September 2008

California long term ENERGY EFFICIENCY STRATEGIC PLAN

ACHIEVING **MAXIMUM ENERGY SAVINGS** IN CALIFORNIA FOR 2009 AND BEYOND

RESEARCH & TECHNOLOGY

COMMERCIAL SECTOR

WORKFORCE EDUCATION & TRAINING

CODES & STANDARDS

AGRICULTURAL SECTOR

LOCAL GOVERNMENTS

RESIDENTIAL SECTOR INCLUDING LOW INCOME

MARKETING, EDUCATION & OUTREACH

INDUSTRIAL SECTOR

California Public Utilities Commission

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DSM COORDINATION AND INTEGRATION

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INTRODUCTION

In October 2007, the California Public Utilities Commission (CPUC) created a framework to make energy efficiency a way of life in California by refocusing ratepayer-funded energy efficiency programs on achieving long-term savings through structural changes in the way Californians use energy.[1]

The Commission recognized that California's very ambitious energy efficiency and greenhouse gas reduction goals require long-term strategic planning to eliminate persistent market barriers and effect lasting transformation in the market for energy efficiency across the economy. Accordingly, the Commission committed to prepare and adopt a long-term strategic plan for California energy efficiency through 2020 and beyond.

This *Long Term Energy Efficiency Strategic Plan (Plan)* was developed through a collaborative process involving the CPUC's regulated utilities – Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company (SoCalGas) (collectively, "IOUs") – and over 500 individuals and organizations working together over an eleven-month period.[2]

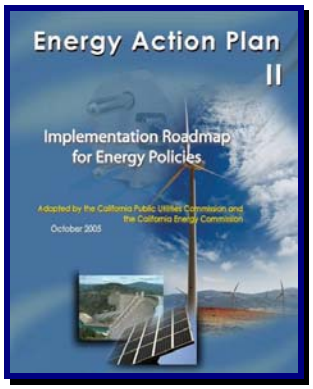
This *Plan* sets forth a roadmap for energy efficiency in California through the year 2020 and beyond. It articulates a long-term vision and goals for each economic sector and identifies specific near-term, mid-term and long-term strategies to assist in achieving those goals.[3]

With broad stakeholder input, the CPUC has continually refined the implementation strategies which are at the heart of this Plan. Every participant in this process recognizes the formidable task that lies ahead. Every participant also recognizes, however, that ever-increasing energy prices and the urgent threat of climate change require that California set the bar high and move forward quickly and purposefully to realize the full extent of efficiency opportunities statewide and achieve deep reductions in energy demand and usage.

1.1 PAST ACCOMPLISHMENTS AND FUTURE CHALLENGES

The 2005 CPUC and California Energy Commission's (Energy Commission) Energy Action Plan II,[4] declared:

"[The] goal is for California's energy to be adequate, affordable, technologically advanced, and environmentally-sound…[C]ost effective energy efficiency is the resource of first choice for meeting California's energy needs. Energy efficiency is the least cost, most reliable, and most environmentally-sensitive resource, and minimizes our contribution to climate change."

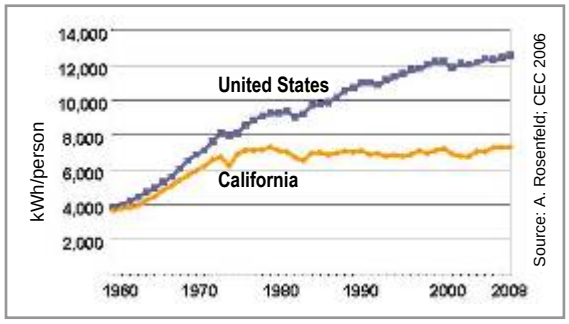


The State's "loading order" – first acknowledged in Energy Action Plan I[5] – identifies energy efficiency as California's top priority resource. Under Public Utilities Code Section 454.5(b)(9)(C) utilities are required to first meet their "unmet resource needs through all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible."

California has taken this principle to heart and with three decades of leadership and innovation in the public and private sectors, California leads the nation, and perhaps the world, in developing and implementing successful energy efficiency efforts.

As the Energy Commission notes in its 2007 Integrated Energy Policy Report (IEPR)[6]:

"Energy efficiency, which helped to flatten the state's per capita electricity use, will continue to be the keystone of California's energy strategy. California's building and appliance standards have saved consumers more than $56 billion in electricity and natural gas costs since 1978 and averted building 15 large power plants. It is estimated the current standards will save an additional $23 billion by 2013."



Over the years, successive CPUC decisions have created a policy framework to motivate IOUs to develop and continuously expand energy efficiency programs on behalf of their customers. This policy framework is composed of a number of elements including: the State's adopted loading order; aggressive goals set based upon up-to-date potential studies; decoupling of sales from revenues for electric and gas utilities; performance-based incentive mechanisms; and a robust dual funding stream comprised of a public goods charge and procurement funding.

The IOUs' 2006-2008 energy efficiency portfolio marks the single-largest energy efficiency campaign in U.S. history, with a $2 billion investment by California's energy ratepayers. In addition, individual and corporate energy consumers; state and local agencies; and publicly-owned utilities continue to make significant independent investments to increase the efficient use of energy across California.

However, with a growing population, increasing demand for energy, and the pressing need to reduce greenhouse gas (GHG) emissions in a rapid and low-cost manner, there has never been a more important time for energy efficiency in California. California is the second-largest GHG-emitting state in the U.S. and electricity production is the second largest source of carbon emissions in California, accounting for some 32 percent of its total, with gas use in businesses and homes another 9 percent.[7]

An Enabling Policy Framework

California's success to date has been enabled by a comprehensive policy framework supporting energy efficiency investment. The aggressive scale-up envisioned by this Plan hinges on a steady foundation composed of the following elements:

- ***Clear Policy Direction.*** *The Energy Action Plan* sets forth a bold policy vision establishing efficiency as the California's first priority energy resource. Specific savings goals, tied to supply procurement, implement that policy.
- ***Adequate Financial Incentives and Funding.*** The decoupling of sales from revenues for electric and gas utilities, along-side performance-based incentive mechanisms, address a fundamental bias against efficiency investment. Meanwhile, a public goods charge and procurement funding produce substantial funding resources for such investment.
- ***Robust Program Administration and Oversight.*** In California, efficiency programs are largely administered by utilities utilizing universal contact with homes and businesses throughout the state, while government maintains primary responsibility for program direction and oversight, including program evaluation and the measurement and verification of claimed energy savings.
- ***Firm Ratcheting Standards.*** The establishment of minimum efficiency standards for buildings and appliances that are updated on a regular basis have driven guaranteed progressive energy savings over the past three decades.

Meanwhile California demand for electricity and natural gas continues to grow, with statewide electricity consumption forecast to increase an average of 1.25 percent per year over the next decade.[8] In addition, the State faces rapidly-escalating fuel prices.

The combination of these pressures poses significant economic and social risks to California. As both an emissions-free and low-cost energy resource alternative, energy efficiency is uniquely-poised to play a central role in reconciling the current challenge. This fact is acknowledged in virtually every discussion of GHG abatement opportunities, including McKinsey & Company's comprehensive 2007 review.[9]

Capitalizing on this opportunity in California will require that we make energy efficiency investments an integral part of life and a "business as usual" choice for California market actors.

It will require that we overcome market barriers that have persisted over the course of California's 30-year history with energy efficiency policy, and it will demand the political will to continue making investments during times of economic stress to extend and to capture the full extent of energy efficiency potential obtainable across the State. However, in succeeding, this initiative will bring benefits not only for California but will allow the State to share its energy efficiency leadership, skills and experience in the national and international efforts to combat global warming through energy efficiency.

1.2 POLICY CONTEXT

The passage of the California Global Warming Solutions Act of 2006 (Assembly Bill 32)[10] has amplified the need for intensive energy efficiency efforts across California. The California Air Resources Board's (CARB) Draft Scoping Plan for Assembly Bill (AB) 32 implementation states that while "California has a long history of success in implementing regulations and programs to encourage energy efficiency… [it] will need to greatly expand those efforts to meet our greenhouse gas emission reduction goals." [11]

The Draft Scoping Plan, which offers preliminary indication of how the State plans to achieve its GHG reduction targets, establishes a statewide energy efficiency target of at least 32,000 gigawatt hours and 800 million therms by 2020.[12] If achieved, emission reductions from these efficiency savings would result in over 25 million metric tons of GHG emissions reductions, making them the second largest component in the State's overall emissions reduction program. The Draft Scoping Plan recognizes this, stating that efficiency provides an emission reduction opportunity for California "on a scale second only to the Pavley regulations."[13]

AB 32 and other pivotal legislation and policy in California — such as the Energy Action Plan II, AB 2021 (establishment of statewide energy efficiency goals), the Low-Income Energy Efficiency statutes, the Governor's Green Building Executive Order[14], and the 2007 IEPR — create an environment where energy efficiency efforts must not only continue to thrive but scale up unprecedented levels.

In July 2008, the CPUC redoubled its own energy savings efforts by establishing new targets for energy savings for the years 2012 through 2020 for its regulated utilities.[15] Within IOU service areas these goals are expected to save over 4,500 megawatts, the equivalent of over 9 major power plants, and over 16,000 GWh of electricity savings and 620 million therms. Combined with recent goal-setting by the State's publicly-owned utilities under AB 2021, these goals provide an aggressive contribution to statewide energy savings targeted under AB 32.

A number of recent policies, such as AB 1109, which requires defined reductions in energy usage for lighting, and the Federal Energy Independence and Security Act of 2007, which contains many provisions for new minimum efficiency standards and research, have dramatically altered the landscape for energy efficiency activities in California.[16] Ensuring the continued effectiveness of public purpose efficiency programs, for instance, will require

careful coordination with emerging mandates and market changes.

This *Plan* provides a strategic roadmap for integrating energy efficiency efforts to achieve the aggressive goals the State has set for itself. It aims to bring together key participants beyond the CPUC and the IOUs, including publicly-owned utilities, the financial and building industries, cities and counties, other State agencies, and businesses and consumers, to work together toward common energy efficiency goals. Therefore, the strategies and goals are not restricted by geographical, jurisdictional, regulatory, or political boundaries. To achieve these goals, all actors must work collaboratively over the long-term to fundamentally transform the way Californians use energy at home and at work.

