water districts, the SWRCB is typically the lead agency for the preparation of the CEQA document. The SWRCB also certifies that an applicant for a federal Clean Water Act Section 401 permit complies with water quality standards.

The SWRCB also has a role in permitting storm water runoff from industrial facilities. The SWRCB grants a General Industrial Storm Water Permit for storm water runoff from energy facilities such as mining and oil and gas operations, and steam electric generating facilities. The SWRCB also issues a General Construction Activity Storm Water Permit for storm water discharges associated with any construction activity including clearing, grading, excavation, reconstruction, and dredge and fill operations that result in the disturbance of at least five acres of total land area. Finally, the SWRCB issues Certification of Adequacy of Water Rights per Public Utilities Code Section 2821.

Local governments can participate in SWRCB review of energy projects through both the CEQA process and individual permit applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

Regional Water Quality Control Board

The California Regional Water Quality Control Boards (RWQCB) form a state entity with specified regional geographic jurisdictions. The Boards are responsible for formulating regional water quality plans and adopting and enforcing waste discharge requirements. They have also been delegated limited federal authority by the U.S. Environmental Protection Agency (EPA) to certify projects under the federal Clean Water Act. The Regional Boards follow the policies adopted by the State Water Resources Control Board (SWRCB), which is responsible for licensing the appropriation of water and controlling and preventing water pollution.

Specific to energy projects, the Regional Boards are concerned with the impact of these proposed projects on the quality of surface and ground waters. Major water quality impacts normally occur during project construction, when earth may be disturbed near rivers and streams. The Boards also review ground or surface water discharges from energy projects for toxicity.

The RWQCBs' permitting authority consists of Waste Discharge Requirements (WDR) or WDR waivers, and National Pollutant Discharge Elimination System (NPDES) permits. The owner or operator of any energy facility that discharges waste which may affect groundwater quality must first obtain WDRs from the appropriate Regional Board. Activities that do not pose a threat to water quality may be granted a WDR waiver. If an energy facility or project will discharge waste (including storm water runoff for certain industrial or construction activities) into any surface waters of the state, the owner or operator must obtain a NPDES permit, rather than WDRs. NPDES permits, issued by the RWQCB in the project area, are in effect for five years.

In addition, developers whose discharges are composed entirely of industrial storm water runoff may be eligible to be regulated under a General Industrial Storm Water Permit issued by the State Water Resources Control Board (SWRCB), rather than under an individual NPDES permit issued by the appropriate RWQCB as stated above. This general industrial storm water permit regulates runoff from industrial activities including mining and oil and gas facilities, and steam electric generating facilities.

Local governments can participate in RWQCB review of energy projects through both the CEQA process and individual permit applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

Department of Water Resources

The California Department of Water Resources (DWR) has general responsibility for water resource development and conservation, and flood control. DWR built and operates the State Water Resources Development System to supply good quality water for municipal, industrial, agricultural and recreational uses and for fish and wildlife protection and enhancement. State Water Project facilities generate hydroelectric power to pump SWP water. DWR is also co-owner of a coal-fired plant near Las Vegas. The power from this plant is also used for pumping water. DWR often has surplus power to sell or exchange with investor-owned utilities and municipal utilities.

DWR also supervises the construction, maintenance and operation of more than 1,200 non-federal dams. Anyone proposing to construct or enlarge a dam or reservoir must obtain DWR's written approval of the project plans and specifications prior to the start of construction. The developer must also obtain a Certificate of Approval to Store Water in order to impound water after the new or enlarged dam is built. Federal dams are exempt from the DWR approval process. Anyone proposing to alter, repair or remove a dam or reservoir must also obtain written approval from the Department.

In addition, any public or private entity requiring permanent or temporary access within, under or over State Water Project facilities' right-of-way must obtain an Encroachment Permit from the Department. This right-of-way includes operating roads, aqueducts, reservoirs, pipelines and transmission lines.

California Coastal Commission

The California Coastal Commission (CCC) is responsible for regulating development in the coastal zone, an area extending seaward three miles and inland to an average of approximately 1,000 yards from the mean high tide of the sea. In coastal estuaries, watersheds, wildlife habitats and recreational areas, the coastal zone may extend as much as five miles inland. In developed urban areas, the coastal zone may extend inland less than 1,000 yards from the mean high tide line. The coastal zone does not include areas over which the San Francisco Bay Conservation and Development Commission (BCDC) has permit authority. (See BCDC near the end of this listing.)

The CCC retains authority over tidelands, submerged lands, and certain lands held in the public trust. The Commission also retains authority to determine whether federal project activity in the coastal zone and the Outer Continental Shelf is consistent with state policies for the coast. The CCC further retains authority to determine appeals of locally issued development permits and must approve all amendments to the local coastal program. The Commission is also required to periodically review each certified local coastal program to determine whether the program is being effectively implemented in conformity with the Coastal Act.

Specific to energy facilities, anyone proposing development within the coastal zone must obtain a Coastal Development Permit from either the CCC or the city or county having authority to issue these permits. The California Coastal Act of 1976 authorized the CCC to issue these permits until such time as the cities and counties within the coastal zone obtained certification of their own local coastal development programs. Once a local program is certified by the CCC, authority to issue most Coastal Development Permits reverts to the city or county.

The CCC is concerned with the impact of proposed energy projects on all resources under its jurisdiction. The CCC is the lead agency for CEQA review if the project crosses a large amount of land in the coastal zone, and there are no other California agencies with a greater degree of involvement. If the project proponent is a public agency, it would have the lead role. If the Energy Commission has jurisdiction, it is required to coordinate its review of proposed coastal power plant projects with the CCC.

Local governments can participate in CCC review of energy projects through both the CEQA process and individual Coastal Development Permit applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

Department of Fish and Game

The Department of Fish and Game (DFG) is a trustee agency responsible for managing and protecting California's fish, wildlife and native plant resources.

Specific to energy facilities, DFG is concerned with the impact of proposed projects on these resources. Any entity proposing any activity that will divert or obstruct the natural flow or change the bed, channel or bank of any river, stream or lake, or proposing to use any material from a streambed, must obtain a Lake or Streambed Alteration Agreement from the DFG. DFG is primarily concerned with a project's potential impact on endangered species, and the potential for altering the natural conditions of rivers, streams or lakes. CEQA lead agencies are required by the California Endangered Species Act to consult with DFG regarding a project's potential impact on endangered species.

DFG is authorized by the U.S. Fish and Wildlife Service (USFWS) to be responsible for the impacts of California projects on any federally-listed endangered species. When federally-listed species are affected, DFG normally notifies the USFWS and requests joint review of project and biological data. If a California project involves a federal agency permit or funding, the USFWS is normally involved. DFG acts as the liaison between the USFWS and the CEQA lead agency.

As part of the CEQA review process, DFG prepares a Biological Opinion on whether the proposed energy facility adversely affects endangered species. DFG also concurrently assesses the project's impact on streams, rivers or lakes, and the significance of this impact. Based on the results of this assessment, DFG issues or denies a Stream or Lake Alteration Agreement. More stringent DFG policies apply to projects proposed for wetland areas.

Local governments can participate in CDF review of energy projects through both the CEQA process and individual Stream or Lake Alteration Agreement proceedings. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

Department of Forestry and Fire Protection

The California Department of Forestry and Fire Protection (CDF) is responsible for regulating timber harvesting practices, conversion of timberland to other uses, and for preventing and suppressing wildfires on over 38 million acres of state and privately-owned lands.

Specific to energy facilities, CDF is interested in the impact of proposed projects on timberland productivity, on timber harvesting associated effects on the environment, and for their wildfire potential. This is normally limited to privately-owned timberlands, as the U.S. Forest Service, and other federal agencies, are responsible for timber resources on federally-owned forest lands.

The permit normally issued by the CDF is a Timber Harvest Plan and/or Timberland Conversion Permit. Public agencies such as municipal utilities are not required to obtain either of these permits when they are building or maintaining a power line right-of-way on their own or other public land. However, one or both of these permits will be required when a public agency is involved in a right-of-way which remains in private ownership.

Local governments have primary jurisdiction over the zoning of lands as Timberland Production Zones. However, the CDF becomes involved in development projects on timberland, whether or not it is zoned Timberland Production Zone, since CDF must issue a Timberland conversion Permit and approve a Timber Harvest Plan. If facility construction will result in the need to dispose of vegetative debris through burning, the project proponent must also obtain a burning permit from either a local fire protection agency or CDF.

The CDF's responsibilities also include implementation of fire prevention statutes, which come into play during the construction and maintenance of energy facilities. These include clearance requirements for welding, use of fire, and around structures, ingress and egress road widths, fire fighting water supply and hydrants, maintenance of fire protection equipment during construction, burning permit requirements and power line clearance standards.

Local governments, and other state agencies participate with CDF in the review of energy projects through the CEQA process. CDF is the lead agency for the review and issuance of Timber Harvest Plans and Timberland Conversion permits. In each of these instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments during the proceedings.

Department of Parks and Recreation

The California Department of Parks and Recreation manages state park lands under its jurisdiction. Specific to energy facilities, any project proponent who needs access across state park property must obtain what the Department of Parks and Recreation refers to as a "right-of-way." A right-of-way can take the form of a permit or license, easement, joint use agreement, or lease. The Department may issue a right-of-way if it determines that it will not be detrimental to park resources and management, no other reasonable access exists, there is statutory authority to comply with the request, and there are no deed restrictions precluding its issuance. Rights-of-way exist for specific periods. A project developer can renew a permit by submitting a new application, and may amend a right-of-way application or approved contract. The state can revoke a permit pursuant to its terms.

Local governments can participate in the Department's review of energy projects through both the CEQA process and individual right-of-way applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

Department of Transportation

The Department of Transportation (Caltrans) manages the state's highways and land within the Department's jurisdiction. As part of its regulatory activities, the Department must issue an Encroachment Permit for all activities proposed by any public or private entity, unless conducted under Caltrans authority, which involve an encroachment upon the State highway right-of-way.

Specific to energy projects, activities within the right-of-way that require an Encroachment Permit include constructing and maintaining road approaches or connections to or grading on any state highway, and access to pipelines and transmission lines.

Private facilities with franchise rights from local agencies which run parallel to and fall in the right-of-way of conventional highways also require Caltrans approval. Proposed encroachments that require permanent access or maintenance in highway rights-of-way are extreme cases and are considered only with certain restrictions, including the requirement that the encroachment must be a public facility or utility dedicated to public use.

Any public comment or public hearings will occur during CEQA review prior to the application for an Encroachment Permit. No public input occurs during the permit process itself.

Reclamation Board

The Reclamation Board is responsible for flood control facilities (levees, embankments and weirs) on the Sacramento and San Joaquin rivers or any of their tributaries, and planning for flood control and reclamation related to these rivers. The Board works in conjunction with the California Department of Water Resources, which has statewide responsibility for flood control.

Specific to energy facilities, any public or private entity proposing an activity adjacent to levees or streams along or near the banks or levees of the Sacramento and San Joaquin rivers, flood control bypasses, or in or adjacent to other regulated Central Valley streams, must obtain an Encroachment Permit from the Board. Applicable activities include installing, sealing or removing gas mains and power lines, removing or depositing earth, and drilling water, oil or gas wells.

Local governments can participate in Reclamation Board review of energy projects through both the CEQA process and individual encroachment permit applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

California Integrated Waste Management Board

The California Integrated Waste Management Board (CIWMB) regulates non-hazardous solid waste in California. This includes overseeing the operations of solid waste facilities such as landfills, transfer-processing stations, compost facilities, and waste-to-energy plants, and certain recycling activities.

Specific to energy facilities, anyone proposing to operate a solid waste energy facility must first obtain a solid waste facilities permit from the local enforcement agency (LEA) with jurisdiction over the proposed site. The CIWMB must concur in the issuance of a proposed permit before it may be issued by the LEA. LEAs may exempt solid waste facilities from the permit requirement provided the LEA can make findings that the exemption is not against the public interest; the quantity of solid waste is insignificant; there is no significant threat to health, safety, or the environment; and the facility meets certain classifications. (See Title 14, California Code of Regulations, 18215.) Historically, the CIWMB has not required energy facilities to obtain a permit if the facility burns only source separated materials, such as wood or tires. The three energy facilities which have been issued solid waste facilities permits burn mixed municipal solid waste.

The primary considerations when issuing permits are preventing environmental damage, providing long-term protection of the environment, and ensuring that facilities will operate in compliance with state standards and financial assurance requirements. The CIWMB evaluates each project's effect on public health and the environment. The Board considers the effect of the project's proximity to sensitive areas, such as residential or commercial developments, although siting decisions are made at the local level. The Board may reject a project if it poses a hazard to nearby residential areas. The Board may also reject a project that will contaminate surface water or groundwater, although surface and groundwater issues are primarily in the jurisdiction of the Water Board. The CIWMB will reject proposals for waste facilities that do not have local land use approval.

Local governments can participate in CIWMB review of energy projects through both the CEQA process and individual solid waste facility permit applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

Department of Toxic Substances Control

The Department of Toxic Substances Control (DTSC) works to protect and enhance public health and the environment by regulating the handling, storage, transportation, and disposal of hazardous waste and promoting the reduction of this waste. Anyone who stores, treats or disposes of hazardous waste must obtain a Hazardous Waste Facilities Permit from the Department.

Specific to energy projects, types of facilities that require a Hazardous Waste Facilities Permit include storage (either onsite or offsite), treatment, disposal, and resource recovery. Permitting “tiers” match the requirements placed on hazardous waste facilities with the hazard posed by that facility’s operation. Several different levels or “tiers” of permits may be required, each with different regulatory burdens, depending on the severity of the activity involved. The DTSC also has authority to issue permits deemed equivalent to the federal permit required by the Resource Conservation and Recovery Act, so a separate federal permit from the U.S. Environmental Protection Agency is not necessary.

Local governments can participate in DTSC review of energy projects through both the CEQA process and individual hazardous waste permit applications. In both instances, responsible agencies and other interested parties are invited through public notices to comment during public hearings and workshops, and to provide written comments at any time during the proceedings.

San Francisco Bay Conservation and Development Commission

The San Francisco Bay Conservation and Development Commission (BCDC) is also a state agency with a specified regional geographic jurisdiction. BCDC is responsible for planning and regulating development in the San Francisco Bay itself and along the immediate shore line. BCDC’s jurisdiction also includes San Pablo and Suisun Bays, adjacent streams, and the Suisun Marsh. Anyone proposing to fill, extract materials, or change the use of water, land or structures in or around these areas must obtain a Development Permit from BCDC. BCDC’s permit jurisdiction extends 100 feet inland from either the mean high tide line or five feet above mean sea level in marshes around the San Francisco, San Pablo and Suisun Bays.

Specific to energy facilities, BCDC is concerned with the impacts of proposed projects on the Bay’s visual and other sensitive resources such as coastal wetlands and plant and wildlife species. BCDC is the CEQA lead agency if the project crosses a large amount of land in the Bay zone, and there are no other California agencies with a greater degree of involvement. If the Energy Commission has jurisdiction, it is required to coordinate its review of proposed energy facilities affecting the Bay with BCDC.

Local governments can participate in BCDC’s review of energy projects through the EIR process under CEQA’s mandate, or through Energy Commission proceedings. This includes participating in public workshops and hearings, and providing written comments on development proposals.

Tahoe Regional Planning Agency.

The Tahoe Regional Planning Agency (TRPA), a bi-state agency with a specified regional geographic jurisdiction, was established by interstate compact between California and Nevada. Anyone proposing any development in the Lake Tahoe Basin must obtain approval from TRPA, which has adopted a regional development plan for the Basin. TRPA implements this plan by applying ordinances to all development projects which could affect the area.

