CALIFORNIA ENERGY COMMISSION
1516 Ninth Street
Sacramento, California 95814

Main website: www.energy.ca.gov

In the matter of,	)	Docket No. 11-IEP-1G
Preparation of the	)	
2011 Integrated Energy Policy Report	)	REQUEST FOR COMMENTS
(2011 IEPR)	)	
	)	

Request for Public Comments

On September 14, 2011, the California Energy Commission's Integrated Energy Policy Report (IEPR) Committee held a public workshop to receive comments on the staff draft *Renewable Power in California: Status and Issues* report. Consistent with direction provided by Commissioners in that workshop, the Executive Summary for the report has been revised to include a list of high-level strategies that will form the basis for development of a comprehensive renewable strategic plan anticipated to be released in mid-2012 as part of the *2012 Integrated Energy Policy Report Update*.

The revised Executive Summary is available online at:

http://www.energy.ca.gov/2011_energypolicy/notices/index.html

Parties should be aware that the only change to the Executive Summary at this point is the addition of a section near the end under the heading "Recommended Strategies." The revised Executive Summary does not include any changes in response to oral or written public comments received at the September 14 workshop. The final *Renewable Power in California: Status and Issues* report, which will include the revised Executive Summary, will include revisions reflecting public comments and is anticipated to be released in early December 2011.

Background

Governor Brown's Clean Energy Jobs Plan directed the Energy Commission to prepare a renewable energy plan to "expedite permitting of the highest priority generation and transmission projects."[1] In response, the March 30, 2011 Scoping Order for the *2011 IEPR* identified a strategic plan for renewable energy development in California as one of the subsidiary volumes that will form the basis for policy recommendations in the *2011 IEPR*.

The staff draft *Renewable Power in California: Status and Issues* was issued on August 31, 2011 for public review and comment. The draft report describes challenges to meeting California's renewable electricity goals and discusses efforts underway to address those challenges. The intent of the report is to reach consensus among

[1] http://www.jerrybrown.org/Clean_Energy.

stakeholders on renewable status and issues as the first step in developing a strategic plan to increase renewable generation and transmission infrastructure in the state.

Written Comments

Written comments on the revised Executive Summary for the draft *Renewable Power in California: Status and Issues* must be submitted by **5 p.m**. on **November 7, 2011**. Please include the docket number 11-IEP-1G and indicate *Executive Summary for Renewable Power in California: Status and Issues* in the subject line or first paragraph of your comments.

All filings in the IEPR proceeding may now be done electronically. Please send your comments in either Microsoft Word format or as a Portable Document File (PDF) by electronic mail to [**docket@energy.state.ca.us**] and copy Suzanne Korosec at **[suzanne.korosec@energy.state.ca.us]** or send them on a Compact Disc to:

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 11-IEP-1G
1516 Ninth Street
Sacramento, CA 95814-5512

Please include your name or organization's in the name of the file. Signatures may be indicated on electronic copies by embedding a scanned signature graphic, "Original signed by" or similar words, or a scanned copy of the signature page may be appended to the electronic file.

A hardcopy original may also be submitted to the Dockets Office during the comment window. All written materials relating to this workshop will be filed with the Dockets Office and become part of the public record in this proceeding.

Date: October 26, 2011

Mail Lists: energypolicy, 33by2020, distgen, electricity, reti, transmission, renewable, research

EXECUTIVE SUMMARY

Governor Brown's Clean Energy Jobs Plan emphasized the importance of investing in renewable energy as a central element of rebuilding California's economy. Investments in renewable energy create local jobs both in clean tech industries and support industries like construction. Renewable generation facilities also provide economic benefits in the form of increased property and sales taxes. In addition to its contribution to the state's economy, renewable energy also improves California's energy independence by using local energy sources and fuels rather than imported natural gas, which is susceptible to supply shortages and price spikes. Increasing the amount of renewable resources in California's electricity portfolio also benefits the environment by reducing fossil-fuel generation that has negative impacts on air and water quality. Renewable resources are also essential to achieving the state's greenhouse gas emission reduction goals and reducing climate change impacts from the electricity sector.

Governor Brown directed the California Energy Commission to prepare a plan to "expedite permitting of the highest priority (renewable) generation and transmission projects" to support investments in renewable energy that will create new jobs and businesses, increase energy independence, and protect public health. As the first step in developing a strategic plan for renewable development in California, Energy Commission staff developed the draft *Renewable Power in California: Status and Issues.* This report describes the status of renewable development in the state and identifies challenges that will affect the state's ability to meet its renewable goals. The intent of this document was to develop consensus among stakeholders on the major challenges facing renewable development in California as the basis for development of a more comprehensive strategic plan that establishes a vision, goals, and suggested strategies. Toward that end, this Executive Summary recommends several high-level strategies based on the analysis in the report and on oral and written comments provided by stakeholders in public workshops. These strategies will be used as the starting point in developing a renewable strategic plan during the *2012 Integrated Energy Policy Report Update* proceeding.

Status of Renewable Development in California

For more than a century, California has used renewable energy – energy from natural resources like sunlight, wind, rain, and the earth's heat – to help meet its electricity needs. Renewable energy represented a relatively small portion of California's electricity mix until the late 1970s when Congress enacted the Public Utility Regulatory Policies Act (PURPA). A key element of PURPA was diversifying and strengthening domestic electricity production by encouraging the development of cogeneration (combined heat and power) and renewable energy facilities. Under Governor Brown's first administration, California established policies to implement this act that resulted in nearly 10,000 megawatts (MW) of new cogeneration and renewable generating capacity by the early 1990s. However, declining fossil fuel prices in the 1990s led to a drop in renewable development as PURPA contracts expired and renewable projects were not able to compete with new natural gas turbines.