1.3 TARGETING MARKET TRANSFORMATION

The CPUC's October 2007 decision (D.07-10-032) directed that "a key element of the Strategic Plan would be that it articulates how energy efficiency programs are or will be designed with the goal of transitioning to either the marketplace without ratepayer subsidies, or codes and standards."[17]

The CPUC also stated that the *Plan* would incorporate the market transformation goal described above and "develop milestones to measure progress towards that goal," including the development of a "targeted timeframe for such market transition and the process for tracking progress so that it is clear at what point a program has made a successful transition or conversely, is having problems."[18]

This *Plan* fulfills the Commission's goal by employing market transformation as its unifying objective. The *Plan* seeks to effect substantial and sustained progress towards more efficient technologies and practices in each of the customer end use sectors (e.g., Commercial, Industrial, Residential, Agricultural). Likewise, the *Plan* describes the market transformation efforts necessary in each of the cross-cutting areas discussed (e.g., Codes and Standards, Workforce Education and Training, Marketing Education and Outreach, and Research and Technology)

As early as 1998, the Commission defined market transformation as:

"Long-lasting sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where further publicly-funded intervention is no longer appropriate in that specific market."[19]

In theory, ratepayer-funded efficiency programs over the past thirty years have been designed either to encourage suppliers and manufacturers to sell efficiency products or services to "push" the market, or to encourage consumers to buy these products or services to "pull" the market. Typical utility rebate programs aim to increase the market penetration of energy-efficient products along a continuum until market acceptance reached sufficient levels for the measure to be incorporated into codes and standards or used in the marketplace without ratepayer subsidies.

In practice, however, utility programs in California have naturally tended towards measures which produce readily-quantified, low-cost, near-term savings which offer the opportunity to "buy" load reduction in easy, well-packaged measures with limited market impacts. There has been little incentive for utilities to engage in measures with a longer-term orientation – those very measures which produce meaningful market transformation.

This *Plan* seeks to move utilities, the CPUC, and other stakeholders beyond a focus on short-term energy efficiency activities into a more sustained long-term, market transformation strategic focus.

By re-emphasizing the market transformation goal, we do not discount the benefits of short-term measures for energy savings. Utility portfolios must contain an appropriate mix of short and longer term energy savings. However, short-term programs such as the replacement of incandescent light bulbs with compact fluorescent light bulbs must be accompanied by solutions which focus on multi-year and holistic lighting system strategies, improved conservation actions, and other means of market transformation.

Additionally, the *Plan* recognizes that the process of market transformation cannot and should not be driven by ratepayer-funded utility programs alone. While utilities will play a continued role in stimulating market transformation across sectors, each of the cross-cutting areas described in this *Plan* represents an avenue where non-utility actors may well be better positioned to drive the "push" of new technologies to market, or the "pull" for customers and business to adopt available efficiency technologies or practices.

Transformation is an evolutionary process, as markets for a given end-use are not transformed just once, but continuously. Understanding when a technology promoted in utility programs has become established within the mainstream market or incorporated into codes and standards will help target when new programs are needed to encourage the next generation of energy efficiency technologies. Decision 07-10-032 recognized this in directing the utilities' proposed 2009-2011 portfolios to identify "an 'end game' for each technology or practice that transforms building, purchasing, and the use decisions to become either 'standard practice', or incorporated into minimum codes and standards."[20]

It is necessary to develop appropriate rules, metrics, and guidelines for determining when market-transformation has occurred and publicly-funded intervention is no longer appropriate, so as to define an end-point for strategies and set the course for new programs and goals. A key priority for the first update of this *Plan* will be the development of end-point definitions, rules, and progress metrics. The *Plan*'s content, however, is oriented towards charting a programmatic course that embraces the goals and strategies of market transformation by seeking to achieve significant transformative progress in all sectors by 2020 or earlier.[21]

The CPUC also recognizes its responsibility to examine changes to the policy rules on counting savings from IOU programs to attribute gains from market transformation and long-term strategies resulting from IOU actions. In order to ensure utilities are motivated to devote portfolio dollars towards market transformation measures, associated savings must be fairly accounted for in attribution methodologies.

Policy Tools for Market Transformation

The market transformation strategies covered in the Plan are built upon one or more of the following policy tools employed to "push" or "pull" more efficient products or practices to market:

- ***Customer Incentives*** including rebates; innovative or discounted financing; and/or non-financial support to consumers are the "carrots" that help *pull* consumers into choosing the efficient option.
- ***Codes and Standards*** which mandate minimum efficiency thresholds for buildings, appliances and/or equipment, removing the less efficient choices from the marketplace are the "sticks" that *push* builders and manufacturers to provide efficient goods and services.
- ***Education and Information*** through marketing, education and outreach inform market actors about energy efficiency opportunities. These programs often include labeling; benchmarking; internet-based comparisons; professional and trade materials; school curricula; peer-to-peer exchanges; and other resources.
- ***Technical Assistance*** helps to ensure that knowledge barriers on the part of customers, installers or retailers are not unnecessarily hampering the progress of critical efficiency initiatives.
- ***Emerging Technologies*** rely on research, development, demonstration and/or deployment to move energy-efficient products and developments from the laboratory into the commercial marketplace.

1.4 STRATEGIC PLANNING PROCESS

Decision 07-10-032 outlined the key goals, content, and development process for this *Plan*. During November and December 2007 and January 2008, working groups for four "vertical" market sectors — residential, including low-income, commercial, industrial, and agricultural — and seven cross-cutting areas — Heating, Ventilation and Air Conditioning (HVAC) systems; Demand Side Management (DSM) Coordination and Integration; Workforce Education and Training (WET); Marketing Education and Outreach (ME&O); Research and Technology; Codes and Standards; and Local Governments — held 36 public stakeholder workshops.

The objective of these workshops was to facilitate information exchange and develop an action plan for each market sector and each cross-cutting sector. In January 2008, these plans ("Convener Reports") were provided to the IOUs to inform their strategic planning efforts.

Throughout this process, the CPUC acted as a centralized information hub via a specially built webportal, disseminating team updates and reports and providing models for teams to look to in recording their findings.

As required by the CPUC, the IOUs filed a draft *Plan* on February 8, 2008. On March 6, 2008, the IOUs filed a revised draft *Plan*, supplementing the February draft pursuant to Commission direction. Three stakeholder workshops were then held in San Diego, Los Angeles, and San Francisco.[22]

All public comments, workshop transcripts, IOU and CPUC staff materials, and convener reports have been archived and are available on the strategic planning website: www.californiaenergyefficiency.com.

"BIG BOLD" ENERGY EFFICIENCY STRATEGIES

In order to guide market transformation in a number of key sectors, this Plan embraces four specific programmatic goals, known as the "Big Bold Energy Efficiency Strategies," established by the CPUC in D.07-10-032 and D.07-12-051.These goals were selected not only for their potential impact, but also for their easy comprehension and their ability to galvanize market players.

1. All new residential construction in California will be zero net energy by 2020;
2. All new commercial construction in California will be zero net energy by 2030;
3. Heating, Ventilation and Air Conditioning (HVAC) will be transformed to ensure that its energy performance is optimal for California's climate; and
4. All eligible low-income customers will be given the opportunity to participate in the low income energy efficiency program by 2020.

1.5 LIMITATIONS OF THIS FIRST PLAN

Two limitations to this 2008 *Plan* should be noted:

1. Because it is the initial plan—and due to time and other constraints—this *Plan* has not undergone cost-benefit analysis. However, the efficiency activities envisioned in this *Plan* subject to the Commission's jurisdiction will only be funded by ratepayers as part of cost-effective portfolios. Similarly, the strategies and actions have not been fully evaluated for prioritization or for budget and resource-allocation decisions. Accordingly, the strategies and actions described in this *Plan* will be updated as conditions change and new experience and information is obtained.
2. This *Plan* does not specifically address three important elements of energy efficiency. These are the evaluation and measurement and verification of energy savings; transportation; and the water-energy "nexus." The reasons for these exclusions are two-fold: first, there was no specific input provided by the working groups on these topics; and, second, various State agencies are covering these issues in separate processes. Future strategic planning cycles are likely to address these issues.

Many of the strategies in the *Plan* do not require changes in State or Federal law or the regulations of various agencies. Specifically, most of the activities to be implemented in the near term (approximately 2009-2011) are expected to be feasible under current law and the rules of the CPUC and other agencies. However, there are longer term elements of the *Plan* for which changes in law and/or agency rules and policies would be useful—or even essential—to achieve the desired cost-effective energy efficiency over the 2009-2020 period.

1.6 UPDATING THE PLAN

This *Plan* is a dynamic document that will be regularly updated to reflect past successes, failures, and lessons learned and to adjust the visions, goals and strategies accordingly. Given the urgency of the need to achieve the AB 32 goals, it is necessary to quickly and efficiently complete foundational activities such as studies, data collection and pilot programs and to move just as quickly to implement actual programs and deliver real results in the near term.

The process that started during the fall of 2007 was a tremendous and highly productive effort by the utilities, CPUC, and the Energy Commission working with a large number of stakeholders from all sectors of the California economy. This process must continue in order to continue the momentum and build the sustained velocity needed to achieve the goals expressed in this *Plan*.

In the short term, this process will be advanced through the establishment of goal and/or strategy-specific task forces, to be coordinated by the CPUC. Over the longer term, there is widespread stakeholder support for coordination at a statewide level by an entity with a membership and mandate better suited to the multi-jurisdictional scope of the strategies articulated in this *Plan*. Such an entity would build on the collaboration initiated by the strategic planning process thus far and allow for enhanced participation by all stakeholders.

The next planning cycle will include:

- Incorporating data collection efforts, including market assessment and market potential studies, more directly in this and other planning processes, such as the Energy Commission's IEPR and the utilities' long-term procurement planning processes.
- Aligning this planning effort with related statewide long-term resource plans, such as those associated with water, land use, and greenhouse gas mitigation.
- Evaluating performance with respect to the goals and strategies established in the current *Plan*, and market transformation criteria in particular.
- Engaging even more key stakeholders prior to initiating the planning cycle and cooperatively developing roles and a process that increases information exchange and participation of these stakeholders. Conducting more widespread public workshops to enable these stakeholders to provide planning input and to vet planning documents.
- Central to this expanded process will be participation by additional State agencies, which may wish to co-sponsor various task forces—for example, in Workforce Education and Training or the Agricultural Sector -- and obtaining commitments from key participants willing to fund, lead, or implement strategies.