For energy projects, TRPA has established environmental carrying capacity thresholds for air quality, water quality, scenic quality, soils, vegetation, wildlife, fisheries, noise and recreation. TRPA reviews these projects to determine whether these thresholds would be exceeded, and must deny those projects which exceed the thresholds. The Tahoe Compact requires the preparation of a federal Environmental Impact Statement (EIS) for every project which may have an effect on the environment, as required by the National Environmental Policy Act (NEPA). The EIS is prepared by TRPA and may be used by other California agencies in lieu of an EIR.

Local governments can participate in TRPA’s review of energy projects through the EIS process under NEPA’s mandate. This includes participating in public workshops and hearings, and providing written comments on development proposals.

NOTES NOTES NOTES

APPENDIX D: STATE AND FEDERAL OFFICES INVOLVED IN ENERGY FACILITY PERMITTING

The addresses and telephone numbers of the following agencies involved in energy facility permitting are listed in this appendix in this order:

STATE AND REGIONAL AGENCIES

Department of Fish & Game
Department of Forestry and Fire Protection
Department of Housing and Community Development
Department of Parks and Recreation
Department of Water Resources
Department of Toxic Substances Control
Department of Transportation
CAL/OSHA Consultation Offices
Coastal Commission
Energy Commission
Integrated Waste Management Board
Public Utilities Commission
Reclamation Board
San Francisco Bay Conservation and Development Commission
State Lands Commission
State Water Resources Control Board
Tahoe Regional Planning Agency

FEDERAL AGENCIES

U.S. Army Corps of Engineers
U.S. Department of Agriculture
U.S. Department of the Interior, Bureau of Land Management

DEPARTMENT OF FISH AND GAME

State Headquarters
1418 Ninth Street, 12th Floor
Sacramento, CA 95814
(916) 653-7664
(916) 653-1856 (fax)

Northeast District
601 Locust
Redding, CA 98001
(916) 225-2300
(916) 225-2381 (fax)

Central Valley District
1701 Nimbus Road
Rancho Cordova, CA 95870
(916) 355-0978
(916) 355-7102 (fax)

Napa Valley District
7829 Silverado Trail
Napa, CA 94588
(707) 944-5500
(707) 944-5563 (fax)

Bay Area District
1234 East Shaw Avenue
Fresno, CA 93710
(209) 222-3761
(209) 445-6426 (fax)

Southern District
330 Golden Shore, Suite 50
Long Beach, CA 90602
(310) 590-5132
(310) 570-5193 (fax)

DEPARTMENT OF FORESTRY AND FIRE PROTECTION

(Timber Harvesting Plan)
The Department of Forestry and Fire Protection (Headquarters)
1416 Ninth Street
Sacramento, CA 95814
(916) 653-7211

(Timberland Conversion Permit)
North Coast Region
135 Ridgeway Avenue
Santa Rosa, CA 95402
(707) 576-2275

Sierra Cascade Region
6105 Airport Road
Redding, CA 96002
(916) 224-2445

South Sierra Region
1234 East Shaw Avenue
Fresno, CA 93710-7899
(209) 222-3714

Southern California Region
2524 Mulberry Street
Riverside, CA 92501
(714) 782-4140

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

(Permit to Construct)

Division of Codes and Standards
Northern Area Office
8911 Folsom Boulevard
Sacramento, CA 95826
(916) 255-2501

Division of Codes and Standards
Southern Area Office
2038 Iowa Avenue, Building B, Suite 102
Riverside, CA 92507
(909) 782-4420

DEPARTMENT OF PARKS AND RECREATION
(Right-of-Way)

Office of Park Services
1416 9th Street, Room 1431
Sacramento, CA 94296-0001
(916) 653-4272

DEPARTMENT OF WATER RESOURCES

(Approval of Plans and Specifications to Construct, Enlarge, Repair, Alter, or Remove a Dam or Reservoir; and Certificate of Approval to Store Water)

Division of Safety of Dams
2200 “X” Street, Suite 200 (95818)
P.O. Box 942836
Sacramento, CA 94299-9836
(916) 445-8768

(Encroachment Permit)

Division of Land and Right-of-Way
1416 Ninth Street (95814)
P.O. Box 942836
Sacramento, CA 94299-9836
(916) 653-8490

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Headquarters Office
400 P. Street
P.O. Box 806
Sacramento, CA 95812-1826
(916) 324-1826

Region 1- Sacramento Office
10151 Croydon Way, Suite 3
Sacramento, CA 95827
(916) 255-3545

Region 1 - Clovis Office
(Surveillance & Enforcement and Site Mitigation Branch Office)
1515 Toll House Road
Clovis, CA 93612
(209) 297-3901

Region 2 - Berkeley
700 Heinz Avenue, Bldg. F,
Suite 200. Berkeley, CA 94710
(510) 540-2122

Region 3 - Glendale
1011 Grandview Avenue
Glendale, CA 91201
(818) 551-2800

Region 4 - Long Beach
245 West Broadway, Suite 350
Long Beach, CA 90802
(310) 590-4868

DEPARTMENT OF TRANSPORTATION
(Encroachment Permit)

1656 Union Street
Eureka, CA 95501
(707) 445-6385

1000 Center Street
Redding, CA 96001
(916) 225-3400

801 B Street
Marysville, CA 95901
(916) 741-5374

111 Grand Avenue
P.O. Box 23660
Oakland, CA 94623
(510) 286-4404

50 Higuera Street
San Luis Obispo, CA 93401
(805) 549-3152

1333 West Olive Avenue
Fresno, CA 93728
(209) 445-6578

120 South Spring Street
Los Angeles, CA 90012
(213) 897-3631

247 W. Third Street
San Bernardino, CA 92492
(714) 383-4017

500 South Main
Bishop, CA 93514
(619) 872-0671

1976 East Charter Way
Stockton, CA 95206
(209) 948-7891

4080 Taylor Street
San Diego, CA 92110
(619) 688-6843

2501 Pullman Street
Santa Ana, CA 92705
(714) 724-2260

CAL/OSHA CONSULTATION OFFICES

Headquarters
455 Golden Gate Avenue,
Room 5246
San Francisco, CA 94102
(415) 703-4050

Santa Fe Springs
10350 Heritage Park Dr., Suite 201
Santa Fe Springs, CA 94403
(310) 944-9366

Fresno
1901 N. Gateway, Suite 102
Fresno, CA 93727
(209) 454-1295

Sacramento
2424 Arden Way, Suite 410
Sacramento, CA 95825
(916) 263-2855

San Diego
7827 Convoy Court, Suite 406
San Diego, CA 92111
(619) 279-3771

San Mateo
3 Waters Park Drive, Room 230
San Mateo, CA 94403
(415) 573-3864

Anaheim
2100 East Katella Avenue,
Suite 200
Anaheim, CA 92806
(714) 939-7602

San Fernando Valley
3550 West 6th Street, Room 415
Los Angeles, CA 90020
(213) 736-2187

COASTAL COMMISSION
(Coastal Development Permit)

North Coast District
North Coast Area Office
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219
(415) 904-5260

Central Coast District
Central Coast Area Office
725 Front Street, Suite 300
Santa Cruz, CA 95060-4508
(408) 427-4863

South Central Coast Area Office
89 S. California Street, Suite 200
Ventura, CA 93001-2801
(805) 641-0142

South Coast District
South Coast Area Office
245 West Broadway, Suite 380
Long Beach, CA 90802-4416
(213) 590-5071

San Diego Coast Area Office
3111 Camino Del Rio North,
Suite 200
San Diego, CA 92108-3520
(619) 521-8036

Headquarters Office
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219
(415) 904-5200

ENERGY COMMISSION
1516 9th Street
Siting Office
(916) 654-3928
Sacramento, CA 95814

INTEGRATED WASTE MANAGEMENT BOARD
(Solid Waste Facilities Permit)

8800 Cal Center Drive
Sacramento, CA 95826
(916) 255-2200

PUBLIC UTILITIES COMMISSION
(Certificate of Public Convenience and Necessity)

Public Utilities Commission
State Office Building
505 Van Ness Avenue
San Francisco, CA 94102
(415) 703-1282

RECLAMATION BOARD
(Application for a Permit/ Encroachment Permit)

Floodway Protection Section
1416 Ninth Street, Room 455-8
Sacramento, CA 95814
(916) 653-5726

SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION (BCDC)
(Development Permit)

30 Van Ness Avenue, Room 2011
San Francisco, CA 94102
(415) 557-3686

STATE LANDS COMMISSION

Executive Office
100 Howe Avenue, Ste. 100-South
Sacramento, CA 95825-8202
(916) 574-1800

Division of Land Management
Land Use Lease
(916) 574-1940
Dredging Lease
(916) 574-1890
Marine Salvage Permit
(916) 574-1850

Division of Environmental Planning and Management
(916) 574-1890

Mineral Resources Management
200 Oceangate, 12th Floor
Long Beach, CA 90802-4331

Geothermal Exploration or Prospecting Permit
(310) 590-5201

Mineral Prospecting Permit
(310) 590-5201

Marine Facilities Division
330 Golden Shore, Suite 210
Long Beach, CA 90802-4246
(310) 499-6312

STATE WATER RESOURCES CONTROL BOARD

Headquarters
901 P Street
P.O. Box 100
Sacramento, CA 95812-0100
(916) 657-2390

Division of Clean Water Programs
Underground Storage Tank Program
P.O. Box 944212
Sacramento, CA 94244-2120
(916) 227-4303

North Coast Region
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403
(707) 576-2220
(707) 523-0135 (fax)

San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, CA 94612
(510) 286-1255
(510) 286-1830 (fax)

Central Coast Region
61 Higuera Street, Suite 200
San Luis Obispo, CA 93401-2156
(805) 549-3147
(805) 643-0397 (fax)

Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754-2156
(213) 266-7500
(213) 266-7600 (fax)

Central Valley Region
3443 Routier Road
Sacramento, CA 95827-3098
(916) 255-3000
(916) 255-3015 (fax)

Fresno Branch Office
3514 East Ashlan Avenue
Fresno, CA 93726
(209) 445-5116
(209) 445-5910 (fax)

Redding Branch Office
415 Knollcrest Drive
Redding, CA 96002
(916) 224-4845
(916) 224-4857 (fax)

Lahontan Region
2092 Lake Tahoe Blvd, Suite 2
South Lake Tahoe, CA 96150
(916) 544-5400
(916) 544-2271 (fax)

Victorville Branch Office
15428 Civic Drive, Suite 100
Victorville, CA 92392-2383
(619) 241-6583
(619) 241-7308 (fax)

Colorado River Basin Region
73-720 Fred Waring Drive,
Suite 100
Palm Desert, CA 92260
(619) 346-7491
(619) 341-6820 (fax)

Santa Ana Region
2010 Iowa Avenue, Suite 100
Riverside, CA 92507-2409
(909) 782-4130
(909) 781-6288 (fax)

San Diego Region
9771 Clairemont Mesa Blvd,
Suite B
San Diego, CA 92124
(619) 467-2952
(619) 571-6972 (fax)

TAHOE REGIONAL PLANNING AGENCY
(Project Permit)

195 U.S. Highway 50
P.O. Box 1038
Zephyr Cove, Nevada 89448-1038
(702) 588-4547

U.S. ARMY CORPS OF ENGINEERS

San Francisco District
Corps of Engineers
211 Main Street
San Francisco, CA 94105-1905
(415) 744-3036

Sacramento District
Corps of Engineers
1325 "J" Street
Sacramento, CA 95814
(916) 557-5250

Los Angeles District
Corps of Engineers
300 North Los Angeles Street
(90012)
P.O. Box 2711
Los Angeles, CA 90053-2325
(213) 894-5606

U.S. DEPARTMENT OF AGRICULTURE
(USDA Forest Service)

Angeles National Forest
Supervisor's Office
701 North Santa Anita Avenue
Arcadia, CA 91006
(818) 574-1613

Cleveland National Forest
Supervisor's Office
10845 Rancho Bernardo Road
San Diego, CA 92127-2107
(619) 673-6180

El Dorado National Forest
Supervisor's Office
100 Forni Road
Placerville, CA 95667
(916) 622-5061

Klamath National Forest
Supervisor's Office
1312 Fairlane Road
Yreka, CA 96097
(916) 842-6131

Lassen National Forest
Supervisor's Office
55 South Sacramento Street
Susanville, CA 96130
(916) 257-2151

Mendocino National Forest
Supervisor's Office
420 East Laurel Street
Willows, CA 95988
(916) 934-3316

Plumas National Forest
Supervisor's Office
159 Lawrence Street, Box 11500
Quincy, CA 95971
(916) 283-2050

Sequoia National Forest
Supervisor's Office
900 West Grand Avenue
Porterville, CA 93257-2035
(209) 784-1500

Sierra National Forest
Supervisor's Office
1600 Tollhouse Road
Clovis, CA 93612
(209) 487-5155

Stanislaus National Forest
Supervisor's Office
19777 Greenley Road
Sonora, CA 95370
(209) 532-3671

Inyo National Forest
Supervisor's Office
873 North Main Street
Bishop, CA 93514
(619) 873-2400

Lake Tahoe Basin
Management Unit
P.O. Box 731002
870 Emerald Bay Road, Suite 1
South Lake Tahoe, CA 96150
(916) 573-2600

Los Padres National Forest
Supervisor's Office
6144 Calle Real
Goleta, CA 93117
(805) 683-6711

Modoc National Forest
Supervisor's Office
441 North Main Street
Alturas, CA 96101
(916) 233-5811

San Bernardino National Forest
Supervisor's Office
1824 South Commercenter Circle
San Bernardino, CA 92408-3430
(714) 383-5588

Shasta-Trinity National Forest
Supervisor's Office
2400 Washington Avenue
Redding, CA 96001
(916) 246-5222

Six Rivers National Forest
Supervisor's Office
1330 Bayshore Way
Eureka, CA 95501
(707) 442-1721

Tahoe National Forest
Supervisor's Office
631 Coyote Street
P.O. Box 6003
Nevada City, CA 95959-6003
(916) 265-4531

U.S. DEPARTMENT OF INTERIOR - BUREAU OF LAND MANAGEMENT
(Developer-Applicant Inquiry)

California State Office
2800 Cottage Way, Room E-2807
Sacramento, CA 95825
(916) 978-4754

Bakersfield District
3801 Pegasus Drive
Bakersfield, CA 93308
(805) 391-6000
(805) 391-6072 (fax)

California Desert District
6221 Box Spring Boulevard
Riverside, CA 92507
(909) 697-5200
(909) 697-5299 (fax)

Susanville District
705 Hall Street
Susanville, CA 96130
(916) 257-5381
(916) 257-4831 (fax)

Ukiah District
2550 North State Street
Ukiah, CA 95482
(707) 468-4000
(707) 468-4027 (fax)

NOTES NOTES NOTES

APPENDIX E: SOURCES OF INFORMATION

The following sources of information are provided to assist local governments in energy facility planning. The sources are identified by organizations, university resource centers, publication and electronic and computer resource services. Additional information sources are located in individual chapters.