In response, in 2002 the California Legislature established the Renewables Portfolio Standard (RPS) to diversify the electricity system and reduce growing dependence on natural gas by increasing the amount of renewable electricity in the state's power mix to 20 percent by 2017. In 2006, this target date was accelerated to 2010, and in 2011 the RPS was revised to require that renewable electricity should equal an average of 20 percent of the total electricity sold to retail customers in California during the compliance period ending December 31, 2013, 25 percent by December 31, 2016, and 33 percent by December 31, 2020. To support the RPS targets, Governor Brown's Clean Energy Jobs Plan calls for adding 20,000 MW of new renewable capacity by 2020, including 8,000 MW of large-scale wind, solar, and geothermal as well as 12,000 MW of localized generation close to consumer loads and transmission and distribution lines.

California appears to be on track to achieve the 20 percent by 2013 Renewables Portfolio Standard target, with nearly 16 percent of statewide retail sales coming from renewable generation facilities in 2010. The California Public Utilities Commission reports that more than 2,000 MW of new renewable capacity has begun commercial operation since the RPS was established in 2002. Publicly owned utilities have added another 290 MW of renewables since the RPS program began. As of 2010, California had more than 9,000 MW of renewable generating capacity, with nearly 6,000 MW from utility-scale renewables, 2,292 from wholesale distributed generation facilities, and nearly 1,000 MW from customer-side distributed generation systems.

Table ES-1: In-State Renewable Capacity and Generation (2010)

Renewable Resource	Utility-Scale Capacity (MW)	Wholesale Distributed Generation Capacity (MW)	Distributed Generation Capacity (MW)	Total Capacity (MW)	Total Generation (GWh)
Biomass	598	454	25	1,077	5,745
Geothermal	2,470	130	0	2,600	12,740
Small Hydro	308	1,072	0	1,380	4,441
Solar	387	16	953	1,356	908
Wind[C]	2,191	620	8	2,819	6,172
Total	**5,954**	**2,292**	**986**	**9,232**	**30,005**

Source: California Energy Commission

California has also made progress toward achieving the Governor's 12,000 MW renewable distributed generation goal, with 3,278 MW of distributed generation capacity installed as of June 2011. If existing state programs to support distributed generation are fully successful, the state could add 5,400 MW of additional capacity in the next five to eight years, leaving a gap of roughly 3,500 MW that may require additional programs or incentives. However, given declining trends in solar photovoltaic costs, it may make sense to focus on developing the low-hanging fruit and reforming permitting and interconnection processes in the early years to take advantage of cost reductions and improved regulatory structures in later years.

Energy Commission staff has developed regional targets to break down the 12,000 MW distributed generation goal into its component parts as a starting point to help meet the goal and measure progress over time. These regional targets are "soft targets" that serve as a starting point for discussions on a local level and may be reevaluated annually by the Energy Commission.

Table ES-2: Proposed Regional DG Targets by 2020

Region	Behind the Meter (all technologies)	Wholesale	Undefined (mix of behind the meter and wholesale)	Total
Central Coast	280	90	0	370
Central Valley	830	1590	0	2,420
East Bay	420	30	0	450
Imperial	50	90	0	140
Inland Empire	480	430	0	910
Los Angeles, *city and county	970	860	2170	4,000
North Bay	220	0	0	220
North Valley	120	50	0	170
Sacramento Region	410	170	220	800
San Diego	500	50	630	1,180
SF Peninsula	480	10	310	800
Sierras	30	40	0	70
Orange	420	10	40	470
Total	**5,210**	**3,420**	**3,370**	**12,000**

Source: California Energy Commission

As mentioned above, the Governor's Clean Energy Jobs Plan also sets a target for developing 8,000 MW of utility-scale renewable generating capacity by 2020. In 2010, more than 9,000 MW of new renewable capacity was permitted. Of that amount, about 8,000 MW were associated with new California Independent System Operator transmission lines and upgrades (Table ES-3). If these new lines and upgrades are permitted, built, and operating before 2020, they could allow more than 16,000 MW of additional generation to flow to load centers at any point in time. Only half of the capacity to fill these lines was permitted last year, meaning another 8,000 MW of capacity could be sited in the Competitive Renewable Energy Zones associated with these lines in the future. This is consistent with Governor Brown's goal of 8,000 MW of new capacity sited and built by 2020. Some of these zones are located in California's Mojave and Colorado Desert regions. The Energy Commission continues to support a fully integrated transmission and generation planning process, which includes the land use assumptions and natural resource planning information being developed in the state/federal Desert Renewable Energy Conservation Plan process.

Table ES-3: Preliminary Regional Targets for 8,000 Megawatts of New Renewable Capacity by 2020

Identified Transmission Line (s)	CREZ Served	Total Additional Capacity With New/Upgraded Lines (MW)[A]	Project Capacity Permitted in 2010 Associated With the New/Upgrades (MW)[B]	Additional Project Capacity for 8,000 MW of New Large-Scale Renewables (MW)
Sunrise Powerlink	Imperial North and South, San Diego South	1,700	760	940
Tehachapi and Barren Ridge Renewable Transmission Projects	Tehachapi, Fairmont	5,500	2,810	2,690
Colorado River, West of Devers, and Path 42 Upgrade	Riverside East, Palm Springs, Imperial Valley	4,700	1,825	2,875
Eldorado-Ivanpah, Pisgah-Lugo, and Coolwater-Jasper-Lugo	Mountain Pass, Pisgah, Kramer	2,450[C]	1,470	980
Borden-Gregg	Westlands	800	145	655
South of Contra Costa	Solano	535	155	380
Carrizo-Midway	Carrizo South, Santa Barbara	900	800	100
TOTAL				8,620

[A] California Energy Commission data.

[B] Renewable Energy Action Team database. Only projects associated with the transmission projects specified were included.