2. RESIDENTIAL SECTOR INCLUDING LOW INCOME

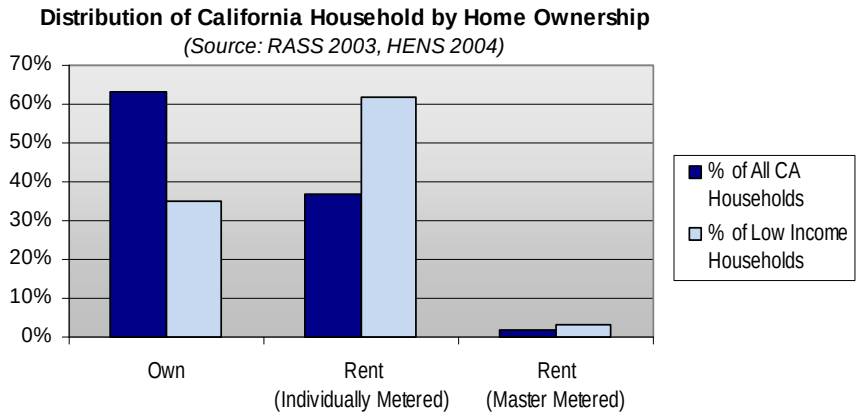
2.1 CORE RESIDENTIAL

2.1.1 VISION

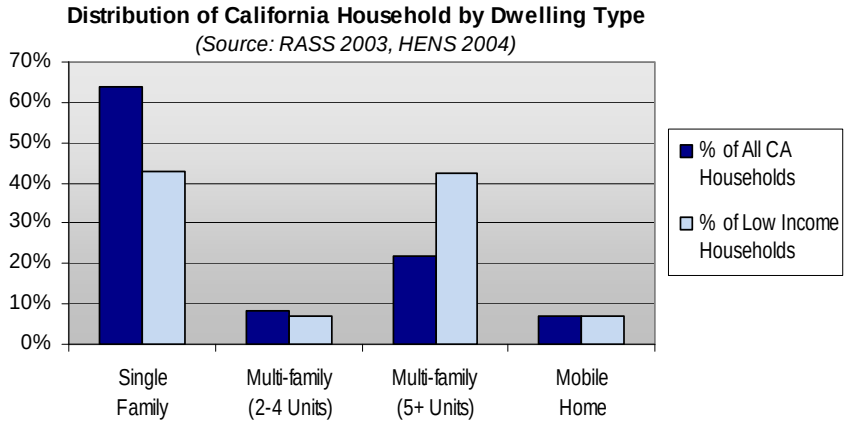
Residential energy use will be transformed to ultra-high levels of energy efficiency resulting in Zero Net Energy new buildings by 2020. All cost-effective potential for energy efficiency, demand response and clean energy production will be routinely realized for all dwellings on a fully integrated, site-specific basis.

2.1.2 PROFILE

In 2008, energy demand for California's 12.6 million households was over 25,000 MW. The residential sector represents approximately 32% of total state electricity consumption and 36% of its total natural gas consumption. Electricity demand is expected to grow to almost 31,000 MW by 2018.[23]

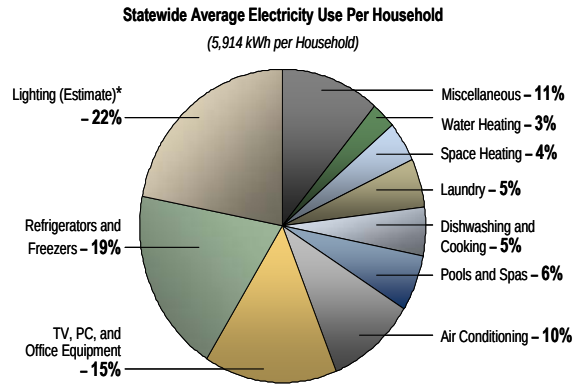


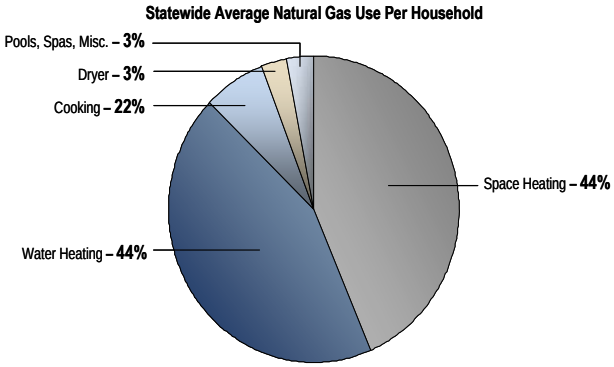
Approximately one-third of all households live in multi-family structures, and two-thirds in single family homes. The balance of renters to homeowners is about 42% to 58%, respectively. Most or all of these households qualify for utility energy efficiency programs targeting residential customers.[24] About one-third (approximately 4 million) of these households qualify for additional low income energy efficiency (LIEE) programs extended to households with annual incomes less than or equal to 200% of Federal Poverty Guidelines.[25]



Pursuant to a legislative mandate to reduce energy usage in California, the Energy Commission adopted California's Appliance Efficiency Regulations in 1976 (Title 20) and Part 6 of Title 24 of the California Code of Regulations, the Energy Efficiency Standards for Residential and Nonresidential Buildings in 1978, (Title 24).[26] The Title 24 standards are updated triennially to incorporate new energy efficiency technologies and methods. The Title 20 standards are updated more frequently.

The utilities have responded to the diverse needs of California's residential sector by offering a wide range of energy efficiency programs that impact every level of the residential market, including rebates for efficient products, such as lighting, air conditioners, and refrigerators; training and education to architects, engineers, building managers and building inspectors; and work to enhance the Energy Commission's building and appliance codes and standards. The utilities also have introduced a number of innovative whole-house or community-wide programs such as the SCE Sustainable Communities program which targets new residential developments and the Design for Comfort Program that provides efficiency assistance to affordable housing developments that are undergoing renovation.





VISION

Over the past two utility program cycles (2004/2005 and 2006/2008), the utilities have focused heavily on residential lighting, which accounts for the largest electricity end use in the residential sector. As a result, the bulk of residential efficiency savings has come from lighting programs such as measures that encourage the use of compact fluorescent light (CFL) bulbs. In the past few years, the CFL market has undergone a major transformation, as evidenced by the ubiquity of CFL products in the retail market and recent energy measurement and verification studies.

A major transformation of the lighting market will be completed through the passage and implementation of AB 1109, the 2007 California Lighting Efficiency and Toxics Reduction Act.[27] AB 1109 requires a 50% increase in efficiency for residential general service lighting by 2018 through phased increases in the Energy Commission's Title 20 regulations, with the first phase of the standards taking effect by January 1, 2010.[28] These changes in the lighting market provide will allow opportunities to redirect utilities' residential energy efficiency resources towards new lighting technologies and other innovative programs focused on whole-building efficiency measures.

Likewise, the strategies set forth in this *Plan* will create longer-term savings from the built environment with a goal of continual incorporation of advances into codes and

standards or the private marketplace. The 2009-2011 IOU program cycle will lay the foundation for aggressive, long-term strategies to change the way residential buildings are constructed, used and maintained.

2.1.3 GOALS

Goal	Goal Results
1. New construction will reach "zero net energy" (ZNE) performance (including clean, onsite distributed generation) for all new single and multi-family homes by 2020.	By 2011, 50% of new homes will surpass 2005 Title 24 standards by 35%; 10% will surpass 2005 Title 24 standards by 55%. By 2015, 90% will surpass 2005 Title 24 standards by 35%. By 2020, all new homes are ZNE.
2. Home buyers, owners and renovators will implement a whole-house approach to energy consumption that will guide their purchase and use of existing and new homes, home equipment (e.g., HVAC systems), household appliances, lighting, and "plug load" amenities.	Energy consumption in existing homes will be reduced by 20% by 2015 and 40% by 2020 through universal demand for highly efficient homes and products.
3. Plug loads will be managed by developing consumer electronics and appliances that use less energy and provide tools to enable customers to understand and manage their energy demand.	Plug loads will grow at a slower rate and then decline through technological innovation spurred by market transformation and customer demand for energy efficient products.
4. The residential lighting industry will undergo substantial transformation through the deployment of high-efficiency and high-performance lighting technologies, supported by state and national codes and standards.	Utilities will begin to phase traditional mass market CFL bulb promotions and giveaways out of program portfolios and shift focus toward new lighting technologies and other innovative programs that focus on lasting energy savings and improved consumer uptake.

Transformation of markets for new multi-family homes can be achieved through strategies targeting the Commercial or Residential sectors or a combination of both, since rental buildings are commercial enterprises as well as dwelling units. In this first *Plan,* with the exception of the approximately 50 percent of LIEE-eligible households living in multi-family housing, there is no specific focus on strategies to upgrade efficiency in existing multi-family dwellings. This is a recognized shortcoming and strategies for this market must be addressed in greater detail in the next iteration of this *Plan*.

The leadership and active participation of many organizations are also necessary to achieve the vision for the residential sector. The Energy Commission must continue to lead the efforts to continually enhance and expand the building and appliance codes with active technical support and expertise from the IOUs, national laboratories, and the building industry.

In addition, the United States Department of Energy (DOE) and the United States Environmental Protection Agency (EPA) play critical roles in residential energy efficiency efforts. Moreover, significant attention must be directed towards manufactured (or "prefabricated") housing, a substantial and growing component within new housing stock, which is built under federal code set by the United States Department of Housing and Urban Development.

Extensive R&D efforts and partnership programs will push the market further. For technological advances in buildings, appliances and plug loads, the IOU's Emerging Technologies program and the Energy Commission's ratepayer-funded Public Interest Energy Research (PIER) program must work cooperatively with the national laboratories and private industry to achieve the advances envisioned in this *Plan*.

2.1.4 STRATEGIES

The market transformation envisioned by the residential sector *Vision and Goals* involves changing both the supply chain of products and services and the behaviors that residential energy consumers rely on to use energy efficiently. The four interrelated residential Goals are designed to achieve this transformation through the following themes:

1. **Building Innovation**: Drive continual advances in technologies in the building envelope, including building materials and systems, construction methods, distributed generation, advanced metering infrastructure, and building design, and incorporate technology advances into codes and standards.