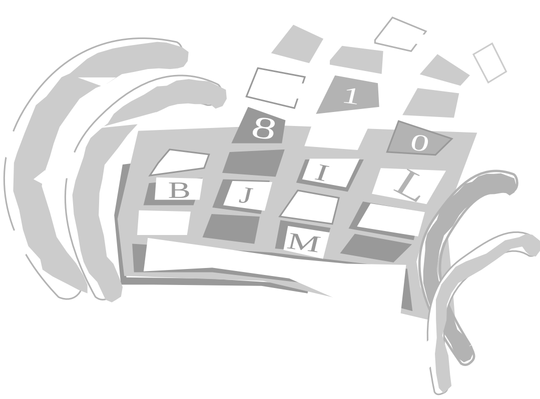
ORGANIZATIONS

Alliance to Save Energy

1725 K Street SW, Suite 509, Washington, DC 20006-1401. (202) 857-0666; Fax: (202) 331-9588. A coalition of business, government, environmental and consumer leaders who seek to increase the efficiency of energy use. Conducts research, pilot projects, and education programs. Publishes *Alliance Update* (quarterly newsletter) and reports, manuals, software, and other materials on energy topics.

American Association for Fuel Cells

50 San Miguel Avenue, Daly City, CA 94015. (415) 992-3963; Fax: (415) 755-0709. Promotes public understanding of fuel cells and their environmental benefit. Provides information to the public and conducts educational programs. Publishes a quarterly newsletter, *American Association for Fuel Cells Newsletter.*



American Council for an Energy Efficient Economy (ACEEE)

1001 Connecticut Avenue NW, Suite 801, Washington, DC 20036. (202) 429-8873; Fax: (202) 429-2248. Independent organization that gathers, evaluates and disseminates information to stimulate greater energy efficiency. Provides independent assessments of energy technologies and policies. Provides technical assistance and referrals to consumers. Advises policy-makers in both the private and public sector. Publishes *Energy Conservation and Energy Policy Series* and various research reports.

American Hydrogen Association

215 S. Clark Drive, Suite 103, Tempe, AZ 85281. (609) 921-0433. Individuals interested in renewable natural resources. Advocates transition from fossil and nuclear energy sources to solar-hydrogen technologies in order to help resolve environmental problems such as global warming, acid rain, ozone depletion and urban air pollution. Promotes the production of hydrogen from sewage and garbage and the generation of electricity from solar power. Publications include *Hydrogen Today* (bi-monthly newsletter) and numerous books on solar-hydrogen technologies.

American Wind Energy Association (AWEA)

122 C Street NW, Fourth Floor, Washington, DC 20002-2109. (202) 383-2500; Fax: (202) 383-2505. A professional membership association whose purpose is to encourage a high standard of business practices within the wind energy industry. Assists members in designing, building, installing, operating, and maintaining wind energy conversion systems and system components in a manner compatible with public health, safety, and environmental values. AWEA has a large publications catalog. Magazines and newsletters include *Wind Energy Weekly and Windletter.*

Biomass Energy Research Association

1825 K Street NW, Suite 503, Washington, DC 20006. (202) 785-2856. Promotes the development and commercialization of biomass energy systems. Supports technology transfer research of nonfossil fuels such as municipal solid waste, refuse-derived fuels, wood waste, and sludge.

California Municipal Utilities Association

1225 8th Street, Sacramento, CA 95814. (916) 441-1733. Trade association that represents publicly owned utilities before the California Legislature and various state Boards and Commissions.

Cogeneration Institute of the Association of Energy Engineers
4025 Pleasantdale Road, Suite 420, Atlanta, GA 30340. (404) 447-5083. Engineers, architects, manufacturers, and industrialists with an interest for energy management and cogeneration. Publishes *The Cogeneration Journal.*

Directory of Environmental Organizations, 1993
Educational Communications, P.O. Box 351419, Los Angeles, CA 90035-9119. (310) 559-9160. This directory lists the names, addresses, and telephone numbers of most national and local environmental organizations. Specific language concerning each group's functions and interests is not provided.

Edison Electric Institute
701 Pennsylvania Avenue NW, Washington, DC 20004. (202) 508-5660; Fax: (202) 508-5380. Trade association for investor-owned utilities. Many members have hydropower generating capacity. Every area of electric utility operation is covered. Provides consulting and reference services on any phase of electric utility business. Publishes *Electric Perspectives* (bi-monthly) and *Weekly Electric Power Output.*

Electric Power Research Institute (EPRI)
3412 Hillview, P.O. Box 10412, Palo Alto, CA 94303. (415) 855-2000; Fax: (415) 855-2954. Plans and manages research and development on behalf of the U.S. electric utility industry and the public to advance capabilities in electric power generation, delivery and use. Publishes *EPRI Journal* (eight times per year).

Fuel Cell Association
P.O. Box 66392, Washington, DC 20035. (301) 681-3532; Fax: (301) 681-4896. Promotes the development and use of fuel cells in all markets including utility, industrial, commercial, residential and aerospace/defense. Publishes *Fuel Cell News Quarterly.*

Gale Environmental Sourcebook
Gale Research Inc., 835 Penobscot Building, Detroit, MI 48226-4094. (800) 877-4253. A vast information resource that lists and describes government programs, research centers, organizations, books, directories, and much more relat-ing to environmental protection.

Geothermal Resource Council
2001 Second Street, Suite 5, POB 1350, Davis, CA 95617. (916) 758-2360; Fax: (916) 758-2839. A leading proponent of geothermal energy and a major center for information in the geothermal area. Conducts periodic workshops, seminars, and symposia. Publishes *Transactions* (annually), *Geothermal Council Bulletin* (monthly) and various special reports.

Independent Energy Producers Association
1001 G Street, Suite 103, Sacramento, CA 95814. (916) 448-9499; Fax: (916) 448-0182. Representative before the Legislature and State agencies (i.e. CEC and PUC) on behalf of membership which includes independent power products and qualifying facilities. Conducts annual member meeting. Publishes *Independent Energy Perspectives,* a bimonthly newsletter.

Institute of Gas Technology
3424 South State Street, Chicago, IL 60616.3896. (312) 567-5282; Fax: (312) 567-3857. Conducts research in solid waste management, including waste to energy and landfill stabilization, and distributes information to the public.

Lawrence Berkeley Laboratory
(LBL) MS-50A-4133, Berkeley, CA 94720. (415) 486-5111; Fax: (415) 486-6720. Operated by University of California at Berkeley under contract with U.S. Department of Energy. Research in Energy and Science Program includes energy and environmental sciences. Publications include *LBL Reports* (periodic) and *LBL Research Review* (quarterly). Additional contact: Public Information Department: (415) 486-5771.

Municipal Waste Management Association (MWMA)
C/O U.S. Conference of Mayors, 1620 I Street, NW, Washington, DC 20006. (202) 293-7330. Promotes resource recovery facilities and heating and cooling systems.

National Hydropower Association
122 C. Street NW, Fourth Floor, Washington, DC 20001. (202) 383-2530. Promotes the development of hydroelectric energy.

National Renewable Energy Lab
(NREL) 1617 Cole Boulevard, Golden, CO 80401-3313. (303) 231-1000. Conducts research on the renewable technologies, including photovoltaics, alternative fuels, wind energy, ocean energy, solar thermal energy, and energy efficiency technologies. Research results published in technical journals that are available from the National Technical Information Service

(NTIS). Also publishes *In Review,* a quarterly news magazine. Maintains Technical Inquiry Service which supplies NREL and subcontractors technical information to researchers and scientists. For information on Technical Inquiry Service contact Steve Rubin at (303) 275-4009 or via Internet/ E-mail at RUBIN@ TCPLINK.NREL.GOV.

National Wood Energy Association (NWEA)
777 North Capitol Street NE, Suite 805, Washington, DC 20002-4226. (202) 408-0664; Fax: (202) 408-8536. Lobbies Congress in support of biomass energy and works with federal agencies to address industry need and concerns. Publishes *Biologue,* a quarterly magazine.

Photovoltaics for Utility Scale Applications (PVUSA)
PVUSA Project Office, 3400 Crow Canyon Road, Sunset Building, San Ramon, CA 94583. (510) 866-5569. Provides utilities with hands-on experience with PV systems and allows PV manufacturers to gain experience in meeting the needs of utilities.

Renewable Fuels Association
1 Massachusetts Avenue NW, Suite 820, Washington, DC 20001. (202) 289-3835; Fax: (202) 289-3835. Represents the renewable fuels industry before the government and throughout the United States. Publishes a monthly newsletter.

Society for the Application of Free Energy
POB 8276, Silver Springs, MD 20910. (301) 587-8686. Promotes solar energy and other alternative energy programs. Research and development activities include photovoltaic cells, coal gasification and desulfurization systems.

Solar Energy Industries Association (SEIA)
122 C Street NW, Fourth Floor, Washington, DC 20002-2109. (202) 383-2600; Fax: (202) 383-2670. Ongoing reports on the state of the solar industry, including economic status and policy recommendations for accelerating most-effective technologies facing institutional barriers and market imperfections. Publishes *Solar Industry Journal,* a quarterly magazine.

Utility Wind Interest Group
(UWIG) Western Area Power Administration Representative, Steve Sargent, A0400, 1627 Cole Boulevard, Golden CO 80401-3393. (303) 231-1694.

UNIVERSITY RESEARCH CENTERS

Arizona State University
Center for Energy System Research
College of Engineering and Applied Sciences, Tempe, AZ 85287-5806. (602) 965-2896; Fax: (602) 965-0745. Dr. Byard D. Wood, Director. Energy management and biomass conversion to fuels, PV and PV system design. Provides energy analysis and diagnostic services. Research results published in journals, technical reports, theses and dissertations.

San Diego State University
Center for Energy Studies,
Department of Physics
San Diego, CA 92182. (619) 594-6240; Fax: (619) 594-5485. Dr. Alan Sweedler, Director. Energy, environmental and economic modeling for local regions. Economic analysis for energy systems. Air quality impacts on energy systems. Demand side management. Energy and environment in the US-Mexico border region. Research results published in technical reports and open literature.

University of California, Berkeley
Energy Research Group
Bldg T-9 RM 216, Berkeley, CA 94720. (510) 642- 9588; Fax: (415) 643-5180. Professor Richard J. Gilbert, Director. Two research programs:

1) The California Energy Studies Program which support faculty research on critical energy problems and issues facing California.

2) The Energy Science and Technology Research Program emphasizes basic science and engineering research related to development of energy technologies including conservation and renewable conventional energy sources. Publishes *Technical Report Series* (list available on request).

PUBLICATIONS

Biofuels Update
National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80401-3393. (303) 275-4347. Free quarterly newsletter.

Biologue
National Wood Energy Foundation, 777 Capitol Street NE, Washington, DC 20002. (202) 408-0664. Reports quarterly on biomass energy projects for the U.S. Department of Energy. Also chronicles outstanding biomass energy projects overseas.

Biomass Energy Directory, 1993
Independent Energy Magazine, 620 Central Avenue N., Milaca, MN 56353-1788. (612) 983-6892. Complete directory of the biomass market, company descriptions, and trade groups.

Center for Environmental Research Information

26 West Martin Luther King Drive, Cincinnati, OH 45268. (513) 569-7391. This center operates the U.S. Environmental Protection Agency's (EPA's) Office of Research and Development's electronic bulletin board system. A researcher with a computer modem can access 20,000 research reports by dialing (513) 569-7620. Reports, dated from 1977, are listed by title, author, abstract, and test fields. Hard copies of reports are available through EPA or National Technical Information Service (NTIS).

COGEN

Formerly *Cogeneration & Resource Recovery Magazine,* Cogeneration Publications, 747 Leigh Mill Road, Great Falls, VA 22066. (703) 759-5060. Bimonthly magazine of economic and technical information on cogeneration.

Energy Information Abstracts

Bowker AI&I Publishing, a division of Reed Publishing (USA) Inc., 121 Chanlon Road, New Providence, NJ 07074. (800) 521 -8110. Focuses on research and development, resources, consumption, conservation, economics, and industrial applications of energy sources and technologies. Information is abstracted and indexed from scientific, technical, and business journals; conference and symposium proceedings; and academic, government, and corporate reports. Includes a listing of conferences and events.

Energy Review

800 Garden Street, Suite D, Santa Barbara, CA 93101. (805) 965-5010; Fax: (805) 965-6071. Digest of current books, articles, and reports on all facets of energy, including alternative energy, fossil fuel and nuclear energy sources, as well as waste.

Fuel Cell News

P.O. Box 66392, Washington, DC 20035. (301) 681-3532: Fax: (301) 681-4896. Quarterly news letter published by the Fuel Cell Association.

Gas Turbine World

Pequot Publishing Inc., Box 447, Southport, CT 06490-0447. (203) 259-1812. A bi-monthly publication covering gas turbines for industrial and electric utility applications, including recent technological advancements and orders for new projects.

Geothermal Resources Council Bulletin

Geothermal Resources Council, 2001 Second Street, Suite 5, Davis, CA 95617. (916) 758-2360; Fax: (916) 758-2839. A monthly publication featuring on-the-spot reports from world correspondents.

Hydro Review

HCI Publications, 410 Archibald Street, Kansas City, MO 64111-3046. (816) 931-1311; Fax: (816) 931-2015. Published eight times each year. Contains features and technical articles of interest to the North American hydroelectric industry.

Independent Energy Magazine

620 Central Avenue N., Milaca, MN 56353-1788. (612) 983-6892. Provides a forum for relatively small, independent energy producers.

Journal of Wind Energy Technology, 1988

Windbooks Inc., P.O. Box 4008., St. Johnsbury, VT 05819-4008. (802) 748-5148. Examines the aerodynamic, meteorological, structural, electrical, and mechanical engineering of energy systems and their applications worldwide.

National Energy Information Center (NEIC)

U.S. Department of Energy's Energy Information Administration (EIA), EI-231, Forrestal Building, Washington, DC 20585. (202) 586-8800. NEIC provides statistical and analytical data about energy resource reserves, energy production, demand, consumption, distribution, and technology. In print, with Energy Abstracts, and on-line through EIA's electronic bulletin board system. (202) 586-2557.

National Technical Information Service (NTIS)

5285 Port Royal Road, Springfield, VA 22161. (703) 487-4650. Operated by the U.S. Department of Commerce, NTIS is the central source for scientific and technical reports on research sponsored with federal funds. NTIS also catalogs and distributes software developed by the federal government. In total, NTIS makes more than 2 million documents available to the public and provides conference proceedings from a variety of technical conferences. NTIS indexes are available on-line, on disk, and in print. NTIS publications are compiled into a DIALOG computer data base called NTIS.

Photovoltaics for Municipal Planners, 1993

National Renewable Energy Laboratory (NREL), 1617 Cole Boulevard, Golden, CO 80401-3393. (303) 275-4363.

Power Magazine

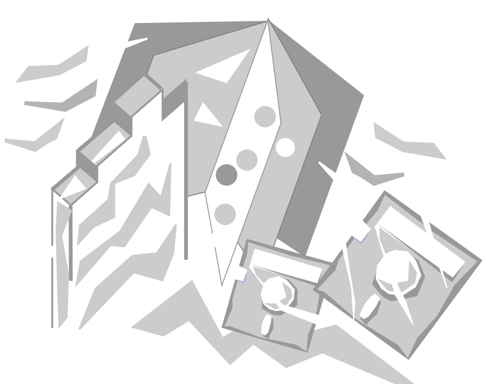
McGraw-Hill Inc., 12201 Avenue of the Americas, New York, NY 10020. (212) 512-2000. To subscribe write P.O. Box 521, Highstown, NJ 08520. Article topics include waste-to-energy, cogeneration, boiler operation, and utility operations from an engineering perspective.

PV News
Photovoltaic Energy Systems Inc., P.O. Box 290, Casanova, VA 22017. (703) 788-9626. International newsletter on photovoltaic energy, covers all industry news, markets, products, economics, government programs, key people and annual market survey.