[C] The total deliverability potential with these lines could be as high as 3800 MW. However, the Eldorado-Ivanpah and the Pisgah-Lugo lines upgrade the same corridor and the capacity associated with the new lines may not be additive. The 2,450 MW includes the deliverability linked to the Pisgah-Lugo and the Coolwater-Jasper-Lugo lines.

Source: California Energy Commission

Looking forward, California has significant potential for additional renewable development to meet the 33 percent RPS target, with an estimated 18 million MW of renewable technical potential (the amount of generating capacity theoretically possible given resource availability, geographical restrictions, and technical limitations like energy conversion efficiencies). Achieving even a fraction of this potential, however, will depend on the ability of project developers to secure financing, permits, transmission, interconnection, and power purchase contracts.

Table ES-4: California's Renewable Energy Potential

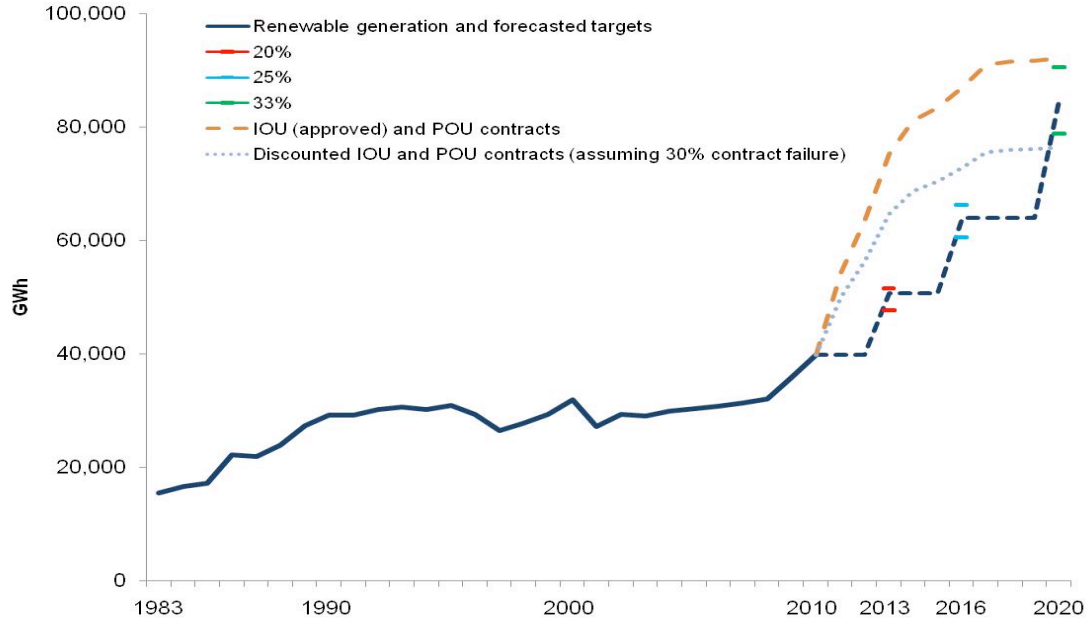
Technology	Technical Potential (MW)
Biomass	3,820
Geothermal	4,825
Small Hydro	2,158
Solar	
Concentrating Solar Power	1,061,362
PV	17,000,000
Wave and Tidal	32,763
Wind	
On-shore	34,000
Off-shore	75,400
TOTAL TECHNICAL POTENTIAL	**18,214,328**

Source: California Energy Commission.

Although an estimate of renewable market potential is beyond the scope of this report, recent trends indicate an increasing market interest in renewable development. The 2009 RPS solicitation by the California Public Utilities Commission drew bids from developers offering to supply enough renewable generation to meet half of the investor-owned utilities' total electrical load in 2020, and utilities have signed contracts for between 9,305 and 10,505 MW of new renewable capacity. In 2010, state and local entities issued permits for 9,435 MW of renewable capacity, and renewable projects totaling nearly 26,000 MW of capacity are being tracked in various permitting processes. As mentioned above, the California Independent System Operator's Interconnection Queue includes about 57,000 MW of renewable capacity, and there are 450 active interconnection requests for distributed generation systems in the Wholesale Distribution Access Tariff queue totaling about 5,200 MW.

The ability of developers to navigate successfully through each of these processes will affect the amount of renewable generation that is ultimately built and contributing toward meeting the state's renewable energy goals. Estimates of the amount of renewable energy needed to meet the 33 percent by 2020 RPS target beyond what is expected to be provided by existing facilities in 2020 range from 35,300 gigawatt hours to 47,000 gigawatt hours. As of May 2011, enough renewable generation was either on-line or under contract to achieve this range, assuming all existing renewable facilities remain on-line in 2020 and all to most of the contracted renewables are built (Figure ES-1).

Figure ES-1: On-Line or Contracted Generation to Meet Renewables Portfolio Standard Goals



Source: California Energy Commission

However, this estimate includes a number of short-term contracts that may not be renewed, as well as existing facilities that may retire due to age or contract expiration, which could reduce the contribution from existing facilities. There is also risk of contract failure; data from the Energy Commission's investor-owned utility contract database indicates that since the start of the RPS program, about 30 percent of long-term RPS contracts (10 years or more) approved by the California Public Utilities Commission have been cancelled. This suggests utilities should be contracting for a renewable generation in the range of 50,500 gigawatt hours to 67,000 gigawatt hours.

Post 2020, additional investments in renewable generation may be needed to replace generation expected to decline over the course of the next decade, such as generation from expiring coal contracts. Generation from a number of these contracts, which currently represents about 10 percent of total generation serving California, is expected to decline by 61 percent between 2010 and 2020 due to constraints imposed by the Emission Performance Standard (Senate Bill 1368, Perata, Chapter 598, Statutes of 2006). Remaining coal contracts are expected to expire between 2027 and 2030, which will require replacement with a mix of renewable and thermal generation with storage to satisfy electricity needs while still meeting greenhouse gas emission reduction goals.