2. **Comprehensive Solutions**: Develop, offer and promote comprehensive solutions for single and multi-family buildings, including energy efficiency measures, demand management tools and real-time information, and clean distributed generation options in order to maximize economic decision-making and energy savings.

3. **Customer Demand**: Create high levels of customer demand for progressively more efficient homes through a coordinated statewide public education campaign and targeted incentive programs.

4. **Statewide Solutions**: Coordinate and collaborate with State agencies and private organizations to advance research and development and to align State efforts on buildings.

5. **Financing**: Work with the financial community to develop innovative and affordable financing options for energy efficient buildings and retrofits.

6. **Codes and Standards**: Adopt aggressive and progressive minimum energy codes and standards for buildings and plug loads, effective code compliance and enforcement, and parallel, tiered voluntary energy efficiency standards that pull the market along and set a higher bar for subsequent standards.

While the overall mission for the residential sector is ambitious, these goals and strategies are interrelated and many of the efforts to reach one goal will contribute to the achievement of a different goal; for example, success in Goal 3 (Plug Load) will contribute to the success of Goal 1 (ZNE Homes) and Goal 2 (Whole House Performance). Improvements in building standards resulting from improvements in technologies (Goal 1) will promote efficiencies from existing home renovations and improvements (Goal 2).

Certain strategies in the residential market (e.g., marketing, education and outreach) are part of larger, cross-cutting strategies. As a consequence, the strategies described below contain a certain amount of repetition and cross-referencing; however, each strategy will require refinements to accomplish the specific goal for target markets. This is consistent with our overall goal of encouraging integrated energy efficiency programs that recognize and leverage the benefits of related projects, while at the same time aligning specific strategies with the requirement of each goal.

2.1.5 IMPLEMENTATION PLAN

Goal 1: Deliver Zero Net Energy New Homes By 2020.

Goal 1 envisions a continual and dramatic increase in the demand for and supply of lower energy homes based on new technologies, new building principles, and policy support to achieve a statewide standard of zero net energy (ZNE) for all new homes built in 2020.

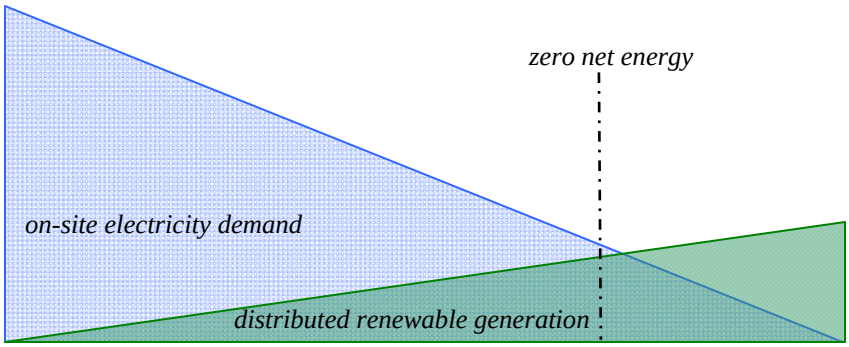
A ZNE home employs a combination of energy efficiency design features, efficient appliances, clean distributed generation, and advanced energy management systems to result in no net purchases of energy from the grid. The CPUC has defined "Zero Net Energy" at the level of a single "project" seeking development entitlements and building code permits in order to enable a wider range of technologies to be considered and deployed, including district heating and cooling systems and/or small-scale renewable energy projects that serve more than one home or business.

A wide range of design features may be considered to achieve zero net energy, including building orientation (relative to the daily and seasonal position of the sun), window and door type and placement, insulation type and values of the building elements, weatherization, the efficiency of heating, cooling, lighting and other equipment, as well as local climate.

Heating and cooling loads are lowered by using high-efficiency equipment, added insulation, high-efficiency windows, in addition to passive solar and other design elements; water heating loads can be alleviated by using heat recovery units and high-efficiency water heating equipment; lighting energy needs are reduced by daylighting and fluorescent and LED fixtures; while plug loads are managed by efficient appliances and minimized standby power.

WHAT IS ZERO NET ENERGY?

Zero net energy is a general term applied to a building with a net energy consumption of zero over a typical year. To cope with fluctuations in demand, zero energy buildings are typically envisioned as connected to the grid, exporting electricity to the grid when there is a surplus, and drawing electricity when not enough electricity is being produced.



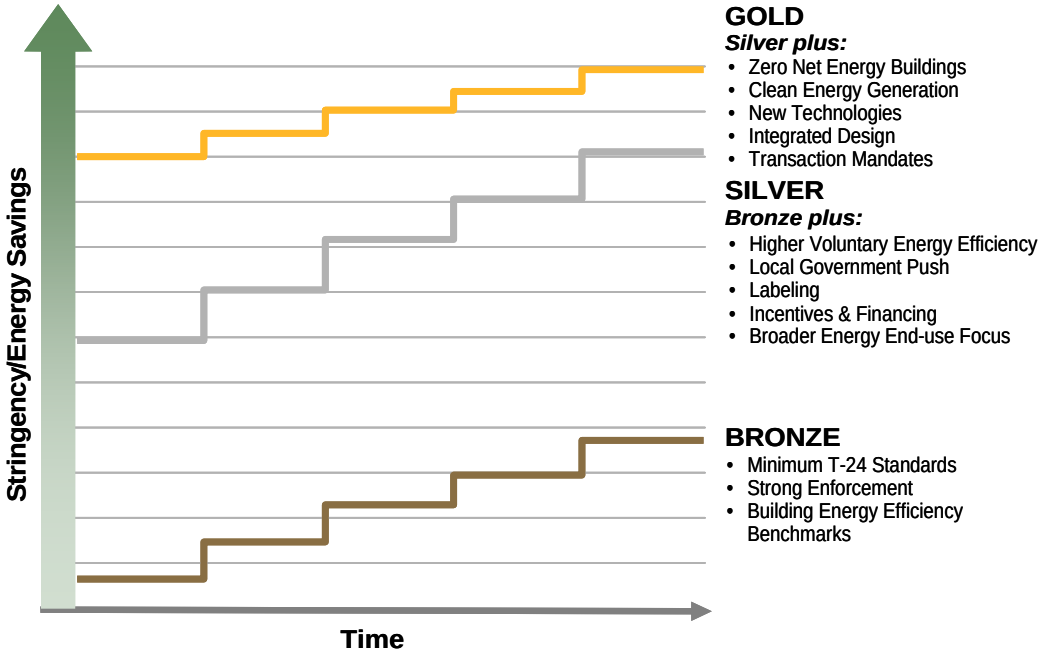
- The amount of energy provided by on-site renewable energy sources is equal to the amount of energy used by the building.
- A ZNE building may also consider embodied energy – the quantity of energy required to manufacture and supply to the point of use, the materials utilized for its building.[29]

Interim milestones for this programmatic goal are that by 2011, 50% of new homes will be 35% more efficient than 2005 Title 24 standards (coincident with the Energy Commission's Tier II standard for incentives under the New Solar Homes Partnership[30]) and 10% will be 55% more efficient; and that by 2015, 90% of homes will surpass 2005 Title 24 standards by 35%.

The "Big / Bold" goal of achieving ZNE for 100% of new residential construction and the supporting interim goals are extremely aggressive. Accordingly, we characterize them in this first *Plan* as "reach" and "programmatic" goals. They are intended to capture the imagination and spark the enthusiasm of all who participate in transforming residential new construction to ultra-high levels of energy efficiency.

As part of this effort, California will establish a "Path to Zero" campaign sponsored by the CPUC, State agencies, utilities, the building industry, and others. This campaign will feature real-world experience and data on emerging technologies, practices, and designs that deliver zero net and ultra-low energy buildings, alongside mechanisms to demonstrate their effectiveness and create demand in the marketplace for high-performance buildings coordinated with marketing tactics and financial incentives. A first step will be convening a task force of key stakeholders committed to zero net energy buildings.

California's Title 24 should continue to be progressively updated and tightened on a triennial basis along a planned trajectory leading to achievement of goals for the year 2020. Mandatory standards of Title 24 should be linked to one or two tiers of voluntary, beyond-code standards such that the single mandatory and one or two voluntary levels comprise a bronze-silver-gold approach to residential efficiency performance. Each Title 24 Code update will achieve a stepped pattern of tightening standards toward what had been the higher voluntary level, dropping the previous minimum mandatory (i.e., 2011's gold becomes 2014's silver and 2017's minimum mandatory). These voluntary silver-gold tiers could be used as reference points for "reach" building policies and programs, local ordinances, and utility incentives.



In July 2008, California's Building Standards Commission (BSC) adopted a first-ever set of Green Building Standards that apply to commercial and residential construction statewide.[31] The standards will take effect on a voluntary basis in 2009, and will likely be adopted as mandatory standards by 2012. In addition, in August, the City and County of San Francisco adopted a Green Building ordinance requiring newly constructed commercial buildings over 5,000 sq ft, residential buildings over 75 feet in height, and renovations on buildings over 25,000 sq ft to meet the United States Green Building Council's Leadership in Energy and Environmental Design standards (LEED) and other green building certifications. [32] Similarly, the City of Los Angeles enacted its own Green Building Ordinance in April 2008, which takes affect later in 2008 and 2009. It establishes a series of requirements and incentives for developers to meet LEED standards and is expected to affect at least 7.5 million square feet each year.[33]

The emergence of sustainable building policies and ordinances are an indication that many local governments desire building practices that go beyond State minimum building codes. As more local governments enact codes that are more stringent than State codes, a patchwork of different and potentially conflicting building requirements is arising. As requirements become more varied across geography, developers and particularly production home builders may have difficulty designing and building major developments consistent with both State and local codes.

Accordingly, Strategy 2 requires coordination of local government building codes and development policies to facilitate common approaches to the adoption and rapid evolution of highly energy efficient technologies and techniques in new construction statewide. Coordination also will advance testing of sustainable building technologies and techniques in different operating environments to provide a stronger basis for progressive increases in the stringency and coverage of energy efficiency standards within State building codes.