Solar Energy
Pergamon Press, 660 White Plains Road, Tarrytown, NY 10591-5153. (914) 524-9200. International Solar Energy Society journal for scientists, engineers, and technologists in solar energy and its applications. Published monthly.

Solar Industry Journal
Solar Energy Industries Association, 122 C Street NW, Fourth Street, Washington, DC 20002-2109. (202) 383-2600; Fax: (202) 383-2670. Quarterly magazine. Once a year, the magazine publishes a useful list of solar industry manufacturers.

Solar Today
American Solar Energy Society, 2400 Central Avenue, Unit G—1, Boulder, CO 80301. (303) 443-3130. A bimonthly publication that provides information on solar energy for engineers, scientists, architects, educators, practitioners, research, and users. Includes actual case histories, and reviews of different technologies.



The Energy Daily
Kings Communication Group, 627 National Press Building, Washington, DC 20045. (202) 662-9724; Fax: (202) 662-9719. A unique publication covering the entire spectrum of energy sources, oil and gas, nuclear, coal, electricity and synthetic fuels. Includes coverage of energy finance.

UDI Who's Who in Cogeneration and Independent Power, 1993
Utility Data Institute, 1700 K Street NW, Washington, DC 20006. (202) 942-8788.

Western Energy Update
Western Interstate Energy Road 600 17th Street, #17045, Denver, CO 80202-5401. (303) 573-8910. Newsletter published approximately 12 times a year focusing on energy policy developments affecting the energy interests of 12 Western States and three western Canadian provinces. The primary audience is state and provincial energy policy makers.

Wind Energy News, 1987
Windbooks Inc., P.O. Box 4008., St. Johnsbury, VT 05819-4008. (802) 748-5148. International newsletter of wind power. Focuses on business, marketplace, and international policies of windmill industry.

Windletter
American Wind Energy Association (AWEA), 122 C Street NW, Fourth Floor, Washington, DC 20002-2109. (202) 383-2500; Fax: (202) 383-2505. To further the art and science of utilizing wind energy.

Wind Power Monthly
Vrinners Hoved, 8420 Knebel, Denmark. +45-86365465; Fax: +45-86365626; Telex: 64728 newind dk. US Office: P.O. Box 496007, Suite 217, Redding, CA 96099-6007. Fax: (415) 474-1985. News magazine published in English that covers news from around the world in the wind industry. *Windstats Newsletter* also available.

ELECTRONIC RESOURCES

Alternative Energy Network Online Today
Environmental Information Networks, 119 South Fairfax Street, Alexandria, VA 22314. (703) 683-0774; Fax: (703) 683-3893. EIN provides a variety of electronic services via Fax and Internet including Alternative Energy Network Online Today, Alternative Fuel Vehicle Online Today and Electric Vehicle Online Today. Additional services include Daily Fax Service and a monthly publication entitled *Month in Review* which is a bound copy of daily news releases.

Electric Power Database
DIALOG Information Services, 3460 Hillview Avenue, Palo Alto, CA 94304. (800) 334-2564. Provides references to research and development projects of interest to the electric power industry.

Energy and Regulatory Matters Information Service (ERMIS)
Michigan Public Service Commission, 6545 Mercantile Way, Lancaster, MI 48909. (517) 334-6240. Provides access to electronic mail, files and data bases. Covers all types of energy and regulatory matters. Includes energy, environmental public information, software and technical support, regulatory, telecommunications, and other miscellaneous forums. Free access is available by dialing (517) 882-1421.

Energy Efficiency and Renewable Energy Network (EREN)
Uniform Resource Locator: http://www.eren.doe.gov. EREN is a gateway to energy efficiency and renewable energy information from national laboratories and other organizations. Provides single-point access to computer bulletin boards; on-line catalogs; lists of manufacturers and vendors; and World Wide Web, Gopher, Telnet and Wide Area Information servers. For information call: (800) 363-3732.

Energy Ideas Clearinghouse Bulletin Board Service
Washington State Energy Office, 809 Legion Way, FA-11, Olympia, WA 98504. (206) 956-2237. A helpful and comprehensive electronic bulletin board system for technical information about energy efficiency and renewable energy as applied to commercial and industrial facilities. Toll-free access is available from 18 western states (AZ, CA, CO, ID, IA, KS, MN, MT, NB, NV, NM, ND, OR, SD, TX, UT, WA, WY) by dialing (800) 797-7754.

Federal Energy Regulatory Commission Hotline
(202) 208-1163. Contains data on regional powerflow base-cases and transmission utility planning reports as required under the National Energy Policy Act of 1992.

LOGIN (Local Government Information Network)
LOGIN Information Services, 245 East Six Street, Suite 809, St. Paul, MN 55101. (800) 328-1921. LOGIN's *News and Current Affairs* bulletin board selects and condenses news of interest to local governments. Local government officials can post messages and read postings from other communities.

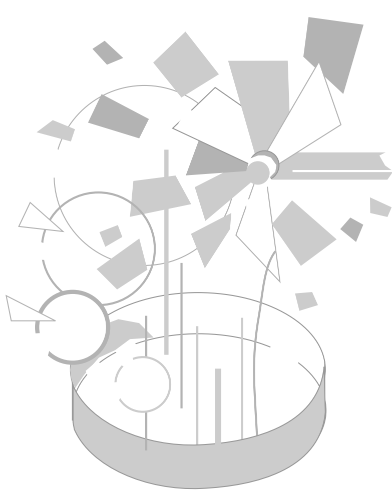
APPENDIX F: POWER PLANT GENERATING EFFICIENCY

BACKGROUND

What is generating efficiency? Generating efficiency, or fuel efficiency, refers to the percentage of energy content in the fuel which a power plant actually converts into electrical energy. The higher the efficiency, the more electricity can be produced from a given fuel input.

Why is it important? The efficient use of energy, especially from non-renewable energy sources, is important for several reasons. First, the more efficient the power plant, the less fuel will be consumed for a given level of electricity output. Less fuel consumption means valuable resources are conserved.

Second, since a more efficient plant consumes less fuel than a less efficient plant of comparable electrical output (for a given fuel), the environmental impacts associated with power production will be less severe. For example, for steam cycle or combined cycle thermal power plants there will be less thermal discharge, so the need for cooling water will be lessened. New generations of combustion turbines tend to reflect both improvements in efficiency as well as improvements in emissions, and therefore the air quality impacts of new technologies are typically less.



Third, since fuel costs can represent as much as 60 percent of the total lifetime cost (includes capital, fuel, and operations and maintenance costs) for some technologies, the efficiency of the power plant can play a large role in its economic viability. More efficient power plants will also be less vulnerable to higher than expected fuel prices than less efficient plants.

Can older power plants be made more efficient? Yes. One way to capture the benefits of efficiency while simultaneously dealing with the problem of aging power plants is through repowering. In one method of repowering, the existing boiler is replaced by one or more combustion turbines and heat recovery steam generators, while the existing steam turbine remains in service. Not only does the output of the plant increase considerably, but the generating efficiency often increases dramatically while air emissions are greatly reduced. Often the repowered configuration will be able to utilize much of the existing infrastructure at the site, thereby offering the potential to reduce some of the environmental and economic costs compared to a new site.

Why is cogeneration efficient? Cogeneration is defined as the *sequential* use of energy to produce useful thermal energy for an industrial or commercial process as well as electricity. Many industrial processes need large quantities of thermal energy (typically in the form of hot water or steam). Many power plants create a large amount of waste heat that must be dealt with. The key to cogeneration is to turn the waste heat from the power plant into a useful form of thermal energy for a nearby industrial process. By generating both electricity and needed thermal energy at the same time (hence the name *cogeneration*), there is tremendous potential for increased efficiency and reduced environmental impacts over the case where electricity and needed thermal energy are produced separately.

Is generating efficiency important for power plants that use renewable resources? Energy conversion efficiency takes on a different meaning for plants that use renewable resources. For example, solar technologies are land- and capital-intensive, and certain types of solar technologies and configurations are more land-intensive and capital-intensive than others (for a given electrical output). Since the "fuel" (i.e., solar insolation) is free and inexhaustible, the efficiency with which the solar input is converted to electrical output is not necessarily an indicator of how "good" a project is (although the conversion efficiency could be important in situations where it is important to maximize the electrical output in a constrained land-use situation [e.g., rooftop or substation photovoltaic system]). Increased efficiency, however, may yield significant savings in capital costs and land use. Project developers must weigh the benefits of increased solar-to-electrical efficiency against any additional cost required to achieve that efficiency.

◪ What factors influence a plant's efficiency? Among the many factors that influence the efficiency with which a power plant converts its fuel input to electricity are:

- The technology type (e.g., gas turbine-based, steam turbine based, fuel cells)

- The fuel type (e.g., a given gas turbine will have a two percent to three percent higher output and a one percent to two percent improvement in efficiency when operating on natural gas rather than distillate oil)

- The choice of equipment manufacturer and product line. Most gas turbine manufacturers offer gas turbines in a wide range of sizes and capabilities. In general, the newer the product line, the more efficient the equipment. A particular model will typically be uprated in output and efficiency over a period of several years)

- The equipment configuration (e.g., gas-turbine based configurations include simple cycle mode, combined cycle mode [with the addition of a heat recovery steam generator and a steam turbine], and cogeneration modes)

- The operating profile (e.g., baseload operation vs. frequent cycling)

- The level of power output (e.g., power plants are typically optimized to be most efficient at rated [100 percent output] conditions, and are less efficient at off-rated [less than 100 percent output] conditions

- Site-specific conditions (e.g., elevation, ambient temperature, relative humidity)

- Equipment "add-ons" (e.g., emissions controls tend to decrease the facility's efficiency and output, while inlet air evaporative cooling or chillers for gas turbines in warm climates tend to increase the output)

WHAT LAWS, ORDINANCES, REGULATIONS, AND STANDARDS REGULATE EFFICIENCY FOR POWER PLANTS?

The only types of projects which must meet a numerical efficiency standard are certain classes of cogeneration projects. Those cogeneration projects must meet the Federal Energy Regulatory Commission (FERC) efficiency standard. In addition, the California Environmental Quality Act (CEQA) addresses fuel efficiency through its examination of energy resources impacts. See the section entitled "How is Efficiency Measured?" on page F.5 for a discussion of the terms used to measure and describe efficiency.

◪ FERC efficiency standard. Title 18 Code of Federal Regulations, Part 292 contains the efficiency criteria for projects which are certified as Qualifying Facility (QF) cogeneration projects. These standards were created as part of the Public Utility Regulatory Policies Act of 1978 (PURPA), and were the nation's first efficiency standards. The standard which must be met depends on whether the facility is a topping-cycle or bottoming-cycle cogeneration facility.

A topping-cycle cogeneration facility uses the energy input to the facility to produce useful power output first, and then uses the waste heat to provide useful thermal energy. A bottoming-cycle cogeneration facility uses the energy input to the facility to produce a useful thermal energy process first, and then uses the waste (exhaust) heat from that process for power production.

For topping-cycle facilities, the efficiency standard depends on the operating standard. The operating standard is calculated as the useful thermal energy output of the facility divided by the total energy output, on an annual basis and expressed as a percentage. The operating standard must be at least five percent in order for the facility to qualify as a cogeneration facility. For projects with an operating standard between 5 percent and 15 percent, the FERC efficiency standard is 45 percent (net, lower heating value (LHV)). For projects with an operating standard greater than 15 percent, the FERC efficiency standard is 42.5 percent (net, LHV).

For bottoming-cycle cogeneration facilities, there is no minimum operating standard, and the FERC efficiency standard is 45 percent (net, LHV).

An actual project's FERC efficiency is calculated as described in the preceding section and compared to the appropriate standard.

◩ California Environmental Quality Act (CEQA). CEQA does not set numerical standards for efficiency or promote efficiency per se, but it does have several provisions which relate to energy resources impacts. The inefficient and unnecessary consumption of energy (particularly in the form of non-renewable fuels such as natural gas and oil) constitutes an adverse environmental impact [CEQA Guidelines, Title 14 California Code of Regulations section 151 26(c)]. This adverse environmental impact is considered significant if it will encourage activities which result in the use of large amounts of fuel, or use fuel or energy in a wasteful manner [CEQA Guidelines, 14 CCR Appendix G, items (n) and (o)].

CEQA requires the examination of alternatives if the project has the potential for significant adverse impacts with respect to energy use. "Alternatives should be compared in terms of overall energy consumption and in terms of reducing wasteful, inefficient and unnecessary consumption of energy." [CEQA Guidelines, 14 CCR Appendix F, section II.E]

The next step is to identify whether any of the alternatives is feasible (from both a technical and economic standpoint) and meets the project objectives. If any feasible alternative would eliminate or substantially reduce the significant environmental impact (and not result in other significant environmental impacts that cannot be mitigated), then the project should either be redesigned to incorporate the feasible alternative, or there should be some other mitigation measure to account for the fuel "wasted" by the project.

UNDER WHAT CIRCUMSTANCES SHOULD SUCH A CEQA ANALYSIS BE PERFORMED?

A CEQA analysis of power plant generating efficiency is not necessary for projects that use renewable resources such as wind and solar since the "fuel" is inexhaustible and hence cannot be wasted. For dedicated solar thermal or solar photovoltaic plants, there may be other environmental impacts such as land use that could be mitigated to a certain extent by more efficient technologies or equipment configurations. As such, there may be a reason to consider more efficient technologies because of other CEQA requirements. In addition, some solar thermal power plants such as Luz Solar Electric Generating systems (SEGS) units have natural gas-fired backup capability, and therefore do use a non-renewable fuel source.

Proposed projects that burn natural gas are the most likely candidates for CEQA efficiency analyses, since natural gas is a non-renewable fossil fuel source. The issue of whether a natural gas-fired project uses a significant amount of natural gas, and whether that fuel use is wasteful, depends on several factors. By itself, any project that uses a significant amount of natural gas could be considered to have an adverse impact on the natural gas supply. In light of the alternatives, however, the project could result in an overall reduction in natural gas use. For example, a proposed project may result in an overall reduction in natural gas consumption if the electricity it produces results in displacing electricity that would otherwise be produced from less efficient existing units. A cogeneration project that produces both electricity and useful thermal energy may result in an overall reduction in natural gas consumption compared to the case where electricity and useful thermal energy are produced by separate means.

A repowering project may increase the consumption of natural gas at the existing site because the electrical output of the site may increase by a factor of three, but there will be an overall system decrease in natural gas due to retiring the existing boiler and displacing generation by other inefficient plants on the system.

Evolving technologies that use natural gas, such as fuel cells, may not at the present time be more efficient than commercially-available technologies, but have the potential to dramatically improve natural gas conversion efficiencies in the future. From an efficiency standpoint, projects such as these should be encouraged.

Note that even if a project meets one or more of the conditions described in the paragraph above, it could still be considered a wasteful use of fuel if it is not the most efficient alternative. In general, project proponents have an incentive to propose efficient projects, since fuel costs are often a major portion of the total project lifetime costs. They may not, however, choose the most efficient project possible if the cost of the equipment is prohibitive or there are other barriers to such a project.

One way to deal with the significance of the amount of natural gas that would be wasted by a project compared to the most efficient project possible is to consider how much more fuel would be consumed on an annual basis by the less efficient project.

Differences in annual fuel consumption are affected by three factors: the size (output capacity) of the project, the efficiencies of the two alternatives, and the number of hours a year the plant is expected to operate. Table F-1 shows some examples of the effects of these variables on the amount of natural gas that would be wasted if the less efficient alternative is chosen.