When signing the 2011 RPS legislation, Governor Brown indicated that the 33 percent by 2020 RPS target should be considered a floor rather than a ceiling. This is consistent with the need for additional renewable generation and other zero-carbon electricity resources to meet the state's

long-term (2050) carbon reduction goals. A back-of-the-envelope estimate of the amount of renewable electricity needed to serve all new electricity demand through 2050 is 67 percent of total electricity sales in 2050. This assumes that energy efficiency programs in the long-term are developed at rates targeted for 2010-2020, distributed generation targets established in the Governor's Clean Energy Jobs Plan are met, more than 5 million full electric and hybrid vehicles along with high-speed rail are developed by 2050, existing in-state renewable facilities operate through 2050, and existing nuclear plants are relicensed through 2050. If the nuclear plants are not relicensed, the estimate of renewable energy needed to provide zero-emission generation needed in 2050 rises to 79 percent.

Issues Affecting Future Renewable Development in California

This draft *Renewable Power in California: Status and Issues* identifies many of the challenges that must be addressed to achieve California's renewable energy targets and goals. Planning, permitting, and environmental issues can delay or jeopardize project development and increase development costs. Because many renewable resources are located in remote areas, the state will need to upgrade existing or develop new transmission infrastructure to bring electricity from these areas to the state's load centers. This is made more complex by the current disconnect between generation and transmission planning and permitting processes wherein the length of time needed for transmission development requires transmission projects to proceed while there is still uncertainty about where generators will ultimately be located.

Once generation and transmission infrastructure is in place, there are further issues with integrating large amounts of intermittent renewable electricity, such as solar and wind, into the state's electric grid. Because generation from these resources may vary over time in periods as short as seconds, it can cause difficulties for grid operators who must maintain a constant balance between generation supply and real-time customer demand while also meeting established standards for controlling fluctuations in frequency and voltage. Connecting distributed generation projects to the distribution system also involves challenges due to aging infrastructure that also was not designed to accommodate the two-way flows of electricity that can result from high levels of distributed generation on the system.

On the financial side, there are financing gaps at certain stages of renewable development as well as costs associated with environmental review and permitting, construction, and interconnection of renewable facilities. Significant investment is needed to bring down the costs of existing renewable technologies and develop the new technologies that will be crucial to integrating renewable technologies into the grid. However, investment in energy-related research and development is currently about $1 billion less than a decade ago. In the absence of private and corporate funding for energy-related research and development, government funding for research – such as that provided by the Energy Commission's Public Interest Energy Research Program – becomes even more critical to maintaining the state's leadership role in developing a clean energy economy.

These and other issues discussed in this draft report and current efforts that are helping to address these challenges are summarized below.

Planning, Permitting and Environmental Issues

- **Site selection:** One of the main lessons learned during the Energy Commission's permitting of more than 4,000 MW of large solar thermal power plants in the California desert in 2010 is that location matters. Locating renewable facilities on undisturbed and/or sensitive lands in the desert raises a host of environmental concerns, including impacts on sensitive animal and plant species, water supplies and waterways, and cultural resources such as areas of historical or ethnographic importance. There are also land use concerns since the majority of desert lands in California are owned by the federal government and managed for multiple uses, including recreation, wildlife habitat, livestock grazing, and open space.

  To help developers design projects that minimize environmental impacts for renewable projects in the desert, the state's Renewable Energy Action Team in December 2010 published the multidisciplinary *Best Management Practices and Guidance Manual: Desert Renewable Energy Projects*. The Desert Renewable Energy Conservation Plan being developed by the Renewable Energy Action Team is also identifying areas in the Mojave and Colorado Desert regions suitable for renewable energy project development and areas that will contribute to the conservation of sensitive species and natural communities. To contribute toward reducing environmental impacts of renewable energy facilities, the Energy Commission's Public Interest Energy Research Program is identifying strategies to reduce the effects of desert solar and wind projects on sensitive species as well as low-risk sites for wind turbine installations to reduce avian impacts.

- **Fragmented or overlapping licensing authority:** A variety of federal, state, and local agencies have licensing authority for different types of utility-scale renewable projects. This can result in inconsistent environmental reviews and standards along with inaccurate and incomplete information on biological and cultural resource impacts. Although state and federal protocols for analyzing these impacts are essentially the same, there is wide variation in the extent of the evaluation, interpretation of results, and mitigation requirements. When involved agencies cannot agree on a set of mitigation or licensing conditions, developers have to satisfy more than one set of conditions, submit duplicate information, or face delays while agencies attempt to come to agreement.

  The Renewable Energy Action Team is working to streamline and expedite permitting processes for renewable energy projects, and state and federal agencies are increasing cross-agency cooperation and coordination of renewable permitting processes through a variety of multiagency agreements. In addition, the Energy Commission's Order Instituting Information Proceeding is identifying "lessons learned" during the licensing of large-scale renewable energy facilities in 2010 with the goal of identifying new approaches to planning and permitting in the future.

- **Unclear, duplicative, and uncoordinated requirements for renewable distributed generation projects:** Distributed generation projects are permitted at the local level, but many cities and counties do not have energy elements in their general plans or zoning ordinances to guide renewable development. In addition, the wide variation in standards,

codes, and fees among local governments make it difficult for developers to meet permit requirements. Land-use requirements for identical systems can vary significantly from jurisdiction to jurisdiction. Fees also vary widely among municipalities and even within municipalities for the same system size, and are often based on project cost rather than staff time needed for permit review, with many municipalities exceeding estimated cost recovery fees. Developers must also get permit approvals from local fire departments, building and electric code officials, and local air districts, leading to duplication and inefficiency in the permit application process. Finally, while distributed generation projects are subject to an environmental review under the California Environmental Quality Act and in some cases the National Environmental Protection Act, many local permitting agencies only have thorough environmental screening and review processes in place for traditional development and are ill-prepared to assess environmental impacts associated with renewable distributed generation.