The Energy Commission is the logical candidate to lead the codes and standards effort along with the BSC and the Department of Housing and Community Development. Near-term, the Energy Commission could collaborate with these agencies to publish a provisional, performance-based "reach code" reference standard for "beyond code" residential construction in California. This would be advisory and create a reference from which to gauge further improvements.

The process could coordinate with the Energy Commission's Public Interest Energy Research (PIER) and other research organizations (Lawrence Berkeley National Laboratory (LBNL), National Renewable Energy Laboratory (NREL), Building Industry Research Alliance (BIRA) to assess and provide the foundation for recommendations, including monitoring and measurement approaches.

This Goal also requires a major transformation in the construction, design and usage of residences through a combination of mandates and voluntary actions. The technical feasibility of ZNE homes is in early stages of demonstration through the pioneering efforts of the Sacramento Municipal Utility District (SMUD), NREL, and home designers and builders. DOE's Building America effort, for instance, has put ZNE research to work in homes across 34 states. These demonstrations also provide a forum for continual research on optimizing performance of homes with ZNE elements.

Several ZNE residential projects, such as SMUD's project in Roseville, CA, are already underway and others are in the planning or conceptual phase. In the near term, the utilities will aggressively promote additional proof of concept pilots, including affordable housing elements in these pilots.

Significant additional resources will be required to scale these efforts up to for full-scale production and sale at affordable prices. In an effort to marshal private, public, academic, corporate, and entrepreneurial resources towards this objective, a prominent philanthropy organization will soon announce an Energy Free Home Challenge: to achieve net zero energy at net zero cost. Launching in fall 2008, the prize will award $20 million in cash prizes both for enabling technology innovation and whole-home innovation.

California will need new, cost-effective technologies for home building materials and fabrication techniques, and "smarter" home operating systems, such as visual displays of real-time (or near real-time) energy use. In addition, the energy efficiencies of household equipment and appliances must increase. (In this regard, see Strategies 2 and 3 below and the Heating, Ventilation & Air Conditioning Chapter.) These innovations must be accompanied by a strong education, outreach and marketing effort to increase consumer demand for efficient homes, including the use of energy or carbon benchmarks and labels.

Affordability is a key consideration in California, where the cost of housing is a serious, long-term issue.[34] A key element of this Goal is to develop ZNE example homes across the spectrum of housing options, including multi-family affordable housing in urban infill areas with access to public transportation.

Finally, innovative financing solutions, such as loans that remain with the property through owner-occupant turnover and energy efficient mortgages, will be essential in allowing builders and owners to leverage the cost-savings inherent in ZNE buildings into investment costs. Furthermore, finance mechanisms must fully reflect the savings in monthly operating costs from low energy homes. New programs must leverage and build upon financing options available from private markets and other government initiatives. To this end, the CPUC will establish a Finance Task Force for the commercial and residential sectors made up of members of the financial/investment industries; building and developer community; and, State, Federal and local governments to identify existing and additional needed tools, instruments, and information necessary to attract greater participation of capital markets in funding efficiency transactions. The Task Force will identify actors to develop innovative and effective financing tools especially suited for ZNE and ultra low-energy buildings.

Goal 1: Zero Net Energy Homes

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid-Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Drive continual advances in technologies in the building envelope, including building materials and systems, construction methods, distributed generation, and building design.	Energy Commission (PIER) Utilities DOE, national labs Production home builders and building industry organizations	• 50% of new homes exceed 2005 Title 24 standards by 35% • 10% of new homes exceed 2005 Title 24 standards by 55%	• 90% of new homes exceed Title 24 by 35% • 40% of new homes exceed Title 24 by 55%	• 100% of new homes exceed Title 24 by 35% • 90% of new homes exceed Title 24 by 55%
		• Develop and participate in pilot projects in specific climates to prove technologies for next generation of lower and zero energy homes, including affordable housing projects. • Continually monitor performance of pilot projects to provide feedback for next level of design and development of technologies.	• Develop and implement next generation of pilot projects; continually monitor performance of pilots to provide feedback for next level of design and development of technologies.	• Develop and implement next generation of pilot projects; continually monitor performance of pilots to provide feedback for next level of design and development of technologies.

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid-Term 2012 – 2015**	**Long Term 2016 – 2020**
		• Advance technological innovation through collaboration of Energy Commission PIER and Emerging Technologies Programs, LBNL, NREL, Utilities, CBIA, and other appropriate organizations.	• Ongoing	• Ongoing
		• Assess existing technologies and identify areas for strategic involvement in research and development.	• Ongoing	• Ongoing
1-2: Continual coordination and cooperation between the Energy Commission and others to progressively increase Title 24 building standards and Title 20 appliance standards consistent with the interim and long-term goals set forth in this Plan.	Energy Commission Utilities Local governments California Building Standards Commission	• Map a trajectory for Title 24 mandatory and voluntary standard(s) through 2020. • Progressively make energy efficiency advances permanent by raising Title 24 mandatory standards in 2011 consistent with the trajectory. • Progressively advance Title 24 voluntary, "beyond code" standard(s) and ratings systems in step with changes to the mandatory standards.	• Fine-tune and revise the trajectory based on the changing energy efficiency state-of-the-art. • Progressively make energy efficiency advances permanent by raising Title 24 mandatory standards in 2014 consistent with the trajectory. • Progressively advance Title 24 voluntary, "beyond code" standard(s) in step with mandatory standards in 2011 and 2014.	• Fine-tune and revise the trajectory based on the changing energy efficiency state-of-the-art. • Progressively make energy efficiency advances permanent by raising Title 24 mandatory standards in 2017 and to ZNE by 2020 consistent with the trajectory. • Progressively advance Title 24 voluntary, "beyond code" standard(s) in step with mandatory standards in 2017 and 2020.
1-3: Coordinate and Support "Reach" Building Standards	Energy Commission Utilities Local governments California Building Standards Commission Building Industry	• Identify and resolve conflicts or inconsistencies between Title 24 and local "green" building ordinances or other standards. • Establish policies and procedures for statewide coordination of local building standards that are acceptable to local governments. • Provide technical support for the development and implementation of reach standards through partnerships with local governments.	• Monitor success of coordination and resolve new issues as they arise.	• Monitor success of coordination and resolve new issues as they arise.

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid-Term 2012 – 2015**	**Long Term 2016 – 2020**
1-4: Develop innovative financing programs for the construction of energy efficient homes.	Finance Task Force Financial institutions Building Industry Utilities	• Convene a task force of financial experts to develop attractive financial products for energy efficiency homes. • Implement Options	• Ongoing expansion of these options.	• Ongoing expansion of these options.
1-5: Encourage local, regional, and statewide leadership groups to support pilots and foster communication among pioneering homeowners and builders.	Local Governments Homeowner groups Leading Builders Utilities	• Develop network of building owners (home-owners associations) and builders to help support the dissemination of information and develop peer-to-peer relationships.	• Ongoing	• Ongoing

Goal 2: Transform home improvement markets to apply whole-house energy solutions to existing homes.

The overall objective of Goal 2 is to reach all existing homes and maximize their energy efficiency potential through delivery of a comprehensive package of cost-effective, whole-house energy efficiency retrofit measures—including building shell upgrades, high-efficiency HVAC units, and emerging deep energy reduction initiatives— with comprehensive audits, installation services and attractive financing. This can be achieved through parallel and coordinated initiatives among utility programs, private market actors, and State and local government policies.

The IOUs currently offer a wide range of energy efficiency programs for existing homes, including audits, efficient appliance rebates, and consumer education. This Plan envisions a refocusing of these programs to move from a "widget" based approach to a "whole house" approach to program delivery to offer comprehensive packages of audits, demand side management options and tools, rebates and financing options, and installation services.

A similar approach must be developed for multi-family housing, both condominiums and rentals. The key to this effort will be defining workable financing mechanisms that allow energy bill savings from improvements occurring in the individual units to offset the up-front capital costs typically paid by building owners and homeowners associations. These mechanisms also must allow repayment of energy improvements from successor occupants so that turnover does not dissuade taking action. With such financing mechanisms, it should be possible for multi-family housing to take fuller advantage of both private energy services and utility programs and incentives. Since many lower-income households live in multi-family housing, they can be served via the strategies targeting low income households discussed later in this Chapter.

It is also essential that market actors, once aware of efficiency opportunities at hand, have access to suitable financing mechanisms for whole-house measures. The Finance Task Force referenced in the ZNE discussion above, will focus on effective financing tools especially suited for whole-house retrofit measures.

While many residential building retrofit measures have unacceptably long customer payback periods based on energy prices alone, they can find market acceptance and leverage private sector investment based on attributes other than energy savings (e.g. comfort and noise reduction). Financing mechanisms for whole-

house measures will also improve customer affordability and thus may increase market acceptance. In the future, the increased value of GHG reductions may also improve the economics of such measures. These issues should be considered in updating the methodology for calculating program or portfolio cost-effectiveness.

A key driver for the success of this Goal is to create market demand for efficient homes by increasing awareness of, and information on, energy efficiency. In the near term, the Energy Commission will adopt its Home Energy Rating System (HERS) standards for existing homes by the end of 2008. In cooperation with the Energy Commission, the IOUs will begin voluntary pilot programs to implement the HERS system and to encourage local governments to adopt residential energy conservation ordinances for energy ratings at the time of sale. In the longer-term, additional mechanisms might include community initiatives to reduce the "carbon footprint" of homes or neighborhoods, or promoting inclusion of home energy ratings in real estate sales listing information.

To achieve both widespread and deep levels of energy efficiency throughout the existing housing stock will require local government leadership. Individual local governments can adopt residential energy conservation ordinances (RECOs) for energy ratings and possible improvements at the time of sale. Utility programs can partner with these governments to provide supporting information on ratings systems, cost-effective measures and related implementation issues.

In addition, many actors must work together to ensure building code compliance. Strengthening building codes without improving local on-the-ground compliance leads to illusory progress. Concerns have arisen regarding whether HVAC compliance issues already undermine the effectiveness of Title 24 standards, and increasing the stringency and coverage of State standards is likely to add to these issues. The reasons behind compliance issues vary with jurisdiction and may include conflicts between State and local priorities, local government budget limitations, and market disincentives for contractors to comply.

The CPUC and utilities should coordinate with the Energy Commission and local governments to identify barriers to aggressive enforcement of State building standards and to develop effective plans for overcoming these barriers. An objective of these plans should be to leverage State and local resources to improve compliance. City and county building officials, for instance, are responsible for the vast majority of Title 24 enforcement, and their statewide association, the California Association of Local Building Officials (CALBO) is one key source of perspective on what is and is not working as energy standards become more stringent.