As shown in Table F-1, the higher the output of the project, the more fuel will be wasted for a given difference in efficiencies. The bigger the discrepancy in efficiencies between alternatives, the more fuel will be wasted. The more frequently the plant will operate during the year, the more fuel will be wasted for a given difference in efficiencies.

While Table F-1 is not intended to serve as a definitive guide to all possible situations which may be encountered by local governments during power plant permitting, it provides a useful reference point for assessing the significance of differences in fuel usage among alternative projects. Local governments can apply the results of Table F-1 to their particular situation in deciding whether to perform a detailed efficiency analysis for a proposed project (see the four-step process on page F-6).

IDEAS FOR ENSURING EFFICIENT ELECTRICITY GENERATION

Many factors determine the efficiency of an electric generation facility. For facilities that use nonrenewable fossil fuels such as natural gas, a great emphasis should be placed on efficient equipment and cycle configurations. The desire to improve efficiency, however, must be viewed in light of other constraints, including technical constraints, environmental constraints, economic constraints, and project objectives. Thus, the “best” project may not necessarily be the most efficient project.

For dedicated solar thermal power plants, the “fuel” (i.e., solar insolation) is free and inexhaustible. As such, the efficiency with which the solar input is converted to electrical output is not necessarily an indicator of how “good” a project is. More important design considerations may include: the amount of land required and the associated land use implications, amount of water required, and the required operating profile (e.g., if the ability to operate at night is required, a backup or storage system is required). The amount of land required for a given electrical output depends not only on the solar-to-electrical efficiency but also on such factors as the technology type, the density of the solar collection field (the amount of solar collection surface per unit of land) and whether the plant has thermal storage capability.

For general plan and implementation ideas, please turn to page F.11.

WHAT EFFICIENCY CAN BE ACHIEVED FROM VARIOUS TECHNOLOGIES?

This section provides a general idea of the range of heat rates and energy conversion efficiencies that can be expected from various power plant technologies. The technologies are divided into two categories: those that are currently commercially available and those that are likely to be commercially available in the near future.

Except as noted below, heat rates (net, higher heating value) are used to describe the efficiency of the technologies, with the corresponding generating efficiency in parentheses. The measurement of efficiency is discussed in the box on the next page.

- For gas turbine-based power plants, heat rates are given both in lower heating value (LHV) and higher heating value (HHV). Such heat rates are referenced to ambient conditions of sea level, 59 degrees Fahrenheit and 60 percent relative humidity, and assume that the plant is operating at its full- load output capability on natural gas. In general, altitude, hotter climates and part-load operation degrade performance.

- Overall project efficiency is used to describe the efficiency of cogeneration power plants.

- Chemical-to-electrical conversion efficiency is used to describe the efficiency of fuel cells. Both LHV and HHV efficiencies are presented.

- Solar-to-electrical conversion efficiency is used to describe the efficiency of solar thermal and photovoltaic technologies.

Power Plant Technologies That Are Currently Available Commercially.

Steam turbine-based power plants in California which have boilers fueled by natural gas, oil, coal, or nuclear fission typically have heat rates (efficiencies) in the range of 10,700 Btu/kWh (31.9%) to 9,000 Btu/ kWh (37.9%).

Gas turbine-based power plants which operate in simple cycle mode (no steam injection to the gas turbine) typically have HHV heat rates in the range of 24,660 Btu/kWh (13.8%) to 9490 Btu/kWh

HOW IS EFFICIENCY MEASURED?

There are several terms that are used to measure and describe the efficiency of a power plant. These include:

- Generating efficiency (%)— also known as fuel efficiency, or energy conversion efficiency, typically expressed as a percentage. Generating efficiency refers to the amount of electrical energy produced divided by the amount of energy (in the fuel) required to generate that electricity. For thermal power plants, thermal efficiency is a term that also describes generating efficiency.

It is necessary to state whether the efficiency is a *gross* or *net* value. The *gross* generating efficiency is based on the actual amount of electricity produced by the facility's generator(s), while the *net* generating efficiency is based on the net electricity produced. The net electrical production is the gross amount minus the electricity needed to run the facility's auxiliary loads. Thus, the net generating efficiency is a measure of the efficiency with which the facility produces electricity that is available for sale.

In addition to identifying whether the efficiency is a gross or net value, it is necessary to know whether the efficiency calculated is based on the fuel's lower heating value (LHV) or higher heating value (HHV). The higher heating value is the total chemical energy in the fuel, which accounts for the total heat given up when the fuel is burned (including the formation of water vapor.) The lower heating value is the usable energy content of the fuel (i.e., it assumes that all of the products of combustion remain gaseous, and thus the energy released when water vapor is condensed cannot be recovered.)

The efficiency of steam turbine-based power plants (i.e., boilers with steam turbines) is usually expressed in terms of the fuel's higher heating value, while the efficiency of gas turbine-based power plants (e.g., combustion turbines and combined cycles) is typically expressed on the basis of the fuel's lower heating value. For natural gas, the ratio of the fuel's higher heating value to its lower heating value is 1.11 to 1.

In order to be certain that appropriate comparisons are made among various projects' efficiencies, it is necessary to convert all efficiency values to the same type. See the box on page F.10 for sample calculations of converting from gross to net values, and from lower heating values to higher heating values.

- Heat rate (Btu/kWh) — the reciprocal of efficiency, it is the amount of thermal energy required to produce a given amount of electrical energy. It is usually specified as the amount of fuel (measured in Btus) needed to generate one kilowatt-hour (kWh) of electrical output. Like the measurement of generating efficiency, it is necessary to specify whether the heat rate is based on the gross or net electrical output, and whether the fuel input is based on the fuel's lower or higher heating value. A facility's generating efficiency and heat rate are related by the following equation:

  - Generating efficiency = $\dfrac{(3413 \text{ Btu/kWh}) \times 100\%}{(\text{heat rate in Btu/kWh})}$

Note that the lower the heat rate is, the more efficient the power plant is. See the box on page F.10 for more on the conversion of generating efficiency to heat rate.

- Overall project efficiency (cogeneration only) (%) — the sum of the amount of electrical energy produced and the amount of useful thermal energy produced, divided by the total fuel energy input required to generate that electricity and useful thermal energy, expressed as a percentage. All three terms (electrical energy, useful thermal energy, and fuel input energy) must be expressed in the same engineering units (for example, in Btus.)

- Federal Energy Regulatory Commission (FERC) efficiency (%) — this efficiency must be calculated for facilities which need Qualifying Facility cogeneration status, and that use fuel input in the form of natural gas or oil. It is calculated by summing the amount of useful electrical energy produced and one-half the amount of useful thermal energy produced, and dividing by the energy input from oil and natural gas to the cogeneration facility, expressed as a percentage, and based on the net electrical output and the fuel's lower heating value.

TABLE F-1
FUEL CONSUMPTION DIFFERENCE AS A FUNCTION OF PROJECT CAPACITY, EFFICIENCY AND OPERATING PROFILE
(Compared with a proposed Project with an Efficiency of 40% [HHV, gross])

Project capacity (proposed & alternate)	Efficiency of alternate project (HHV, gross)	Number of hour operated per year	Difference in yearly nat. gas consumption	# of homes this difference could heat or a year[1]
1 MW	50%	7000	1.19×10^{10} Btu	199
	45%		6.64×10^{9} Btu	111
	41%		1.46×10^{9} Btu	24
	50%	3500	5.97×10^{9} Btu	100
		1000	1.71×10^{9} Btu	28
25 MW	50%	7000	2.99×10^{11} Btu	4,977
	45%		1.66×10^{11} Btu	2,765
	41%		3.64×10^{10} Btu	607
	50%	3500	1.49×10^{11} Btu	2,489
		1000	4.27×10^{10} Btu	711
50 MW	50%	7000	5.97×10^{11} Btu	9,955
	45%		3.32×10^{11} Btu	5,530
	41%		7.28×10^{10} Btu	1,214
	50%	3500	2.99×10^{11} Btu	4,977
		1000	8.53×10^{10} Btu	1,422

[1] Based on an annual average household heating requirement of 60 million Btu. A typical household in Pacific Gas & Electric territory consumes 74 million Btu per year, a typical household in The Gas Company territory consumes 62 million Btu per year, a typical house hold in San Diego Gas & Electric territory consumes 42 million Btu per year.

PROCEDURE FOR PERFORMING A DETAILED EFFICIENCY ANALYSIS FOR A PROPOSED POWER PLANT PROJECT

Step #1: Analyze project for conformance with FERC QF efficiency standard (if applicable). If the project is a cogeneration project that must be certified as a FERC QF, the first step is to confirm whether the project is a topping cycle or a bottoming cycle, and then examine the project proponent's assumptions and calculations in order to determine if the project will comply with the appropriate efficiency and operating standards on an annual basis. Confirm further that the project proponent has applied for or received FERC certification as a QF.

Step #2: Analyze the project for adverse energy impacts. The inefficient and unnecessary consumption of energy (particularly in the form of non-renewable fuels such as natural gas and oil) constitutes an adverse environmental impact [CEQA Guidelines, Title 14 California Code of Regulations section 15126(c)]. This adverse environmental impact is considered significant if it will encourage activities which result in the use of large amounts of fuel, or use fuel or energy in a wasteful manner [CEQA Guidelines, 14 CCR Appendix G, items (n) and (o)].

Step #3: Analyze alternatives to the project in order to determine if the energy impacts are significant. The purpose of this step is to determine if there are more efficient alternatives that could result in a significant decrease in natural gas consumption and that are feasible. Such a decrease in natural gas consumption must either eliminate or substantially mitigate the adverse impact.

In order to accomplish this, the local agency can ask the developer for information on the proposed project configuration (number and type of gas turbines, whether cogeneration or non-cogeneration, combined cycle or simple cycle or STIG, whether any heat recovery steam generator has additional firing capability, steam turbine output), its expected yearly operating profile (number of hours expected to operate per year in each mode [e.g., full load, part load, hot standby]), and any future plans related to major changes in equipment or operating profile.

The local agency can also ask the project developer for information on other alternatives which were considered. This should include both non-fossil fueled alternatives as well as other natural gas-fired project configurations and equipment manufacturers. Project developers should provide heat rate information on alternatives which are more efficient than the proposed project. They should provide information on the amount of natural gas that could be saved each year if a more efficient alternative were chosen, and should discuss why a more efficient alternative was not chosen.

Step #4: Determine whether mitigation measures are feasible in order to eliminate the significant adverse energy impact. First, determine if any of the more efficient alternatives would result in totally or substantially mitigating the adverse impact, and then determine whether any of the alternatives is feasible. (Note: the local agency should not necessarily rely on the project developer's assessment of feasibility, but should consider the items discussed in the last paragraph of this step.)

If the fuel savings with a more efficient alternative are substantial, and the alternative is feasible, the local agency must pursue feasible mitigation measures. These could take the form of requiring the project developer to redesign the project in order to incorporate the more efficient design, or requiring other feasible energy-related mitigation measures which could compensate for the fuel "wasted" by the project.

Note that the outcome of this analysis depends on the definition of feasibility. To be considered feasible, an alternative must be able to meet the project's technical objectives (e.g., available for installation within the project's time frame, meet the project's needs for energy supply and operational characteristics, be sufficiently reliable, and capable of meeting licensing requirements). It also must be capable of being financed and must be cost-effective.

(36.0%). In terms of LHV, the heat rates (and efficiencies) range from 22,220 Btu/kWh (15.4%) to 8,550 Btu/kWh (39.9%). The lowest heat rates (highest efficiencies) are typical of the newest products and those which are optimized for simple cycle operation (not necessarily the largest machines), while the highest heat rates (lowest efficiencies) are typical of machines under 2 MW. One simple cycle gas turbine which is expected to be offered in 1996 will have a HHV heat rate of 9100 Btu/kWh (37.5% efficiency). In terms of LHV the heat rate (and efficiency) is 8,200 Btu/kWh (41.6%). Note: all of these figures are gross values, not net.

Steam-injected gas turbines (STIGs) typically have HHV heat rates in the range of 10,000 Btu/kWh (34.1 %) to 8640 Btu/kWh (39.5%). In terms of LHV, the heat rates (and efficiencies) range from 9020 Btu/kWh (37.8%) to 7780 Btu/kWh (43.9%). Note: all of these figures are gross values, not net.

Cogeneration power plants (gas turbine-based) typically have overall project efficiencies in the range of 40% to greater than 70%. To a large extent, the efficiency depends on the relationship between the amount of thermal energy produced and the amount of electrical energy produced.

The term operating standard is used to refer to the ratio of useful thermal energy produced to the total (useful thermal plus useful electrical) energy produced, expressed as a percentage. Since the combustion of fossil fuels for boiling water (for thermal process needs) is more efficient than the combustion of fossil fuels for generating electricity, in general the higher the operating standard, the higher the cogeneration efficiency. For operating standards in the range of 5%, the efficiency will likely be near the lower end, while facilities with operating standards in the range of 60% or higher will likely have efficiencies near the higher end.

The efficiency is also a function of the gas turbine configuration, with simple-cycle cogeneration configurations showing lower efficiencies than combined-cycle cogeneration configurations for a given operating standard.

New combined cycle power plants (one or more gas turbines and HRSGs paired with a steam turbine) typically have full-load HHV heat rates in the range of 10,350 Btu/kWh (33.0%) to 6630 Btu/kWh (51.4%). In terms of LHV, the heat rates (and efficiencies) range from 9,330 Btu/kWh (36.6%) to 5980 Btu/kWh (57.1 %). One manufacturer has recently announced the development of a combined cycle that can achieve a LHV efficiency of 60% (equal to about 54% on a HHV basis). Projects greater than 200 MW are likely to have heat rates in the lower range (i.e., higher efficiency range), while projects less than 10 MW are likely to have heat rates in the upper range.

Repowered combined cycle power plants typically have slightly higher heat rates (lower efficiencies) than their new combined cycle counterparts. A drop in efficiency of two or three percentage points (compared to the same gas turbine(s) paired with an optimized steam turbine) is typical.

The lower efficiency for repowered projects is due to the fact that the new gas turbine(s) are paired with an existing steam turbine(s). It may not be possible to provide an exact match between the gas turbine's exhaust heat and the steam turbine's requirements since gas turbines are available only in discrete sizes. Also, a new steam turbine is likely to be more efficient than an existing steam turbine which could be as much as 30 or 40 years old (although steam turbine refurbishment at the time of repowering could improve the overall efficiency).

Note, however, that repowering efficiencies that are two or three percentage points less efficient than new combined cycles are still a major improvement over the boiler configuration they replace (see steam turbine-based power plants above.)

Geothermal power plants have heat rates which vary widely, depending on the quality and type of the geothermal resource. Vapor-dominated geothermal plants in operation in the Geysers area (Lake and Sonoma County) typically have heat rates in the range of 22,000 Btu/kWh (15.5%) to 18,500 Btu/kWh (18.4%). Future development of liquid- dominated resources using flash steam technologies is estimated to produce heat rates in the range of 24,000 Btu/kWh (14.2%) to 12,800 Btu/kWh (26.7%), with double- flash configurations providing better heat rates than single- flash configurations. Future development of liquid-dominated binary technologies is estimated to produce heat rates of about 23,000 Btu/kWh (14.8%).

Geothermal resources are considered to be renewable only if the rate of geothermal steam or liquid extraction does not exceed the rate at which the resource is renewed. Therefore, it is important to both manage the resource appropriately and to use efficient energy conversion equipment in order to maximize the resource potential.