There are efforts at the national, state, and local levels to identify and provide solutions to barriers to permitting renewable distributed generation facilities. The U.S. Department of Energy's Solar America Cities Program provided funding for cities that promote solar power and streamline interaction between local government and residents. In addition, the U.S. Department of Energy's SunShot Initiative provides funding to encourage cities and counties to streamline and digitize permitting processes and to develop innovative information technology systems, local zoning and building codes, and regulations. At the state level, the California State Assembly has introduced Assembly Bill X1 13 (V. Manuel Perez, Bradford and Skinner), which would require the Energy Commission to provide $7 million in grants to qualified counties in California to develop or revise rules and policies, including general plan elements, zoning ordinances, and a natural community conservation plan, to promote the development of eligible renewable energy resources. At the local level, many jurisdictions are supporting renewable distributed generation through strategies like identifying permitting barriers and developing expedited permitting processes, offering on-line permits for solar photovoltaic systems, and offering permit fee waivers for solar and wind projects. The California County Planning Directors Association is also coordinating a multistakeholder effort to draft a model ordinance for solar electric facilities for cities and counties across the state.

Transmission Issues

- **Ensure interconnection of renewable generation projects receiving federal stimulus funding:** There are 13 major transmission projects critical to the interconnection and deliverability of renewable generation in California needed to meet the 33 percent by 2020 renewable mandate (Table ES-5).

Table ES-5: Major Transmission Projects for Interconnection and Deliverability of Renewable Generation in California

Balancing Authority	Transmission	Served CREZ	Cumulative Renewable Deliverability Potential (MW) With Upgrade	Expected Commercial On-line Date
California ISO	Sunrise Powerlink (new 500 kV and 230 kV lines)	Imperial North and South, San Diego South	1,700	2012
California ISO	Tehachapi Renewable Transmission Project	Tehachapi, Fairmont	4,500	2015
California ISO	***Colorado River –Valley Transmission Project and new Colorado River and Red Bluff 500 kV substations.***	***Riverside East, Palm Springs***	***4,700 combined with West of Devers project***	***2013***
California ISO	***Eldorado - Ivanpah 115 to 230 kV conversion***	***Mountain Pass***	***1,400***	***2013***
California ISO	Borden - Gregg (230 kV line reconductoring)	Westlands	800	2015
California ISO	South of Contra Costa (reconductoring)	Solano	535	2015
California ISO	***Pisgah - Lugo 230 kV to 500 kV conversion***	***Pisgah, Mountain Pass***	***1,750***	***2017***
California ISO	***West of Devers 230 kV reconductoring***	***Riverside East, Palm Springs***	***4,700 combined with Colorado River- Valley Project***	***2017***
California ISO	Carrizo - Midway sections of Morro Bay - Midway (230 kV lines reconductoring)	Carrizo South, Santa Barbara	900	2012
California ISO	***Coolwater – Jasper – Lugo (new 230 kV line and other upgrades)***	***Kramer***	***700***	***2018***
California ISO/Imperial Irrigation District (IID)	Path 42 Upgrades	Imperial Valley	1,400	2015
IID	Internal IID Upgrades	Imperial Valley	See above	2011+
Los Angeles Dept. of Water and Power	***Barren Ridge-Renewable Transmission Project***	***Tehachapi, Barren Ridge***	***1,000***	***2016***

Source: California Energy Commission

Many of the projects in Table ES-5 are needed to interconnect renewable generation projects receiving funding through the American Recovery and Reinvestment Act that will be essential to achieving the state's renewable goals (indicated in the table by bold italics). While a number of the 13 projects have been licensed or are under construction, several key projects do not yet have active licensing applications.

- **Lack of coordinated land use and transmission system planning:** Transmission planning processes need to be streamlined and coordinated to ensure siting, permitting, and construction of the most appropriate transmission projects to connect renewable resources

while ensuring proper consideration of land use and environmental factors. Currently, the project development process, which identifies routing issues and constraints, does not begin until after the "wires" planning process is complete. This lengthens the transmission development process and increases the risk of approved transmission projects not being developed due to environmental issues. In addition, assumptions and processes used by transmission planning organizations are not always transparent or consistent, and the large number of planning forums makes it difficult for stakeholders to participate effectively.

The Renewable Energy Transmission Initiative was a statewide land use planning process to help identify transmission projects needed to meet the state's renewable energy goals. This effort identified about 30 "competitive renewable energy zones" (CREZs) throughout the state that were most likely for cost-effective and environmentally benign generation development with corresponding transmission interconnections and lines. This established the precedent for incorporating land-use planning into the statewide transmission planning process, and led directly to the collaborative land use planning activity occurring in the Desert Renewable Energy Conservation Plan process. Energy agencies are working together to develop a "virtual" process to ensure integration of land use planning from the Desert Renewable Energy Conservation Plan into the California Independent System Operator's annual transmission planning process.

In addition, the California Transmission Planning Group, formed in 2009, is working to address California's transmission needs in a coordinated manner by developing a conceptual statewide transmission plan that identifies the necessary transmission infrastructure to meet the state's 33 percent by 2020 RPS goal. The California Independent System Operator has also revised its transmission planning process to include transmission upgrades needed to meet California's policy mandates, with the 2010-2011 Transmission Plan focusing on the RPS mandate in identifying policy-driven transmission projects. The California Independent System Operator also requested and received a one-time waiver from the Federal Energy Regulatory Commission to exempt upgrades associated with renewable projects receiving federal stimulus funding from further study in the 2010-2011 transmission planning process to allow generators to meet the construction start date of December 31, 2010.

- **Better use of the existing grid:** Currently, proposed projects are based on existing need demonstrated by individual interconnection requests. Allowing "upsizing" of projects, for example by constructing a double circuit line in an existing right-of-way, can provide unused capacity available for future use and maximize the value of land associated with already necessary transmission investment and avoid future costlier upgrades needed to accommodate additional renewable development.