In order to ensure progress in implementing this Goal, a task force of key stakeholders should be convened to refine and oversee the strategies identified here.

Goal 2: Existing Homes

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-1: Deploy full-scale Whole-House programs.	Utilities Home improvement industry	• Implement pilot home retrofit programs with effective integration and delivery of comprehensive demand-side options including energy efficiency, demand response and renewable energy measures in specific locations to prove technologies for next generation of lower energy homes in various climate zones.	• Monitor performance of selected lower energy homes. Design implement, monitor and continuously improve full-scale programs for whole-house energy efficiency and renewable energy retrofits.	By 2020: • 25% of existing homes have a 70% decrease in purchased energy from 2008 levels • 75% of existing homes have a 30% decrease in purchased energy from 2008 levels • 100% of existing multi-family homes have a 40% decrease in purchased energy from 2008 levels

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-2: Promote effective decision-making to create widespread demand for energy efficiency measures.	Utilities Home improvement industry Real estate industry assns Local governments	• Complete initial market research to determine homeowner "decision triggers" to improving home energy efficiency, including an assessment of the impact of EE or carbon labeling.	• Follow-up market research.	• Follow-up market research.
		• Develop, launch, monitor and continuously improve campaigns to raise demand for lower energy homes, including home energy or carbon labeling programs. • Actively support local governments considering RECOs to improve the energy performance of existing homes at time of sale or during major renovations. • Develop and implement home rating system pilot projects based on the Energy Commission HERS program.	• Continuously improve campaigns to raise demand for lower energy homes, including home labeling programs.	• Continuously improve campaigns to raise demand for lower energy homes, including home labeling programs.
2-3: Manage research into new/advanced cost-effective innovations to reduce energy use in existing homes	Energy Commission DOE/National labs Utilities	• Gather and disseminate information on advanced retrofits. • Advance technological innovation through collaboration of Energy Commission PIER and Emerging Technologies Programs, Utilities and other appropriate organizations. • Promote commercialization of home energy management tools including AMI-based monitoring and display tools.	• Ongoing	• Ongoing
2-4 Develop financial products and programs such as on-bill financing to encourage demand for energy efficiency building products, homes systems, and appliances.	Finance Task Force Financial institutions Contractors Local Government Utilities	• Develop partnerships for innovative financing programs, such as performance contracts and City of Berkeley's solar and EE property loans. • Investigate the feasibility of on-bill financing and other lending products. • Convene Task force on Financing with attention to issues of multi-family housing and paying for actions with longer-term paybacks.	• Design implement, monitor and continuously improve financial products and programs for whole-house energy efficiency and renewable energy retrofits.	• Design implement, monitor and continuously improve financial products and programs for whole-house energy efficiency and renewable energy retrofits

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-5: Increase Title 24 compliance through specific measures leading to aggressive statewide enforcement.	Energy Commission State Contractor Licensing Board Utilities Local Governments CALBO California BSC	• Identify the barriers to compliance and develop a compliance plan to implement remedial measures, including legislation if necessary. • Leverage the compliance plan measures to support enforcement of local energy efficiency codes and standards. Identify opportunities for leveraging Title 24 and local codes enforcement. • Develop program models that require proof of code compliance as a condition of receiving rebates or financing.	• 80% of transactions that trigger Title 24 requirements will comply with all applicable requirements. • Monitor success or failure of leveraging and pursue additional actions to achieve success as necessary.	• Monitor success or failure of leveraging and pursue additional actions to achieve success as necessary.

Goal 3: Develop comprehensive, innovative initiatives to reverse the growth of plug load energy consumption through technological and behavioral solutions.

Plug loads are a complex, rapidly growing driver of electricity consumption, which currently account for at least 10-15% of overall household energy use.[35] The loads range from the ubiquitous energy thief transformers on almost every electronic appliance to home offices and the 1+ kW home entertainment centers growing in popularity. Potential savings from this plug load strategy could be 200 MW by 2011, with larger potential savings in the future.

Reduce plug loads will require changes in consumer purchasing patterns, research to develop smarter products, commercialization support for such products in terms of upstream rebates and incentives, and stimulation of customer demand through informational initiatives including unbiased and ubiquitous labeling. Ultimately, these savings will need to be locked in by raising State and Federal standards.

Goal 3: Reduce Plug Loads

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
3-1 Drive continual advances in residential energy usage, including plug loads, home energy management systems, and appliances.	Energy Commission (PIER) Utilities LBNL Appliance manufacturers Retailers	• Work with research organizations to develop smarter products with lower energy requirements. • Work with manufacturers to raise product energy efficiency, both when in use and when in standby mode.	• 10% reduction in plug loads	• 25% reduction in plug loads

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
3-2 In coordination with Strategy 2-2 above, develop public awareness of and demand for highly efficient products.	Utilities Manufacturers retailers Local Government Consumer information outlets	• Complete initial market research including identification of customer decision triggers for choosing highly energy efficient devices. • Implement public awareness and information campaign to promote purchase of more efficient products and create behavioral changes in the way products are perceived, used, and managed.	• Follow-up market research	• Follow-up market research.
3-3: Create demand for such products through market transformation activities	Utilities Industry partners	• Deploy package of rebates, incentives and voluntary industry agreements to bring significant numbers of the best current technologies for managing plug loads (e.g., smart power strips and informative visual displays) to market. • Promote unbiased labels and Web sites (*Consumer Reports* approach).	• Ongoing	• Ongoing
3-4: Continuously strengthen standards, including the expansion of both Title 24 and 20 to codify advances in plug load management	Energy Commission Utilities	• Continuously incorporate gains in efficiency in the appliance standards.	• Continuously incorporate gains in efficiency in the appliance standards.	• Continuously incorporate gains in efficiency in the appliance standards.

Goal 4: Transform the residential lighting market through technological advancement and innovative utility initiatives.

Lighting programs have composed the majority of savings from the California IOU portfolios for the residential sector over the past several years. Such programs typically represent well over half of the utility efforts in the residential sector. This emphasis is largely due to the widespread conclusion that lighting opportunities are the least expensive and easiest to implement strategies for major, near-term savings in the residential sector.

Over the past year, new legislation has dramatically changed the context for lighting programs in California. As discussed above, AB 1109 and new Federal lighting standards have codified increasingly stringent standards for lighting. California utility lighting programs have coincided with dramatic changes in national and international lighting markets, in addition to recent legislative changes.

While significant savings potential still exists today, as these new standards and market changes come into force, utility programs targeting these same applications will provide little incremental benefit. Ratepayer-funded programs must re-orient towards measures which extend beyond these new standards and

measures accepted in the marketplace to usher in the next generation of high-efficiency lighting. Accordingly, there is a need to move quickly beyond current lighting programs and towards solutions which focus on multi-year and holistic lighting system strategies, improved conservation actions, and other means of market transformation.

There is also a need to improve collection and recycling of end-of-life general purpose lighting to ensure the control of toxic materials. AB 1109 requires the Department of Toxic Substances Control (DTSC) to convene a Task Force of industry, government, and interest group stakeholders to make recommendations on safe disposal programs.

Solid-state lighting (SSL) is a pivotal emerging technology which represents one avenue of possibility for the future of high-efficiency lighting. No other lighting technology currently offers so much potential to save energy and enhance the quality of our living environments.

Increasing the market penetration of advanced lighting solutions will require coordinated efforts on a number of interrelated fronts. Research and development will remain a critical aspect of this effort to drive continual advances in lighting technology and cost performance. Critical solid-state lighting R&D is being conducted at the National Labs through DOE's Building Technology Program, particularly in the area of performance testing. In addition, a wide variety of research in lighting technology applications is being conducted at UC Davis's California Lighting Technology Center, as well as the Energy Commission's ratepayer-funded PIER program.[36]

DOE's current L-prize competition represents an innovative approach to market transformation in the area of residential lighting. The competition challenges industry to develop high-performance solid-state lighting products to replace two of today's most widely used and inefficient products: 60W incandescent lamps and PAR 38 halogen lamps. The performance specifications of the competition are very high and will require significant levels of innovation on the part of manufacturers. To match, the reward is alluring: significant cash prizes, opportunities for Federal purchasing agreements and access to utility promotion programs. Each of California's electricity IOUs has been engaged as sponsors of the program.[37]

Emerging lighting technologies will require commercialization support through a well-coordinated market push. On the supply-side, design competitions to engage manufacturers will be necessary to motivate far-reaching innovations to match customer preferences and needs. Technology demonstration projects will engage utilities and their customers, and build buyer confidence in the emerging technologies. Partnerships between large retailers and utilities to jointly negotiate price buy-downs with manufacturers and large-scale retail stocking commitments will ensure the ubiquity of advanced technologies at attractive prices. Finally, continual upgrading of standards for lighting technology and applications (EnergyStar, Title 24) will ensure new technologies are incorporated into business as usual across the state.

Goal 4: High-Performance Residential Lighting

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
4-1 Drive continual advances in lighting technology through research programs and design competitions.	Energy Commission (PIER) Universities DOE National Labs Manufacturers Utilities Retailers	• Work with research organizations to develop lighting products with lower energy requirements and improved spectral performance. • Work with Utilities and Retailers to develop public awareness and demand.	• Ongoing	• Ongoing
4-2: Create demand for improved lighting products through demonstration projects, marketing efforts, and utility programs.	Utilities Industry partners	• Deploy package of rebates, incentives and voluntary industry agreements to bring significant numbers of the best available lighting technologies (SSL) to market.	• Ongoing	• Ongoing
4-3: Continuously strengthen standards.	Energy Commission DOE EPA Utilities	• Continuously incorporate gains in efficiency in the appliance standards.	• Continuously incorporate gains in efficiency in the appliance standards.	• Continuously incorporate gains in efficiency in the appliance standards.
4-4: Coordinated phase out of Utility incentives for purchase of CFLs	Utilities Retailers	• Ensure that big box and home improvement retailers such as Wal-Mart and Home Depot are ready to stock Energy Star price discounted CFLs in CA as IOUs phase CFL programs out. • Utilities engage in negotiations with manufacturers and retailers to buy-down prices and stock the next generation of high efficiency lighting.	• Ongoing	• Ongoing
4.5: Ensure environmental safety of CFLs and other emerging lighting solutions	CPUC Utilities Retailers DOE / EPA Cal EPA CA Dept. of Toxic Substances Control AB 1109 Lighting Task Force	• Establish minimum mercury content requirements on the CFL manufacturers participating in utility programs. • Determine cost-effective convenient methods for collection and recycling of any end-of-life light bulbs. • Coordinate consumer education and marketing programs to improve disposal habits.	• Ongoing	• Ongoing

2.2 LOW INCOME RESIDENTIAL SEGMENT

2.2.1 VISION

By 2020, 100 percent of eligible and willing customers will have received all cost-effective Low Income Energy Efficiency measures.