Solar thermal power plants include concentrating methods (which include central receiver, parabolic dish, and parabolic trough designs) and salt-gradient solar ponds. Of these, only the parabolic trough design is commercially available. This design is typified by the Luz SEGS solar plants, which are hybrid solar plants that have natural gas-firing backup capability in order to provide electricity at night or during periods of cloud cover. The overall annual average solar-to-electrical efficiency is about 14% to 15%. The heat rate when operating on natural gas is 10,800 Btu/kWh (31.6%) . Note, however, that the "fuel" is free when operating in the solar-only mode.

Biomass power plants use biomass resources (e.g., forest and wood products, agricultural field and food crops, and manure) in waste-to-energy facilities as a fuel in one of three typical processes: direct combustion in a fairly conventional steam boiler; thermal gasification with air to create a gas that is combusted in an engine-generator set; and anaerobic digestion reactors fueled by manure which create a biogas that is then combusted in an engine-generator set. Typical efficiencies for these three technologies are: 20,000 Btu/kWh (17%) to 14,100 Btu/kWh (24%) for direct combustion boiler-steam turbine configurations; 15,230Btu/kWh (22.4%) to 12,540 Btu/kWh (27.2%) for gasification technologies coupled with engine-generator sets; and 20,000 Btu/kWh (17%) to 15,000 Btu/kWh (23%) for anaerobic fermentation technologies coupled with engine-generator sets.

Municipal solid waste (MSW) power plants use MSW as a fuel in waste-to-energy facilities. Mass burn facilities that directly combust MSW with minimal processing typically have heat rates in the range of 16,000 Btu/kWh (21.3%) to 13,000 Btu/kWh (26.3%). Refuse-derived fuel (RDF) facilities that directly combust pelletized or fluff MSW that is the by-product of a resource recovery operation typically have heat rates in the range of 15,000 Btu/kWh (22.8%) to 12,000 Btu/kWh (28.4%).

Solar photovoltaic (PV) power plants include three major types, named for the type of PV collector modules: flatplate crystalline silicon, flatplate thin film, and concentrators. Today's generations of PVs have the following typical annual average solar-to-electric conversion efficiencies: 11 to 13% for flatplate crystalline silicon; 4 to 6% for flat-plate thin film; and a recent world record of greater than 20% for a commercial-scale (2 kW) concentrating system.

Fuel cell power plants include several types, named for the electrolyte material used: phosphoric acid, molten carbonate, solid oxide, alkaline, and proton exchange membrane. Of these, only phosphoric acid fuel cells (PAFCs) are currently sold commercially. International Fuel Cells/ONSI Corporation's PC-25C is a 200 kW PAFC that is capable of achieving a chemical-to-electrical LHV efficiency of 40% on natural gas (equal to a HHV efficiency of 36%). It also produces about 700,000 Btu/hr of low-temperature heat which, if used in a cogeneration application, raises the overall project efficiency to about 77%.

Power Plant Technologies That Are On The Horizon.

Advanced Gas Turbines include the humid air turbine, chemically recuperated gas turbine, and cycle configurations being developed as part of the Collaborative Advanced Gas Turbine (CAGT) program (whose participants include the Electric Power Research Institute and nearly all of California's publicly-owned and privately-owned electric utilities) and the U.S. Department of Energy's (DOE's) Advanced Turbine Systems (ATS) program. The humid air turbine cycle is predicted to have a LHV efficiency of 63% (equal to a HHV efficiency of 57%). The chemically recuperated gas turbine, which is in the conceptual design phase of development, is predicted to have a LHV efficiency of 62 to 63% (equal to a HHV efficiency of 56 to 57%). Efficiencies for the cycles being developed as part of the CAGT program should be about 60% (LHV) or higher. The DOE's ATS program has a minimum efficiency goal of 60% (LHV), with the hope that the cycles developed will be well above that level.

Advanced solar photovoltaic power plants are expected to achieve the following annual average solar-to-electrical conversion efficiencies after the year 2010: greater than 18% for commercial flat-plate crystalline silicon; greater than 15% for commercial flat-plate thin film; and greater than 25% for commercial concentrating systems.

Advanced fuel cell power plants are expected to achieve very high efficiencies, both in terms of electrical efficiency and overall cogeneration efficiency. By the year 2000, phosphoric acid fuel

SAMPLE CALCULATIONS FOR COMPARING EFFICIENCIES AND HEAT RATES FOR VARIOUS PROJECT ALTERNATIVES

Suppose you are presented with two hypothetical power plants. Plant #1 is a conventional fossil-fueled (natural gas) steam turbine-generator with an efficiency of 33% (gross, higher heating value [HHV]), while Plant #2 is a natural gas-fired combustion turbine with a heat rate of 10,000 Btu/kWh (net, lower heating value [LHV]). Plant #1 has a gross output of 100 megawatts (MW), with total auxiliary loads of 5 MW. Plant #2 has a gross output of 120 MW and auxiliary loads that total 4 MW.

Q. Which plant is more efficient?

A. In order to determine which plant is more efficient, it is necessary to convert both measurements of efficiency to the same basis. It is easiest to work with heat rates, since the relationship between fuel use and electrical output is explicit in the heat rate term, whereas it is only implied in the efficiency when expressed as a percentage. Since the higher heating value heat rate is the better indicator of the amount of fuel which must be burned in order to produce a given electrical output, we will convert both efficiency measurements to heat rates based on the net electrical output and the fuel's higher heating value.

Beginning with Plant #1, we first convert the efficiency expressed as a percentage to the corresponding heat rate as follows:

Plant #1 heat rate (gross, HHV)=
(3413 Btu/kWh)/33% (gross, HHV)=
10,342 Btu/kWh (gross, HHV)

Now the gross HHV heat rate for Plant #1 needs to be converted to the net HHV heat rate. From the information given in the example, Plant #1 has a gross output of 100 MW and a net output of 95 MW (100 MW minus the 5 MW of auxiliary loads). The net HHV heat rate is:

Plant #1 heat rate (net, HHV)=
[10,342 Btu/kWh (gross, HHV)]*[(100 MWgross)/(95 MWnet)] =
10,886 Btu/kWh(net, HHV)

Now the heat rate for Plant #2 needs to be converted from its net LHV value to its net HHV value. For natural gas, the ratio of the fuel's higher heating value to its lower heating value is 1.11. Therefore:

Plant #2 heat rate (net, HHV)=
10,000 Btu/kWh (net, LHV)*I.IIHHV/LHV=
11,100 Btu/kWh (net, HHV)

Thus, plant #1 is slightly more efficient than plant #2 since plant #1 has a *lower* heat rate.

cells could achieve a chemical-to-electrical LHV efficiency of about 54% (equal to about 49% on a HHV basis). Molten carbonate fuel cells are being developed as second-generation alternatives to phosphoric acid fuel cells, with one objective being to improve significantly upon the heat rate limitations of phosphoric acid fuel cells. The 2 MW Santa Clara Demonstration Project, the world's first demonstration of a utility-scale molten carbonate fuel cell, is expected to achieve a LHV chemical-to-electrical efficiency of 58% (equal to about 52% on a HHV basis). Follow-on commercial units are expected to have a LHV chemical-to-electrical efficiency of about 60% (equal to about 54% on a HHV basis). In cogeneration applications, advanced molten carbonate fuel cells could achieve overall project efficiencies approaching 80% to 90%.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can encourage the improvement of the overall generating efficiency of electric generation facilities by permitting new and repowered generation facilities that are the most efficient feasible, considering technical constraints, environmental constraints, economic constraints, and project objectives.

- The city/county can identify the amount of renewable resource potential (such as wind, solar, biomass, municipal solid waste, and geothermal) and appropriate areas for development of such resources in its jurisdiction, and can encourage facility configurations which use these resources efficiently.

- The city/county can encourage the development of efficient cogeneration facilities tied to existing industrial and commercial thermal or heating processes which can reduce overall energy use compared to that needed to generate the electricity and useful thermal energy separately.

- The city/county can encourage the development of efficient cogeneration facilities as a means to meet the electricity and thermal needs of future planned industrial and commercial facilities.

- The city/county can encourage the repowering of existing aging power plants as a means to improve the efficiency of existing plants, increase the site generating capacity, and meet air quality regulations.

- The city/county can encourage the commercial demonstration of new generating technologies which use renewable or nonrenewable resources more efficiently.

IMPLEMENTATION IDEAS

The following are suggestions for implementation ideas which can be applicable to energy facilities in general:

- Develop an energy element to the general plan which addresses electric generation facilities. Such an energy element should identify: the amount and location of renewable resource potential (including wind, solar, geothermal, biomass, hydroelectric, and municipal solid waste) suitable for large-scale and small-scale (distributed) electric generation; existing power plant sites that are candidates for repowering; existing industrial or commercial sites that are candidates for cogeneration; and sites of future industrial and commercial development that could be candidates for cogeneration or small-scale distributed energy systems.

- Provide incentives for electric generation project developers to propose demonstration projects using advanced, more efficient, natural gas conversion technologies. The incentives may include expedited permitting, and reduced permit or operating fees.

- Require a pre-filing conference with each project developer in order to obtain an understanding of the efficiency-related aspects of the project and whether a detailed CEQA examination of efficiency is warranted. For projects that use natural gas, it may be appropriate to ask questions such as:

  - What is the plant's gross output? Net output?
  - How many hours a year is it expected to operate?
  - Is it a cogeneration project?
  - If yes, is it required to meet the FERC efficiency standard?
  - What alternative project types and configurations were considered?
  - Which of the alternatives considered were more efficient?

- How much more efficient are they, and how much natural gas could be saved per year if a more efficient alternative were chosen?

- Why wasn't the more efficient alternative chosen?

CASE STUDY

The San Luis Obispo County Department of Building and Planning is in the process of developing an energy element as part of its General Plan. The element includes policies and guidelines relating to electric generation facilities. The energy element includes a policy which prioritizes the technologies which can meet the county's electricity needs. It states that first preference shall be for increased use of conservation and efficiency measures in all sectors of electricity use; second preference shall be for facilities that use renewable resources such as wind, solar, hydroelectric, biomass, and geothermal; third preference shall be for fossil fuel cogeneration facilities that produce electricity and process steam for industrial uses; and fourth preference shall be for fuel cells and high efficiency fossil fuel facilities on a case-by-case basis.

Contact: David Church, Energy Planner, Department of Planning and Building, San Luis Obispo County, County Government Center, San Luis Obispo, CA 93408, (805) 781-5600, FAX (805) 781-5624.

INFORMATION RESOURCES

The California Energy Commission's Facilities Engineering and Permit Assistance Office can aid local governments in understanding the efficiency implications of a particular project.

Contact: Judy Grau at (916) 654-4206.

RELATED ISSUES

- Energy Facility Planning (Chapter 3)

- Air Quality (Chapter 5.1)

- Water Use/Water Quality (Chapter 5.4)

- Appendix B, Energy Facility Descriptions and Issues

APPENDIX G: GLOSSARY

AC Induction Motor - Electric motor used in most household appliances. The motor works by creating a magnetic field in the rotating element of the motor, and varying the electric current flowing through stationary electric wires.

Acutely Hazardous Material - A material that is hazardous as a result of its relatively high level of acute toxicity.

Air Pollution - Unwanted particles, mists, fumes, or gases (pollutants) which have adverse effects on health and welfare, that are put into the atmosphere as a result of operation of industrial facilities, other human activities, or natural sources.

Alternating Current (AC) - An electric current that reverses its direction of flow from positive to negative at regular intervals, typically 60 times per second. The most efficient type of electric motors use AC.

Alternative Fuel - As defined pursuant to the Energy Policy Act of 1992 (EPAct), methanol, denatured ethanol and other alcohols, separately, or in mixtures with gasoline or other fuels, CNG, LNG, LPG, hydrogen, "coal-derived liquid fuels," fuels "other than alcohols" derived from "biological materials," electricity, or any other fuel determined to be "substantially not petroleum" and yielding "substantial energy security benefits and substantial environmental benefits."

Alternative Fuel Vehicle (AFV) - A vehicle powered by a fuel other than gasoline or diesel. Also referred to as clean air vehicles, AFVs produce less air pollution than gasoline- or diesel-powered vehicles.

Ambient Air Quality - The condition of outside air as determined by the measured levels of air pollutant concentrations within it. Measured levels are compared to federal and state air pollution standards.

Ampere/Amperage (Amp) - Standard unit used to measure electric current; proportional to the quantity of electrons flowing through a conductor past a given point in one second. Amperage is calculated by dividing watts by volts.

Anaerobic Digestion - Also known as methane fermentation or biological gasification, anaerobic digestion uses microbiological methods to produce a gas from biomass fuels such as animal manure, or municipal solid waste fuels such as sewage sludge from sewage treatment plants. See Appendix B, section B-1 for more information.

Anhydrous - The form of a material that is not mixed in water.

Aqueous - The form of a material when mixed with water.

Attainment - A status designation for an air district whose ambient air does not exceed the health-based ambient air quality standards set for a given pollutant (applies to either state or federal standards).

Avoided Cost - The cost that an electric utility would incur to produce or otherwise procure electric power, but does not incur because the utility purchases this power from qualifying facilities.

Base Load - The minimum constant level of electric demand that a utility's generating system must meet, expressed in terms of kilowatts or megawatts. Base load varies by season, due mainly to weather patterns and the resulting space heating and cooling requirements. The base load is typically lowest in the spring and fall, and higher in the winter and summer.

Baseload Unit - An electric generating unit that is normally operated continuously to meet the system's base load. Examples of such facilities include: *coal, geothermal,* and *nuclear* power plants, as well as *hydroelectric (run-of-river)* and *qualifying facilities.* Baseload units typically operate at full capacity for more than 5,000 hours a year.

Battery - A battery is a container, or group of containers, holding electrodes and an electrolyte for producing electric current by chemical reaction and storing energy. The individual containers are called "cells". Batteries produce Direct Current (DC).

Battery Life - Number of miles an electric vehicle will travel on one battery pack before the pack must be replaced.

Battery Storage (utility-scale) - Modular energy storage devices that store electricity in chemical form for use at a later time. See Appendix B, section B-2 for more information.

Best Available Control Technology (BACT) - The most up-to-date methods, systems, techniques, and production processes available to achieve the greatest feasible emission reduction for given regulated air pollutants and the processes that create them. BACT is a requirement of *New Source Review* and *Prevention of Significant Deterioration programs.*

Biennial Resource Plan Update (BRPU) - A California Public Utilities Commission proceeding that addresses the terms and conditions under which California utilities acquire future power resources, including power from independent energy suppliers.

Binary Cycle - A power generation technology for low-temperature geothermal resources. It is the combination of two distinct, closed fluid loops. Heat from the geothermal fluid in the first loop is transferred to a hydrocarbon fluid with a low boiling point in the second loop. The fluid in the second loop is the working fluid for the Rankine power generation cycle (vaporization, expansion through the turbine-generator, condensation, and compression). See Appendix B, section B-7 for more information on geothermal-based binary cycles.

Biomass - Energy resources derived from organic matter. These include wood, agricultural waste, and other living-cell material that produce heat energy through direction combustion, gasification, or fermentation processes. See Appendix B, section B-3 for more information.

British Thermal Unit (Btu) - A standard unit for measuring thermal energy or heat. A Btu is defined as the amount of heat energy required to raise the temperature of one pound of water by one degree Fahrenheit at sea level. One thousand Btu is abbreviated as MBtu, while one million Btu is abbreviated as MMBtu.

Business Plan (Hazardous Materials) - A plan that addresses the use and handling of hazardous materials and emergency response in the event of an accidental hazardous materials release. See also *Risk Management Prevention Plan.*

California Air Resources Board (CARB) - CARB conducts research, monitors California's air quality, and sets policies for controlling emissions from mobile sources. Additionally, CARB and local air districts monitor stationary source emissions and create programs and policies designed to lower pollution levels and achieve ambient air quality standards.