  One of the goals of the Desert Renewable Energy Conservation Plan is to support consolidation of renewable development, including transmission infrastructure, rather than scattered "leapfrog" development. In addition, the Energy Commission's Public Interest Energy Research Program has funded a wide variety of projects related to improving the

performance of the existing transmission system, including technologies to increase the carrying capacity of existing lines, reduce instabilities that are causing some transmission connections to be operated thousands of megawatts below maximum capacity, and develop transmission cables that can be operated at higher temperatures and allow more power to be transferred over existing transmission rights-of-way.

Integration Issues

- **Grid-level integration:** Maintaining reliable operation of the electric system with high levels of intermittent resources will require regulation to follow real-time ups and downs in generation output, voltage, or frequency caused by changes in generation or load; ramping generation from other units up or down to follow swings in wind or solar generation; spinning reserves provided by generating resources standing by and ready to connect to the grid if needed; and replacement power for outages. In addition, system operators need strategies to address potential overgeneration issues that occur when there is more generation than there is load to use it. California currently relies on large hydropower and natural gas generators to provide many of the services needed to integrate intermittent renewable resources, but as more renewable generating facilities are added to the system, it will become increasingly challenging to maintain system reliability and stability.

  Successful integration will require improvements in forecasting of wind and solar technologies so that transmission and generation dispatchers know how much variability to plan for. In addition, complementary technologies like natural gas-fired power plants, energy storage, and demand response can be used to provide integration services. Natural gas units can provide quick startup, rapid ramping, regulation, spinning reserves, and energy when intermittent resources are not available. Energy storage can provide flexible and controllable ancillary services at the transmission level through voltage support and frequency response, and can also store excess energy when on-line generation exceeds load. Demand response – having electricity customers reduce their consumption at critical times or in response to market prices – can help with integration by combining smaller loads to provide regulation or ramping through automatic controls that turn individual loads up or down as needed.

  There are a number of efforts underway to address integration issues. The California Independent System Operator is working to improve its forecasting techniques to reduce uncertainty and the amount of standby capacity that will be needed to compensate for variations between generation and load. Formal planning for adding cost-effective energy storage to the electric system began with the passage of Assembly Bill 2514 (Skinner, Chapter 469, Statutes of 2010), which directed the California Public Utilities Commission and publicly owned utilities to evaluate the need for and benefits of cost-effective and viable energy storage systems, and determine appropriate targets by October 2013. Demand response is being used throughout the United States for ancillary services, and the California Independent System Operator offers two demand response products that are laying the foundation for the role of demand response in renewable integration efforts. In addition, the California Independent System Operator is scheduled to implement a

regulation energy market in spring 2012 that will allow demand response and energy storage to submit bids to provide ancillary services. The California Public Utilities Commission is also evaluating integration costs as part of its Long-Term Procurement Plan proceeding for various scenarios. Finally, the Energy Commission's Public Interest Energy Research Program is funding a wide array of projects intended to develop better forecasting tools for wind and solar generation, develop and demonstrate energy storage technologies, identify ways that demand response can support renewable integration, and develop the smart grid[1] of the future.

- **Distribution-level integration:** There are also significant challenges to integrating large amounts of renewable distributed generation into the distribution system, which brings power from substations to consumers. These resources include small projects on the customer side of the meter that produce energy to satisfy a customer's own electric load; medium-sized projects that provide energy for a customer's load, for export to the grid, or some combination of the two; and larger systems that export all of their power to a utility or some other entity. Today's distribution system still uses designs, technologies, and strategies that were developed to meet the needs of mid-20th century customers. While these large and complex systems have historically provided reliable electric power to tens of millions of customers throughout the state, aging infrastructure coupled with modern demands is beginning to erode this capability. One major challenge is that the system is currently designed to move electricity in one direction, from central-station generator to substation to customer. However, as more distributed generation is added to the system, power generated by these resources may exceed demand and flow backwards into circuits or substations, requiring new protection and control strategies to avoid damaging the electric system. Another challenge is the increasing number of requests for interconnection and the need to reduce the complexity, expense, and length of time associated with that process.

  California utilities are already modernizing their distribution systems by replacing equipment at the end of its useful life with new equipment that often has more advanced communication and functional capabilities. This modernization is likely to increase as a result of Senate Bill 17 (Padilla, Chapter 327, Statutes of 2009), which requires utilities to develop smart grid deployment plans. To address interconnection challenges, the California Public Utilities Commission has established the Renewable Distributed Energy Collaborative working group. There are also fast-track processes available within each of the state's interconnection processes to streamline interconnection of smaller projects, and utilities are providing information on their websites to allow developers to identify locations on the distribution grid where projects can be interconnected more quickly and at lower cost. The Energy Commission and the California Independent System Operator are

1 A "smart grid" incorporates information and communications technology into electricity generation, delivery, and consumption to minimize environmental impacts, enhance markets, improve reliability and service, reduce costs, and improve efficiency.

also funding a study on renewable distributed generation integration in Germany and Spain to identify strategies that can be applied to California's system. Other research funded through the Public Interest Energy Research Program is focused on predicting the impacts of distributed generation on distribution circuits, and developing smart grid and battery storage technologies that can support integration at the distribution level.

Investment and Financing Issues

- **Ensuring adequate financing at critical stages of renewable project development:** Like all emerging industries, there are key financing challenges that face renewable energy development including acquiring significant capital that is injected at the right time, incentives that drive down costs, and solutions that help to reduce or mitigate risk. Lack of funding during early stages of project development can affect the ultimate success of a renewable project. There is little financial incentive for private companies to invest in the types of research and development that are most beneficial to society because there is no certainty of return on their investment. During the later stage of early commercial development, significant capital is needed to finance projects and demonstrate the viability of a project at scale. Technologies currently at or anticipated to be at this stage over the next three years include concentrating solar power towers, advanced solar manufacturing, and energy storage. Because these funding gaps are not addressed by the private sector, government has an important role in addressing financing challenges by promoting research and early technology innovations, reducing credit risks, and developing and maintaining stable and predictable regulatory policies to provide information for medium- and long-term investment decisions.