2.2.2 PROFILE

California's Low Income Energy Efficiency (LIEE) programs provide no-cost energy efficiency and appliance testing and repair measures to qualified low income customers in rental and customer-owned residences. The complementary objectives of the LIEE programs are to provide an energy resource for California and to produce energy savings, while reducing low-income customer bills. Customers qualifying for LIEE programs represent up to 30% of the IOUs' residential customers—or about 3.8 million households. In the past ten years, LIEE programs have provided about 1.6 million low-income households a range of energy-related services including home weatherization, refrigerator replacement, repair and replacement of heating and air conditioning equipment, and CFL distribution.

Although a large number of homes have benefitted from measures under the LIEE programs over the past 10 years, more than 50 percent of low income residences have yet to receive energy efficiency upgrades. The Commission has called upon the IOUs for a fresh look at LIEE programs to provide an expanded role for LIEE programs as a California energy resource, working in concert with other efforts to address climate change and meeting the needs of more low-income customers. In particular, the Commission has adopted a Big/Bold Strategy to provide all eligible and willing low income customers the opportunity to participate in the LIEE programs and to offer cost-effective and quality-of-life improving energy efficiency measures in their residences by 2020.

During the initial years of this *Plan*, the IOUs will focus their efforts on developing a more effective outreach program using segmentation techniques to identify target groups within the low income populations. In order to serve these additional households, the IOUs will design programs to be more administratively and operationally efficient. In the near term, the IOUs will develop partnerships with community organizations and local governments to leverage existing services and tools.

2.2.3 GOALS

This *Plan* contains two goals to achieve the LIEE vision:

Goal	Goal Results
1. By 2020, all eligible customers will be given the opportunity to participate in the LIEE program.	Marketing, Education and Outreach programs will be highly successful and the number of eligible households in California receiving LIEE services will increase. LIEE customers will be educated on the benefits of energy efficiency and conservation behaviors. A trained LIEE workforce will accommodate future job demand and educate their communities.
2. The LIEE programs will be an energy resource by delivering increasingly cost-effective and longer-term savings.	Other State, Federal and local programs will be leveraged to streamline and improve customer identification and program delivery. LIEE programs will be integrated with core energy efficiency programs to achieve economies of scale. Participants will receive comprehensive energy efficiency services that produce long-term energy savings for the state, while reducing low-income customers' bills and improving their quality of life.

2.2.4 STRATEGIES

The market transformation envisioned for the LIEE sector involves changing both the delivery of products and services and the behaviors that low income energy consumers rely on to use energy efficiently.

The LIEE Goals require leadership from the Low Income Oversight Board and the IOUs working in partnership with community-based organizations, contractors, educational and training institutions, and local, State and Federal agencies that also serve the low income community.

2.2.5 IMPLEMENTATION PLAN

Goal 1: By 2020, all eligible customers will be given the opportunity to participate in the LIEE program.

California and the IOUs will approach this Goal through two broad efforts: Marketing, Education, and Outreach (ME&O) and Workforce Education and Training (WE&T). These broader efforts will encompass current activities as a foundation, but will expand to newer, more creative efforts. ME&O efforts will be improved through the statewide collaborative and integrated approach

as discussed in the ME&O Chapter. As part of the overall ME&O program, additional efforts specifically designed for the low income community will be implemented. The IOUs will target outreach efforts based on four customer profile segments: geography, demographic description (e.g., language preference), social networks; and level of energy use. Though this list of factors may expand over time, it represents an extension of current approaches and areas scheduled to be further developed in the IOUs' 2009-2011 programs.

Second, the IOUs will focus on improving delivery methods so that all willing and eligible customers can be reached by 2020. The segmentation approach discussed earlier will improve the efficiency of delivery by identifying geographic and social concentrations of customers to achieve economies in delivery, material purchasing and resources. It also promotes effective use of low-income service providers, including community-based organizations and other qualified agencies. The segmentation or tiered approach will enable the IOUs to offer more households measures more efficiently.

The expanded LIEE programs will require additional trained professionals. Training efforts for the LIEE program are addressed by the strategies described in the WE&T Chapter of the *Plan*, including incorporating the needs of the LIEE programs into the needs assessment. The needs assessment will include the development of LIEE job definitions, inform a LIEE Training Roadmap, and ensure trained resources are available to deliver LIEE services. To promote substantial growth in a trained LIEE workforce, the IOUs will integrate LIEE program installation training with other energy efficiency training. This integration will enable a wider network of providers to provide for LIEE services and provide those trained in LIEE access to other energy service opportunities.

Goal 1: Improve Customer Outreach

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1.1: Strengthen LIEE outreach using segmentation analysis and social marketing tools.	IOUs Low income customers LIOB Contractors Community Based Organizations (CBOs) ME&O Taskforce Local, State and Federal Agencies	• Identify, implement and evaluate effective marketing, education and outreach methods for targeting low-income customer segments. • Use social marketing to effectively engage low income customers in program participation.	• Implement energy education designed to help customers understand and change behaviors in ways that support LIEE savings.	• Continue to assess and evaluate customer-behavior and energy savings; improve upon outreach to eligible communities.
1.2: Develop a recognizable and trustworthy Brand/Tagline for the LIEE programs.	IOUs Low Income customers LIOB Contractors (CBOs)	• Develop a statewide program name and description for LIEE which is coordinated with the ME&O efforts for energy efficiency, demand response and any other demand-side options. • Implement branding.	• Launch integrated EE/LIEE/DSM brand.	• Evaluate progress/refine strategy.

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1.3: Improve program delivery	IOUs LIOB Low Income Customers CBOs Contractors Local, State and Federal Agencies	• Use information from segmentation analysis to achieve efficiencies in program delivery. • Leverage with Local, State, and Federal agencies as well as other organizations to increase seamless coordination, efficiency and enrollment	• Ongoing	• Ongoing
1.4: Promote the growth of a trained LIEE workforce.	WE&T Task Force IOUs Low income customers LIOB Contractors CBOs Local Governments	• Incorporate LIEE training needs into the Workforce Training needs assessment. • Develop Training Roadmap which includes funding requirements and sources other than IOUs. • Implement LIEE workforce education and training.	• Implement LIEE workforce education and training. • Coordinate resources for training related to LIEE program needs to ensure delivery of LIEE-trained resources to the program.	• Implement LIEE workforce education and training. • Coordinate LIEE workforce and service providers with broader market.

Goal 2. The LIEE programs will be an energy resource by delivering increasingly cost-effective and longer-term savings.

Significant opportunities exist for increased collaboration between the IOUs and the State and Federal agencies providing services to the low-income community. In particular, data sharing with other State and Federal agencies, and collaborating with community partners to leverage Federal, State and local funds are critical in achieving this Goal.

The IOUs currently have successful partnerships with low-income population assistance agencies, community based organizations, county agencies, and water districts. Over the longer-term, utility efforts will increase the number of partnerships with additional resources and organizations.

In addition to working with other local, State and Federal agencies, the IOUs will focus on providing LIEE program measures and services that are cost-effective and emphasize long-term and enduring energy savings—for example, refrigerators, attic insulation, and other major appliance replacements. The LIEE program may also include measures that improve customers' quality of life.

The LIEE programs will also incorporate the most recent strategies and programs in the core residential sector energy efficiency and Demand Side Management (DSM) programs, including the energy efficiency mandates of the California Solar Initiative (CSI). The IOUs will ensure that LIEE participants are made aware of core energy efficiency and demand response programs at the time of enrollment. LIEE messaging and outreach will be integrated into energy efficiency marketing to provide information on energy efficiency and demand response programs to low-income customers.

The LIEE programs will also receive the benefits of the core residential strategies on new and existing homes. As new technologies are commercialized for reduced plug loads, energy management tools, and building materials, they will be incorporated into the programs offered to low income customers. As advanced meters are

deployed, the LIEE programs will ensure that low income customers receive the benefits of energy management tools. As discussed above, the ZNE new residential homes goal will include affordable housing components.

In some cases, strategies identified for the core residential sector will be modified for the LIEE context. For instance, while we have indicated a particular strategic direction for lighting programs in the core residential sector, it may be appropriate to take an alternative approach within LIEE programs, largely due to the high initial costs of CFLs and high-efficiency lighting technologies.

The IOUs will focus on improving delivery methods so that all of these homes can be reached by 2020. The segmentation outreach approach discussed earlier will improve the efficiency of delivery by identifying geographic and social concentrations of customers to achieve economies in delivery, material purchasing and resources. It also promotes effective use of low-income customer service providers, including community-based organizations and other qualified agencies. The segmentation or tiered approach will enable the IOUs to offer more households measures more efficiently.