California Clean Air Act (CCAA) - A California law passed in 1988, and amended in 1992, which provides the basis for air quality planning and regulation independent of Federal regulations, and which establishes new authority for attaining and maintaining California's air quality standards by the earliest practicable date.

California Department of Fish and Game (CDFG) - A trustee agency responsible for managing and protecting California's fish, wildlife and native plant resources.

California Endangered Species Act - Enacted in 1970, it expresses the state's concern over California's threatened wildlife, defines rare and endangered wildlife, and gives authority to the Department of Fish and Game to "identify, conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat in California..."

California Environmental Quality Act (CEQA) - Enacted in 1970, it requires state agencies to develop programs to protect the environment. CEQA also requires that the environmental impacts of most large projects and programs be considered, and that measures be adopted to lessen impacts.

California Low Emission Vehicle Program - A California requirement for automakers to produce vehicles with fewer emissions than current EPA standards. The four categories of California Low Emission Vehicle Program standards are Transitional Low Emission Vehicle (TLEV), Low Emission Vehicle (LEV), Ultra-Low Emission Vehicle (ULEV), and Zero Emission Vehicle (ZEV).

California Occupational Health and Safety Administration (Cal. OSHA) - The state agency responsible for protection of workers against occupational injury.

California Porter-Cologne Act - Enacted in 1969, it controls discharge of pollutants into state waterways and onto state lands. It requires state and regional water quality boards to set water quality levels and to regulate industry to attain those levels.

California Public Utilities Commission - The state agency that regulates the rates and services of natural gas, electric, water, steam, pipeline, sewer, telephone, cellular and radio telephone, and telegraph utilities, as well as trucking, railroad, airline, moving, and privately-owned bus companies.

Carbon Dioxide (CO_2) - A product of combustion that has become an environmental concern in recent years. CO_2 does not directly impair human health, but it is a "greenhouse gas" that traps the earth's heat and may contribute to the potential for global warming.

Carbon Monoxide (CO) - A gas found in the exhaust of gasoline-powered vehicles. It results from combustion when there is not enough oxygen. Emissions are regulated by Federal law.

Carcinogenic - Capable of causing cancer.

Charge Inlet - The location on an electric vehicle where the power source is connected for recharging.

Charging Station - The physical device that provides a connection from a power source to an electric vehicle for charging.

Clean Fuel Vehicle (CFV) - Any vehicle certified by the EPA as meeting certain Federal emissions standards. The five categories of Federal CFV's, from least to most stringent, are TLEV, LEV, ULEV, ILEV and ZEV. CFVs are eligible for two Federal programs: The California Pilot Program and the Clean-Fuel Fleet Program. CFV exhaust emissions standards for light-duty vehicles and light-duty trucks are numerically identical to those of CARB's Low Emission Vehicle Program.

Coal -Black or brown rock, formed under pressure from organic fossils in prehistoric times, that is mined and then burned to produce heat energy. See Appendix B, section B-4, for more information on coal-fired power plants.

Cogeneration - Simultaneous production of heat energy and electrical or mechanical power from the same fuel in the same facility. A typical cogeneration facility produces electricity and steam or heat for industrial purposes. See Appendix B, section B-11 for more information.

Combined-Cycle Power Plant - An electric generating plant that uses waste heat from its combustion turbine(s) to produce steam for a conventional steam turbine. See Appendix B, section B-11 for more information.

Combustion turbine - see Gas Turbine.

Compressed Air Energy Storage (CAES) - An energy storage technology in which air is compressed by a gas turbine during low demand periods and is stored in an underground reservoir. During high demand periods, the stored air is discharged, heated by fossil fuel combustion, and fed to a turbine-expander for electricity production. See Appendix B, section B-11 for more information.

Corrosive Material - A material with high chemical reactivity that can directly damage the surface of metals or other materials, including human tissue such as eyes and skin.

Criteria Air Pollutant - An air pollutant for which acceptable levels of exposure can be determined, and for which an ambient air quality standard has been set.

Cumulative Impacts - Two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts. The individual effects may be changes resulting from a single project or a number of separate projects. The cumulative impact from several projects is the change in the environment which results from the incremental impacts of the project when added to other closely related past, present and probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

Cycling Unit - see *Intermediate-load Unit.*

Demand-side Management (DSM) - Measures taken by a utility to influence the level or timing of customers' energy demand in order to optimize the use of available utility resources.

Direct Current (DC) - Electricity that flows continuously in one direction as contrasted with alternating current. Batteries produce Direct Current.

Direct Impacts - Direct or primary effects which are caused by a project and occur at the same time and place.

Distributed Energy Systems (also known as "distributed resources") - Small (50 kW to 50 MW), modular generation, storage, and demand-side management technologies that are strategically placed on electric customers' sites or near load centers in an electric grid so as to obtain benefits beyond the value of the electricity that is generated or stored. For example, distributed generation technologies show promise of allowing utilities to defer transmission and distribution system upgrades when placed at or near substations that are reaching their operating limits (see Appendix B, section B-14 for more on the use of solar photovoltaics for distributed uses). Promising distributed energy technologies include: solar photovoltaics, fuel cells, wind, small gas-fired engine-generators and gas turbines, utility-scale batteries, and customer efficiency/load management devices.

Distributed Generation - See *Distributed Energy Systems.*

Efficiency (thermal) - That percentage of the total energy content of a power plant's fuel which is converted into electricity, the remaining energy being lost to the environment as heat. The efficiency of an energy conversion is the ratio of the useful work or energy output to the energy input.

Electric Consumers Protection Act of 1986 - An amendment to the Federal Power Act which mandates that the Federal Energy Regulatory Commission evaluate the potential impact on the environment of proposed hydroelectric and electric projects under its jurisdiction. Requires extensive agency and public review and comment on proposed projects to determine the potential effects of the projects on the environment and how to mitigate the effects.

Electric Distribution - The delivery of electric energy to customers connected to the electric power distribution system. The distribution system links the transmission system to most customers. See Appendix B, section B-17 for more information.

Electric Energy Storage -The storage of surplus or low-cost electric energy during periods of low energy demand so that it will be available when needed. Technologies include: *battery storage (utility-scale); pumped hydroelectric storage; compressed air energy storage;* and *flywheel energy storage.*

Electricity - The class of physical phenomena arising from the existence and interaction of electric charge. Direct current (dc) electricity can be generated by such power generation technologies as fuel cells and solar photovoltaics. Alternating current (AC) electricity is electromagnetically induced by mechanical generators driven by steam, water (hydro), wind, or combustion turbines.

Electric Power Generation - The conversion of other forms of energy into electric energy. Electric energy is generated from such energy resources as fossil fuels, nuclear fuel, geothermal steam, falling water, and alternative and renewable energy sources. Appendix B addresses the various electric generation technologies.

Electric Power Research Institute - A nonprofit organization sponsored by the U.S. electric utility industry to manage more than 1600 electric power-related research and development programs. Its headquarters are in Palo Alto, California.

Electric Transmission - The transportation of bulk quantities of electric energy by means of electric conductors from generation sources to an electric distribution system, a load center, or an interface with a neighboring control area. See Appendix B, section B-17 for more information.

Electric and magnetic fields (EMF) - Electric and magnetic fields are produced by high-voltage transmission lines, low-voltage distribution lines, building wiring, electric appliances, and light fixtures, in addition to arising from many natural sources. Chapter 5.6 of the Guide focuses on the fields created by power lines and substations. Power lines carry electric currents that change direction (or alternate) 60 times per second. The alternating current produces electric and magnetic fields around the power lines.

Electric Vehicle (EV) - A vehicle that is propelled completely and exclusively by electric power.

Electrolyte - The medium of ion transfer between anode and cathode within the cell. Usually liquid or paste which is either acidic or basic.

Energy - The capability of doing work, expressed in units such as British thermal units (Btus), Watt-hours, kilowatt-hours (kWh), and calories. Forms of energy include: thermal, mechanical, electrical, potential, gravitational, and chemical. Electrical energy is defined as electric power (expressed in units such as kilowatts) supplied over time (e.g., in hours). Energy is transformed from one form to another in the generation and storage of electricity. See also *Power*.

Energy Policy Act of 1992 (EPAct) - A broad-ranging law impacting energy policy (PL 102-486). Titles III, IV, V, XV, and XIX of the Act deal with alternative transportation fuels. EPAct accelerates the purchase requirements for AFVs by the Federal fleet and requires fleets in large urban area to purchase AFVs. In addition, EPAct establishes tax incentives for purchasing AFVs, requires the conversion of conventional gasoline vehicles to operate on alternative fuels, and the installation of refueling or recharging facilities by the private sector.

Environmental Protection Agency (EPA) - A federal agency created in 1970 to permit coordinated governmental action for protection of the environment by systematic abatement and control of pollution through integration or research, monitoring, standards setting and enforcement activities.

Ethanol - Also known as ethyl alcohol or grain alcohol, ethanol is a colorless liquid that burns with a pale flame, producing water and carbon dioxide. Ethanol can be used as a motor vehicle fuel. See Appendix B, sections B-19 and B-20.c for more information.

Exempt Wholesale Generator (EWG) - A class of independent power producers, created by the National Energy Policy Act of 1992, which are exempt from the regulations of the Public Utility Holding Company Act, and which sell their power at wholesale rates which are regulated by the Federal Energy Regulatory Commission. EWGs are a mechanism for allowing electric utilities to compete in the independent power production market without becoming holding companies.

Federal Clean Air Act (FCAA) - A federal law passed in 1970, and amended in 1977 and 1990, which sets primary and secondary National Ambient Air Quality Standards for criteria air pollutants as the basis for the national program to improve air quality conditions.

Federal Clean Water Act (FCWA) - Federal law passed in 1977 and amended in 1987 and also known as the Federal Water Pollution Control Act. The Act provides for the restoration and maintenance of the nation's waterways. It requires the use of pollution control technology.

Federal Energy Regulatory Commission (FERC) - An independent regulatory commission within the U.S. Department of Energy that has jurisdiction over energy producers that sell or transport fuels for resale in interstate commerce; the authority to set oil and gas pipeline transportation rates and to set the value of oil and gas pipelines for rate-making purposes; regulates wholesale electric rates and hydroelectric plant licenses; and has jurisdiction over interstate transmission of electric energy and the authority to set rates, terms, and conditions of service.

Federal Power Act - A federal law originally enacted in 1935 that empowers the Federal Energy Regulatory Commission to regulate the interstate transmission and sale of electric power and to license hydroelectric facilities.

Flammable - Capable of burning and causing fire.

Flywheel Energy Storage - Also known as electromechanical batteries, flywheels are energy storage devices which convert electrical energy to mechanical energy (kinetic energy stored in rotational motion), for conversion to electricity at a later time. See Appendix B, section B-5 for more information.

Fossil Fuel - Oil, coal or natural gas that was formed in the earth in prehistoric times from remains of living-cell organisms.

Fuel Cell - An electrochemical engine (no moving parts) that converts the chemical energy of a fuel, such as hydrogen, and an oxidant, such as oxygen, directly to electricity. The principal components of a fuel cell are catalytically activated electrodes for the fuel (anode) and the oxidant (cathode) and an electrolyte to conduct ions between the two electrodes. See Appendix B, section B-6 for more information.

Fugitive Dust - Particulate matter entrained in the atmosphere from construction and farming activities, wind erosion of soil and storage piles, vehicle movement, and materials handling.

Gas turbine - Also known as a combustion turbine, a gas turbine combusts a mixture of fuel (such as natural gas or distillate oil) and compressed air in a combustion chamber to create hot combustion gases that drive a turbine-generator. See Appendix B, section B-11 for more information.

Geothermal Direct Use - Applications of geothermal energy (typically low- and moderate-temperature resources) that include industrial, agricultural, commercial, and residential direct uses such as water heating and space heating and cooling. See Appendix B, section B-21 for more information.

Geothermal Energy - Natural heat from within the earth that is captured for production of electric power or for direct heating uses such as space heating. See Appendix B, section B-7 for more information on geothermal power plants. See Appendix B, section B-21 for more on direct (non-electrical) uses of geothermal energy.

Hazardous Material - A material that poses the risk of causing injury or property damage if accidentally released into the environment. See also *Acutely Hazardous Material.*

Heat Rate - A measure of the amount of thermal energy needed to generate a given amount of electric energy. It is usually specified as the amount of fuel (measured in British thermal units, Btus) needed to generate one kilowatt-hour (kWh) of electrical output. See Appendix H for more information.

Heat Transfer - The process of transferring heat energy from one medium to another, such as transferring the heat produced by the combustion of fuel to water or steam in a boiler.

Heavy Metal Compounds - Compounds containing higher molecular weight metallic elements which are generally toxic in low concentrations to plant and animal life. Examples include mercury, cadmium, arsenic and lead.

Higher Heating Value - The total chemical energy in the fuel which accounts for the total heat given up when the fuel is burned (including the formation of water vapor.)

Horsepower (hp) - A unit for measuring the rate of doing work. One horsepower equals 745.7 Watts, or 0.7457 kilowatts.

Hydrocarbons (HC) - The hydrogen and carbon residue that are left over after gasoline combustion. Hydrocarbon emissions are regulated by Federal law.

Hydroelectric Power - Electric power that is generated by using the gravitational energy available when water flows from a higher to a lower elevation. See Appendix B, section B-8 for more information.

Independent Power Producer (IPP) - A non-utility power generating entity that is not a qualifying facility (QF). Independent power producers typically sell the power they generate to electric utilities at wholesale prices, and the utility then resells this power to end-use customers.

Indirect Impacts - Indirect or secondary effects which are caused by a project and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Integrated Resource Planning - A planning and selection process for new energy resources that values the full range of alternatives, including new generating capacity, power purchases, energy conservation, district heating and cooling applications, and renewable energy resources, in order to provide adequate and reliable service to customers at the lowest system cost.

Intermediate-load Unit - An electric generating unit that can vary its operation is response to changes in electric demand. Also known as cycling units, they are usually used to meet the level of demand that exceeds base load. Intermediate-load units can be cycled daily, weekly, or both. Such units are typically combined-cycle power plants or older natural gas-fired boilers (see Appendix B, section B-11). They typically operate between 1,300 and 5,000 hours a year.

Investor-Owned Utility (IOU) - A private company that provides a utility, such as water, natural gas or electricity, to a specific service area. In California, IOUs are regulated by the California Public Utilities Commission.

Key Observation Points (KOPs) - View areas most sensitive to the potential visual impacts of a proposed project (e.g., residential and recreational areas).

Kilovolt (kV) - A unit of electric potential and electromotive force equal to the difference in electric potential between two points on a conducting wire. One kilovolt is equal to one thousand volts. Bulk transmission lines are typically those lines rated at 220 kV and above, while distribution lines are typically those lines rated at 115 kV and below.

Kilowatts (kW) - A unit of power equal to one thousand Watts. A unit of measure of the amount of electricity needed to operate given equipment. On a hot summer afternoon a typical home, with central air conditioning and other equipment in use, might have a demand of four kW.

Kilowatt-hour (kWh) - A unit of energy equal to one thousand Watt-hours, or 3,413 Btu. One kWh is the amount of energy required to run a 100-Watt light bulb for 10 hours, or the amount of energy required to run a 1000-Watt hair dryer for one hour.

Landfill Gas - Gas produced when organic matter decomposes in solid waste disposal sites, or landfills. Landfill gas can be flared, used on-site to fuel electric generators, or processed to meet natural gas pipeline-quality standards and then distributed. See Appendix B, section B-10 for more information.