  National government laboratories are helping to address these funding gaps by performing cutting-edge research on a variety of clean energy technologies. In addition, the federal Advanced Research Projects Agency – Energy funds high-risk, high-reward technologies to bridge the gap between basic energy research and industrial application. Other federal government support mechanisms include tax incentives such as the business energy investment tax credit and the renewable production tax credit as well as accelerated depreciation of renewable energy assets and loan and bond financing programs. There are a number of state incentives as well, including programs to support renewable distributed generation and sales and use tax exclusions under California's Advanced Transportation and Alternative Sources Manufacturing Sales and Use Tax Exclusion Program. On the research side, the Public Interest Energy Research Program provided about $179 million for renewable energy research between 1997 and 2010, including seed funding for technology incubators that accelerate the growth and development of clean technologies. Other efforts include the state's Innovation Hub initiative, which leverages research parks, technology incubators, universities, and federal laboratories to provide an innovation platform for startup companies, economic development organizations, business groups, and venture capitalists. Finally, tools like feed-in tariffs (one of the most widely implemented renewable policies in place in 61 countries and 26 states/provinces) are providing greater certainty of project revenues, reducing transaction costs, and helping projects to secure financing.

Cost Issues

- **Renewable technology costs:** Renewable technologies have a wide range of costs depending on the technology. More mature technologies, like geothermal and biomass, have a narrower range of levelized cost than emerging technologies, although biomass costs too can vary depending on feedstock availability. Historically, technologies like solar thermal electric and solar photovoltaics were thought to have levelized costs greater than those of conventional generation. However, recent contract bids show that this is changing. According to the Energy Commission's investor-owned utility contract database, the majority of solar thermal power tower technology contracts that have been signed and are pending are below the 2009 Market Price Referent, a proxy for the levelized cost of a new 500-megawatt natural gas combined cycle.

  In addition, in the past distributed generation projects were considered more costly due to higher transaction costs and lack of economies of scale. However, standardization of contract terms and the way photovoltaics are manufactured and sold have affected bids for distributed generation systems. Pacific Gas and Electric and Southern California Edison have filed advice letters with the California Public Utilities Commission stating that all contracts signed under their solar photovoltaic programs, which are for projects 20 MW and smaller, are also below the Market Price Referent.

  As retail rates increase and solar photovoltaic costs drop, distributed generation projects on the customer side of the meter are also likely to become more cost-competitive even without state rebate programs. For example, even though Pacific Gas and Electric is offering a Performance Based Incentive of only 5 cents per kilowatt hour (down from 39 cents per kilowatt hour less than five years ago), systems are continuing to be installed. It is likely that there will be significant changes in the market in the next five to ten years as distributed generation systems become more cost-competitive.

  For utility-scale renewable projects, the Energy Commission continues to work with the California Independent System Operator and the California Public Utilities Commission to determine the costs of transmission and renewable integration. While costs of both appear significant, they are certainly not insurmountable. Distribution system upgrades and modernization could be significant depending on the location of distributed generation projects and the pace at which they are deployed. However, there are a variety of efforts to identify optimal locations for such projects and to develop the smart grid technologies needed to ease integration into the distribution system.

  Finally, in any discussion of the costs of renewable technologies, it is important to recognize that renewables provide important benefits that have not been adequately quantified, such as the value of having a diverse portfolio of generating resources that reduces costs and risk to ratepayers, business and economic development benefits, reduced dependence on natural gas and vulnerability to natural gas supply shortages or price spikes, and reduced greenhouse gas emissions and climate change impacts.

Research and Development Issues

- **Maintaining state funding for energy-related research and development**: Continued public sector investment in energy-related research and development is essential to address the various challenges to achieving California's renewable energy goals. The Public Interest Energy Research Program has funded a wide variety of research activities to identify ways to address the environmental impacts of renewable energy facilities; develop technologies to improve the performance of the state's transmission and distribution systems; promote integration of renewable generating technologies at both the transmission and distribution level through the development of smart grid, energy storage, and demand response technologies; and reduce renewable technology costs while improving efficiency. With increasing levels of renewable resources in California's electricity mix, continued research will be required in each of these areas to provide the technological advancements needed to support the state's clean energy policy goals.

Environmental Justice Issues

- **Addressing environmental justice concerns:** Environmental justice is defined in California law as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies." Environmental justice organizations have repeatedly voiced concerns about the types of power plants that will be built to meet increased electricity demand and replace aging power plants and plants that may retire as a result of the State Water Resources Control Board's policy on the use of once-through cooling in power plants, particularly in the southern part of the state, which has some of the worst air quality in the nation. There are also concerns about the types of fossil generation that may be built to support renewable integration, including flexible natural gas turbines ("peakers") that are less efficient that baseload resources and have increased emissions that may impact the communities in which they will be located.

  The Energy Commission has considered environmental justice issues in its power plant licensing process since 1995, including conducting outreach to community members, identifying areas potentially affected by emissions or other environmental impacts, determining where there are significant populations of minority or low-income residents in an area potentially affected by proposed projects, and determining whether there may be a disproportionate effect on minority or low-income populations. However, given figures in the 2010 census that indicate California has the highest minority population in the nation at 57 percent, it is likely that new power plants, including those that use renewable resources, will be located in areas that could affect minority communities.

Local Government Coordination Issues

- **Coordination between state and local governments on energy decisions**: Renewable development at the local level will be an essential component of the state's efforts to meet its renewable energy goals. Local governments are closely involved in land use decisions, environmental review, and permitting for a wide range of renewable projects. Many local governments face constraints due to scaled-back staffing as a result of the economic

downturn, limited expertise about renewable technologies, and lack of energy elements in their general plans and ordinances that could delay the processing of permits for renewable facilities. However, a number of local jurisdictions are showing strong leadership and innovation in promoting renewable energy development, including Kern County, Imperial County, Inyo County, Los Angeles County, San Diego County, San Luis Obispo County, Solano County, Fresno County, Tulare County, Marin County, and the cities of Fremont, Santa Rosa, San Jose, Sacramento, Lancaster, Santa Monica, and Berkeley.

Workforce Development Issues

- **Ensuring a well-trained workforce to support California's renewable policy goals**: Nationwide, the clean economy employs more workers than the fossil fuel industry, with California having the highest number of clean energy jobs. While the clean energy economy grew more slowly than the national economy between 2003 and 2010, newer clean tech segments like wind, solar photovoltaics, and smart grid produced explosive job gains. While much of this growth is creating demand for workers in existing occupations, it is also driving the need for workers who need to enhance their skills and for those who need training for emerging occupations. As investment in the clean economy continues to expand, there is a need for a coordinated approach to workforce training that is closely aligned with labor demand. Although there are a number of workforce training programs in place, the fragile economy has made employers hesitant about taking on more employees, which has resulted in low placement rates for some of these programs. In addition, expiration of federal stimulus funding for workforce development may make it difficult for community colleges, trade associations, and other training providers to continue their clean energy training curricula in the future.

  California is at the forefront of workforce training efforts for the green economy with its Clean Energy Workforce Training Program, the largest state-sponsored green jobs training program in the nation. In addition, the Energy Commission's Clean Energy Business Financing Program has awarded funding to six companies focused on production of solar photovoltaic panels that are creating 640 jobs throughout the state.

Public Leadership Issues

- **Demonstrating public leadership**: California has the potential to develop renewable energy systems on state-owned buildings, properties, and rights-of-way to help meet the state's renewable energy goals, create green jobs, and reduce greenhouse gas emissions and other harmful air pollutants. These investments will also reduce energy costs in state buildings and create new revenue for state government through the lease of vacant or unused land. State leadership will also demonstrate the benefits of renewable distributed generation and help encourage larger-scale deployment throughout the state and across the country.

  In December 2010, the Energy Commission adopted a memorandum of understanding with the Departments of General Services, Corrections and Rehabilitation, Transportation (Caltrans), Water Resources, and Fish and Game to promote the development of renewable energy projects on state buildings, properties, and rights-of-way. The California State Lands

Commission and the University of California have since signed on to this effort, and there is an option for additional agencies to join in the future. Based on its inventory of state properties to identify opportunities for deployment of renewable distributed generation systems, Energy Commission staff recommended a target of 2,500 MW of new renewable generating capacity on state properties. There are already a number of efforts underway by various state agencies that will contribute toward meeting these targets.

Recommended Strategies

Building upon this thorough study, numerous public workshops, and the input of stakeholders from various communities and industries throughout California, the Energy Commission proposes five overarching strategies to guide the state as it works toward achieving the 33 percent Renewables Portfolio Standard mandate, the 12,000 megawatt distributed generation goal, and promoting economic recovery and job creation through investments in the clean energy sector:

1. Identify and prioritize geographic areas in the state for both renewable utility-scale and distributed generation development. Priority areas should have high levels of renewable resources, be located where development will have the least environmental impact, and be close to planned, existing, or approved transmission or distribution infrastructure. Prioritization should also include increasing efforts between state and local agencies to coordinate local land-use planning and zoning decisions that promote the siting and permitting of renewable energy-related infrastructure.

2. Evaluate the cost of renewable energy projects beyond technology costs, particularly the costs associated with integration, permitting, and interconnection. This evaluation shall be coupled with a value assessment that ultimately monetizes the various system and non-energy benefits attributable to renewable resources and technologies, particularly those benefits that enhance grid stability and reduce environmental and public health costs.

3. Develop a strategy that minimizes integration needs at the distribution level (through use of remote telemetry and other smart grid technologies) and the transmission level (through improved forecasting, the development of an energy imbalance market, and procurement of dispatchable renewable generation), and that strives for cost reductions and improvements to integration technologies, including storage, and the best use of the state's existing natural gas-fired power plant fleet.

4. Promote incentives for renewable technologies and development projects that create in-state jobs and support in-state industries, including manufacturing and construction. In implementing this strategy, the state should evaluate how current renewable energy policies and programs are impacting in-state job growth and economic activity and identify which renewable technologies rely on supply chains that provide the best opportunities for California businesses.

5. Promote and coordinate existing state and federal financing and incentive programs for critical stages including research, development, and demonstration; precommercialization; and deployment. In particular, the state should maximize the use of federal cash grants and loan guarantee programs by prioritizing the permitting and interconnection of California-based renewable energy projects vying for federal stimulus funds.

Detailed implementation strategies and action items will be developed in the upcoming *2012 Integrated Energy Policy Report Update* proceeding to provide further guidance on specific activities in which various state and local entities can engage to successfully carry out these high-level strategies in the near-, medium-, and long-term.

Conclusion

Achieving California's aggressive renewable energy goals will require a concerted effort by state agencies, utilities, environmental groups, and other stakeholders to develop a strategic plan that includes a clear vision, quantifiable and measurable goals, a set of strategies for achieving those goals, and milestones against which to measure progress. This staff draft *Renewable Power in California: Status and Issues* is the first step in developing such a strategic plan. The Integrated Energy Policy Report Committee seeks stakeholder input on whether the issues identified in this draft report are accurately characterized and whether they are the highest priority issues that need to be addressed. Stakeholder input will be used to further refine this document in preparation for developing a more comprehensive strategic plan by mid-2012.