Liquid-dominated Resources - Geothermal resources that are composed primarily of hot water or brine. See Appendix B, section B-7 for more information.

Liquified Petroleum Gas (LPG) - Propane or butane, or a mixture of these and other hydrocarbon gases, that has been liquified by pressurizing to approximately 190 pounds per square inch at ambient temperature. LPG can be used as an alternative to natural gas, and in alternative fuel vehicles. See Appendix B, section B-20.b for more information.

Lower Heating Value - The usable energy content of the fuel (i.e., it assumes that all of the products of combustion remain gaseous, and thus the energy released when water vapor is condensed cannot be recovered.)

Lowest Achievable Emission Rate (LAER) - The most up-to-date methods, systems, techniques, and production processes available to achieve the lowest emission rate allowed or achieved anywhere, for given regulated air pollutants and the processes that create them, without regard to cost and energy use.

Magnetohydrodynamics (MHD) - The process of generating electricity by passing a conductive fluid or plasma through a magnetic field. See Appendix B, section B-9 for more information.

Maximum Achievable Control Technology (MACT) - The most up-to-date methods, systems, techniques, and production processes available to achieve the maximum control for a given toxic air pollutant.

Megawatt (MW) - One thousand kilowatts (1,000 kW) or one million (1,000,000) Watts. One megawatt is enough energy to power 1,000 California homes per day.

Methanol - Also known as methyl alcohol or wood alcohol, methanol is a light, flammable liquid consisting of four parts hydrogen to one part each of carbon and oxygen. Methanol can be used as a motor vehicle fuel. See Appendix B, sections B-19 and B-20.c for more information.

Micron - One-millionth of a meter.

Milligauss (mG) - A gauss is the unit of magnetic flux density equal to one maxwell per square centimeter. Milligauss is one-thousandth of a gauss.

Municipal Solid Waste (MSW) - Locally-collected garbage, which can be burned (with or without prior processing) to produce energy in a waste-to-energy facility. See Appendix B, section B-10 for more information.

National Energy Policy Act (NEPA) - A Federal Act passed in 1969 requiring government agencies to consider environmental consequences when making policy decisions. Requires that a detailed statement of environmental impacts of, and alternatives to, a project be submitted to the federal government before the project can considered.

Natural Gas - A combustible gaseous mixture of simple hydrocarbons, primarily methane. See Appendix B, sections B-18 and B-23 for information on natural gas production and distribution, respectively. Natural gas is used for commercial and residential heating and cooking needs, as well as for electricity generation (see Appendix B, section B-11) and as an alternative fuel for vehicles (see Appendix B, section B-20.d).

New Source Review (NSR) - A program used in permitting new or modified industrial facilities which are in a non-attainment area, and which emit non-attainment criteria air pollutants. The two major requirements of NSR are BACT and emission offsets.

Nickel Metal Hydride Battery - Composed of nontoxic, completely recyclable materials, nickel-metal hydride batteries may provide double the range and twice the life cycle of current battery technology. The battery is composed of nickel hydroxide and a multicomponent, engineered hydride alloy consisting of vanadium, titanium, zirconium, nickel, and other metals in minor quantities.

Nitrogen Oxide (NO_X) - One of the exhaust emissions of an internal combustion engine. NO_x is produced by the combination of nitrogen and oxygen due to the high temperatures in the internal combustion process. NO_X emissions are regulated by Federal law.

Nuclear Power Plant - A thermal power plant using nuclear fission. Fission is the process of splitting the nuclei of atoms, which releases stored energy (in the form of heat) from within those atoms. See Appendix B, section B-12 for more information.

Ocean Wave Energy - Energy produced by ocean waves, which are caused primarily by the interaction of winds with the ocean surface. Such energy may be captured by energy conversion devices that typically use either pneumatic, hydraulic, or hydropower technologies. See Appendix B, section B-13 for more information.

Ozone - Tropospheric ozone (smog) is formed when volatile organic compounds (VOCs), oxygen and NO_X react in the presence of sunlight (not to be confused with stratospheric ozone, which is found in the upper atmosphere and protects the earth from the sun's ultraviolet rays). Though beneficial in the upper atmosphere, at ground level, ozone is a respiratory irritant and considered a pollutant.

Particulate Matter (PM) - Unburned fuel particles that form smoke or soot and can stick to lung tissue when inhaled. A NAAQS pollutant.

PM10 - Particulate matter less than 10 microns in diameter, consisting of incomplete combustion by-products, salt and larger organic compounds, condensed gases, mists, fugitive dust, sea salts, and pollens. These particles are of interest since they are more readily suspended in the air, stay airborne longer, and can be inhaled more deeply into lungs than the particles greater than 10 microns in diameter.

Peaking Unit - An electric generating facility that operates only to meet the maximum (peak) electricity demand, or to fill emergency requirements. Peaking units are designed to generate electricity on short notice, and for relatively short periods of time. Examples of facilities that operate as peaking units include: *gas turbines, hydroelectric power,* and *pumped hydroelectric storage.* They typically operate for less than 1,300 hours a year.

Photovoltaic - See *Solar Photovoltaic.*

Power - The rate at which work is done, or the rate at which energy is consumed. Power is measured in units such as Watts, kilowatts, megawatts, and horsepower. For example, a 100-Watt light bulb has a power requirement of 100 Watts. The *energy* required to operate that light bulb for 5 hours is the product of its power requirement and the length of time, or 500 Watt-hours in this example. Note that 500 Watt-hours is also the amount of energy consumed by a 50-Watt bulb operating for 10 hours. In both cases, the *energy* requirements are identical, but the *power* requirements are different. See also *Energy.*

Prevention of Significant Deterioration (PSD) - A program used in permitting new or modified industrial facilities in an area already in attainment. The intent is to prevent an attainment area from becoming a non-attainment area. This program can require best available control technology (BACT) and, if an ambient air quality standard is projected to be exceeded, emission offsets.

Public Utility Holding Company Act (PUHCA) - Federal legislation enacted in 1935 to control the financial practices of public utility holding companies and to simplify the holding company structure.

Public Utility Regulatory Policies Act (PURPA) - Enacted in 1978, PURPA is implemented by the Federal Energy Regulatory Commission and the California Public Utilities Commission (CPUC). Under PURPA, each electric utility is required to offer to purchase available electric energy from cogeneration and small power production facilities. See also *Qualifying Facility.*

Pumped Hydroelectric Storage - An energy storage technology in which water from a lower-elevation reservoir is pumped to a higher-elevation reservoir during low demand periods, consuming off-peak electricity. During high demand periods, electricity is generated by releasing the pumped water from the higher-elevation reservoir and allowing it to flow downhill through the hydraulic turbine(s) connected to electrical generators. See Appendix B, section B-8 for more information.

Qualifying Facility (QF) - A cogenerator or small power producer that meets certain guidelines, and thereby qualifies to supply generating capacity and electric energy to electric utilities, which must purchase this power at a price approved by state regulatory bodies. See also *Avoided Cost* and *Public Utility Regulatory Policies Act.*

Range - The distance that an EV can travel on a charge. A common protocol for determining range has not been determined, which makes comparisons among electric vehicles difficult. The United States Advanced Battery Consortium (USABC) recommends the Federal Urban Driving Schedule.

Reactive Material - A chemical with high activity that may react with other materials in a violent and uncontrollable manner if accidentally mixed.

Real time pricing - Real-time pricing involves pricing electricity on an hourly (or other time period) basis, based on the hourly cost of generating and delivering it. Hourly price information is passed on to the consumer who can decide, based on the price and his/her energy needs, what amount of electricity to buy now, and what amount to defer until later, when the cost may be lower.

Refinery (oil) - An industrial facility that converts crude oil into petroleum products that include: liquified petroleum gas, gasoline, aviation fuel, distillates such as diesel and No. 2 fuel oil, heavy residual fuel oils, lube oil, asphalt, and wax. See Appendix B, sections B-23 and B-24 for more information on petroleum and petroleum product pipelines, and refineries, respectively.

Regenerative Braking - Means of recharging the batteries by using energy created by braking the vehicle. With normal friction brakes, a certain amount of energy is lost in the form of heat created by friction from braking. With regenerative braking, the motors act as generators. They reduce the energy lost by feeding it back into the batteries resulting in improved range.

Renewable Resource - Resources that constantly renew themselves or that are regarded as practically inexhaustible. These include solar, wind, geothermal, hydro and wood. Although particular geothermal formations can be depleted, the natural heat in the earth is a virtually inexhaustible reserve of potential energy. Renewable resources also include some experimental or less-developed sources such as tidal power, sea currents and ocean thermal gradients.

Repowering - The upgrading of older generating technology by replacing older units with more efficient units, or by converting older systems into more efficient systems. An example of repowering is the replacement of an existing conventional natural gas-fired steam boiler with one or more combustion turbines and heat recovery steam generators (while retaining the existing steam turbine-generator), thereby forming a combined-cycle power plant. See Appendix B, section B-11 and Appendix H for more information.

Retail Wheeling - Retail wheeling involves a retail customer of a utility obtaining transmission (wheeling) service from that utility while purchasing the power from a different supplier. An example of retail wheeling is an industrial customer in one utility's service area buying power from another utility or third-party power producer, and using the first utility's transmission and distribution system to delivery the power.

Risk Management Prevention Plan (RMPP) - A plan to reduce the risk of accidents involving the use and handling of acutely hazardous materials. See also *Business Plan (Hazardous Materials).*

Selective Catalytic Reduction (SCR) - An air pollution control technology used to reduce nitrogen oxides in fossil-fuel combustion flue gases. The nitrogen oxides are converted to nitrogen and water by injecting ammonia in the presence of metal catalysts (typically titanium and vanadium oxides).

Selective Non-Catalytic Reduction (SNCR) - An air pollution control technology used to reduce nitrogen oxides in fossil-fuel combustion flue gases. The nitrogen oxides are converted to nitrogen and water by injecting ammonia or urea into the flue gas.

Self-generator - A privately-owned generating facility that produces power primarily for the exclusive internal use of the private, non-utility owner.

Sensitive Receptors - Land uses that contain segments of the population who are more sensitive to certain environmental impacts (such as air quality, public health, and noise) than the general population. Depending on the specific impact being considered, sensitive receptors may include: day care centers, schools, hospitals, senior centers, nursing homes, libraries, and places of worship.

Smart Charging - The use of computerized charging stations which constantly monitor the battery so that charging is at the optimum rate and temperature is monitored to prolong battery life.

Smog - A combination of smoke, ozone, hydrocarbons, nitrogen oxides, and other chemically-reactive compounds which, under certain conditions of weather and sunlight, may result in a murky brown haze that causes adverse health effects. The primary source of smog in California is motor vehicles.

Solar Photovoltaic (PV) Cells - Solar cells that convert the sun's electromagnetic energy (not its heat) directly into electrical power. PV cells are semiconductor devices that produce direct current (dc) electricity. See Appendix B, section B-14 for more information.

Solar Thermal - Use of the sun's heat to create electricity via either concentrating methods (which concentrate sunlight on a relatively small area to create the high temperatures needed to vaporize water or other fluids to drive a turbine-generator) or salt ponds. See Appendix B, section B-15 for more information.

Substation - A facility that switches, changes, or regulates the voltage in the electric transmission and distribution system. Voltage is stepped up where power is sent from a generating facility to high-voltage transmission lines. Voltage is stepped down from high-voltage transmission lines to lower-voltage distribution lines. See Appendix B, section B-17 for more information.

Terminal Facility - A facility that receives petroleum or petroleum products by tanker, barge, pipeline, rail, or truck. See Appendix B, section B-25 for more information.

Thermal power plant - An electric generating facility that produces electricity from a thermal energy source. Examples include *coal, geothermal, natural gas, nuclear, solar, biomass, municipal solid waste,* and *landfill gas power plants.*

Threshold - A level triggering an effect or action.

Time-of-use Rates - Electricity rates that vary by time of day. Employing time-of-use rates can result in a reduction in peak electricity usage by giving consumers an incentive to move usages that are not time-critical to off-peak (lower price) periods. For example, a consumer may choose to operate his or her clothes washer at night when rates are cheaper than during the peak afternoon period.

Total Suspended Particles - Particles suspended in air, generally less than 100 microns in diameter, consisting of incomplete combustion by-products, salt and larger organic compounds, condensed gases, mists, fugitive dust, sea salts, and pollens.

Toxic - Poisonous or otherwise hazardous to human health.

U.S. Department of Energy (DOE) - A department of the Federal government established in 1977 to consolidate energy-oriented programs and agencies. The DOE mission includes the coordination and management of energy conservation, supply, information dissemination, regulation, research, development and demonstration. The Department includes the Office of Transportation Technologies, the umbrella of the Office of Alternative Fuels and others.

U.S. Department of Transportation (DOT) - A department of the Federal government established in 1967 that is responsible for transportation safety improvements and enforcement, international transportation agreements and the continuity of transportation services in the public interest. The department facilitates and coordinates various research, development and technology transfer activities to promote and advance technology innovation in the transportation sector.

U.S. Environmental Protection Agency (EPA) - A government agency, established in 1970, responsible for the protection of the environment and public health. EPA seeks to reduce air, water, and land pollution and pollution from solid waste, radiation, pesticides, and toxic substances. EPA also controls emissions from motor vehicles, fuels and fuel additives.

Vapor-Dominated Resources - Geothermal resources that are composed primarily of hot steam. See Appendix B, section B-7 for more information.

Volatile Material - A material which is easily vaporized, readily evaporating into air at typical ambient temperatures.

Volt - Unit of measurement expressing electromotive force. Watts divided by volts equals amps.

Waste-to-energy - The process of converting a waste material to usable energy (including electricity). Examples include: *anaerobic digestion, biomass, and municipal solid waste.*

Watt - The unit of electrical power.

Wholesale Wheeling - A procedure in which a transmission system owner provides transmission services to allow electricity transactions to occur between a third-party supplier and a wholesale buyer.

Wind Power - Electric power generated by wind-driven turbines. See Appendix B, section B-16 for more information.

Zero Emission Vehicle (ZEV) - Emits no exhaust emissions. Electric vehicles are the only practical vehicles that produce no emissions.

INFORMATION RESOURCES

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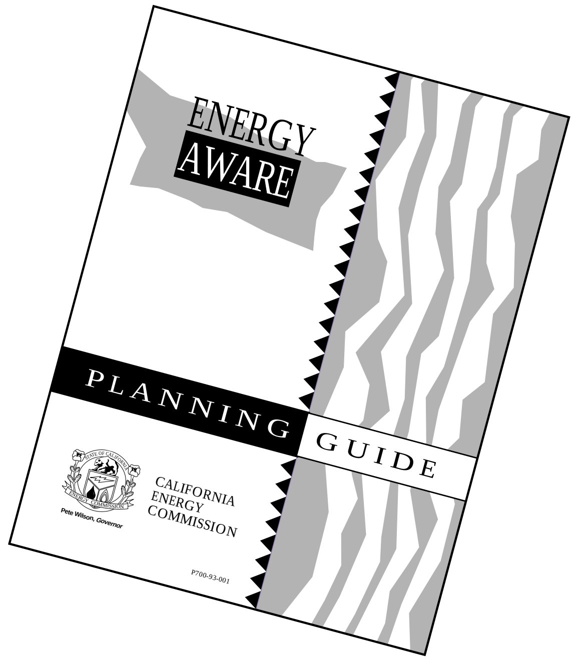
NOTES NOTES NOTES

APPENDIX H: ORDER FORM
FIRST ENERGY-AWARE GUIDE



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