Goal 2: LIEE is an Energy Resource

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2.1: Increase collaboration and leveraging of other low-income programs and services	IOUs LIOB CBOs Department of Community Services Local, State, and Federal Government	• Identify key areas where data sharing would be advantageous and seek legislative changes to ease data sharing between agencies. • Develop partnerships to leverage resources available from local governments, Federal, State, and private project funding sources.	• Continue to expand partnerships with stakeholders and seek new opportunities for data sharing.	• Continue to expand partnerships with stakeholders and seek new opportunities for data sharing.
2.2: Coordinate and communicate between LIEE, energy efficiency and DSM programs to achieve service offerings that are seamless for the customer.	IOUs LIOB	• Ensure LIEE participants are aware of energy efficiency and DSM/EE programs. • Coordinate with CSI programs to provide LIEE program services in qualified low income housing for both single family and multi-family CSI programs. • Coordinate AMI delivery and LIEE Programs.	• Continually reevaluate and update programs to take advantage of new technologies. • Explore in-home displays; home area networks and/or "pay-as-you-go" technology to assist low income customers manage their use.	• Continually reevaluate and update programs to take advantage of new technologies.
2.3: Provide low income customers with measures that result in the most savings in the LIEE program	IOUs LIOB	• Assess design of programs to ensure increasingly cost-effective measures, while reducing low-income customers' bills and improving quality of life. • Continue to include measures that provide long term energy savings, such as refrigerators.	• Assess opportunities to incorporate new energy efficiency measures into the LIEE program, e.g., plug-load reduction, new HVAC technology.	• Continue to evaluate
2.4: Identifying segmented concentrations of customers to improve delivery.	IOUs CBOs Local Governments	• Identify and develop segmented approach to deliver services to households. • Improve use of CBOs in delivering services.	• Evaluate approach determine whether additional segments are needed.	• Continue to evaluate

3. COMMERCIAL SECTOR

3.1 VISION

Commercial buildings will be put on a path to zero net energy by 2030 for all new and a substantial proportion of existing buildings. Innovative technologies and enhanced building design and operation practices will dramatically grow in use in the coming years through a combination of comprehensive whole building programs, technology development, market pull, professional education, targeted financing and incentives, and codes and standards.

3.2 PROFILE

Commercial buildings consume more electricity than any other end-use sector in California. The sector's 5 billion-plus square feet of space is very diverse—not only office buildings but stores, restaurants, warehouses, schools, hospitals, public buildings and facilities[38], and others—in aggregate accounting for 38 percent of the state's power use and over 25 percent of natural gas consumption. Four electric end uses (lighting, cooling, refrigeration, and ventilation) account for 75 percent of all commercial electric use, while just three (space heating, water heating, and cooking) account for over 90 percent of gas use. These end uses command attention for energy efficiency savings strategies.

In terms of the electricity use by the various commercial building types, office buildings are the largest, accounting for nearly 25 percent. Restaurants have a comparable share among gas consumers. Offices, restaurants, and schools and colleges are in the top five facility types for both fuel types.

The following chart provides a snapshot of dominant energy end uses for buildings in California by building type and energy end use category for 2006:

Table 1 - Profile of Consumption by End Use and Major Facility Type *

	Electric %	Cumulative Electric %		Gas %	Cumulative Gas %
End Use			**End Use**		
Lighting-inter & exter	34.5	34.5	Space Heating	36.4	36.4
Cooling	14.9	49.4	Water heating	31.8	68.2
Refrigeration	13.4	62.8	Cooking	22.6	90.8
Ventilation	11.9	74.7	Process	5.9	96.7
Office Equipment	7.1	81.8	Misc.	1.8	98.5
Facility Type			**Facility Type**		
Office	24.5	24.5	Restaurant	24.5	24.5
Retail	14.7	39.2	Health	13.7	38.2
Restaurant	8.9	48.1	Office	13.3	51.5
Food Store	8.8	56.9	School & College	11.1	62.6
School & College	8.8	65.7	Lodging	9.0	71.6
Health	6.8	72.5	Food Store	3.1	74.7
Lodging	4.9	77.4	Retail	2.5	77.2
Unrefrig warehouse	3.7	81.1	Unrefrig warehouse	1.3	78.5

** Source: California End Use Survey, 2006*

Commensurate with the energy demand from the commercial sector, the 2006-2008 IOU energy efficiency programs for commercial building retrofits is approximately one third of the total budget, exceeding $1 billion dollars over the three year period. The IOUs also offer a "Savings by Design" program for new construction, which provides incentives to owners and design teams to incorporate efficient systems into building design or to develop projects that go beyond Title 24 standards using a whole building approach.

For 2009-2011, this *Plan* envisions an increased emphasis on programs to exceed Title 24 standards with the ultimate goal of building codes and standards that require zero net energy (ZNE) new construction and retrofits by 2030.

Achieving the transformational vision and goals established for the commercial sector will involve changing energy user behaviors and the supply chain of services and products that commercial end-users rely on to efficiently use energy as well as continual updating of codes and standards.

3.3 GOALS

The following goals will spur actions to transform the energy patterns of California's largest energy-consuming sector—its commercial buildings.

Goal	Goal Results
1. New construction will increasingly embrace zero net energy performance (including clean, distributed generation), reaching 100 percent penetration of new starts in 2030.	An increasing percentage of the 50-120 million sq.ft. per year of new commercial construction will be progressively more efficient and all new construction will be zero net energy by 2030.
2. 50 percent of existing buildings will be equivalent to zero net energy buildings by 2030 through achievement of deep levels of energy efficiency and clean distributed generation.	250 million square feet (1/20th of existing space) per year through 2030 reach deep levels of energy efficiency improvements and clean, distributed generation through whole building approaches.
3. The commercial lighting industry will undergo substantial transformation through the deployment of high-efficiency and high-performance lighting technologies, spurred by State and national codes and standards and leading-edge incentive strategies.	Utilities will begin to phase out traditional mass market CFL bulb promotions and giveaways from program portfolios and shift toward new lighting technologies and innovative systems that focus on lasting energy savings and more rapid consumer uptake.

3.4 STRATEGIES

Three interrelated and comprehensive strategies will be employed to reach the goals for energy efficiency in new and existing commercial buildings:

1. Codes and Standards: Adopt aggressive and progressive minimum energy codes and standards for buildings and plug loads, effective code compliance and enforcement, and parallel, tiered voluntary energy efficiency standards.

2. Access to Information: Align commercial building benchmarking, advanced metering infrastructure, energy and carbon labeling, and operations and maintenance practices to increase energy efficiency.

3. Financing: Target financing and incentives to support meeting commercial sector goals. Meeting the challenge of reaching ZNE levels, for a substantial fraction of the new and existing commercial building stock, will likely require increased availability and use of innovative and expanded financing and financial incentives, especially approaches to resolve the "principal agent" problem, when economic motivation is split between owners and tenants.

These primary strategies will be supported by three enabling strategies:

1. Promote integrated design knowledge as the basis for commercial building design, construction, renovations and occupancy.
2. Support targeted research and development and promotion of emerging technologies.
3. Offer integrated program delivery of DSM retrofit solutions.

This Plan envisions that the building industry (including developers, construction firms, building owners, tenants, building managers, contractors and others), the CPUC, Energy Commission, architectural and engineering (A&E) firms, and utilities embrace the vision statement and goals as the basis for long-term strategic planning and actions, assuring other market participants of their commitments through 2030. As a result, demand within building space markets will provide demand "pull" alongside both codes and standards and market supply "push" for ZNE and ultra-low energy buildings.

One promising approach for commercial buildings is a progressive set of building codes and standards that steadily tightens over the coming years and is directly linked to one or two tiers of voluntary higher standards, in the "bronze-silver-gold" approach described in the Residential Sector Chapter. These voluntary higher standards (also known as "beyond" or "reach" codes) will be the leading edge that serves to prove and improve the efficacy and cost-effectiveness of advanced products and practices. This *Plan* anticipates that the IOUs, in cooperation with the building industry and local governments, will continue to play a critical role in providing technical support for developing these voluntary standards and the progressively higher mandatory standards.

Commercial building market actors tend to follow the industry leaders. Corporate champions and State and local government leaders can set the direction and pace using the voluntary higher standards. The voluntary tiers should be the common reference points for utility incentives, local government ordinances, recognition given to highly efficient buildings, and other policy and market-based drivers that go beyond the minimum code to pull up new construction and renovation.

A second key approach is to call upon building energy and carbon benchmarking and labeling to inform building owners, tenants, and prospective buyers about the relative efficiency, operating costs, and carbon footprint of buildings and leased space. This information can help drive a competitive market demand for greener, more efficient buildings – both new construction as well as improvements to existing structures.

The Finance Task Force mentioned in the Residential Chapter above, will be critical to identifying existing and additional means to attracting greater participation of capital markets in funding efficiency transactions and innovative and effective financing tools especially suited for ZNE and ultra low-energy commercial buildings. This effort comes at a critical period in the development of California's AB 32 implementation process, which has identified building efficiency as a sizeable source of GHG reductions. The Task Force should investigate methods to leverage the value of carbon reductions from energy efficiency to finance implementation of energy efficiency in buildings.

3.5 IMPLEMENTATION PLAN

Goal 1: New construction will increasingly embrace zero net energy performance (including clean, distributed generation), reaching 100 percent penetration of new starts in 2030.

The CPUC and the Energy Commission have adopted the goal of all new commercial buildings constructed to ZNE levels by 2030. This Big/Bold initiative is based on the Architecture 2030's 2030° Challenge, a global initiative to have all new buildings and major renovations reduce their carbon emissions by 50 percent by 2010, and then increasing new buildings' performance to be carbon neutral by 2030. A consortium of groups including the AIA, the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), the US Green Buildings Council (USGBC), and the Alliance to Save Energy (ASE) have initiated the Commercial Building Initiative which is working to develop a framework and strategy for the 2030 Challenge goal.[39]

In August 2008, DOE launched the ZNE Commercial Building Initiative (CBI) which aims to develop marketable ZNE commercial buildings by 2025. To help with the CBI, DOE has formed the National Laboratory Collaborative on Building Technologies (NLCBT), which will allow DOE and five of its national laboratories to work closely on the research, validation, and commercialization priorities that are critical to the success of ZNE buildings.[40]

The follow actions are necessary to implement the ZNE goal:

- As with the Residential ZNE goal, new construction design, products, materials, and operations innovations must be developed and implemented. California's Title 24 should be broadened to address as many energy end uses as possible, especially plug loads; metering and data management; automated diagnostic systems; and sub-metering for tenant-occupied space. These innovations also can quickly transfer to the existing building market, especially for those undergoing occupancy turn-over renovations or improvements. This effort should be led by the Energy Commission with significant support from the utilities, the Building Standards Commission (BSC), the construction and building design industry, and manufacturers.
- The ZNE goal must promote an integrated design strategy. Integrated design brings together all relevant players at the start of a building project to comprehensively analyze and optimize energy strategies to deliver energy-efficient, high performance buildings and renovations, at little or no additional cost to the building owner. Integrated design can go beyond individual buildings and consider community-level energy and carbon impacts. Led by the utilities' energy efficiency programs, the Energy Commission and the BSC, in partnership with the AIA, ASHRAE, USGBC, the California Architects Board, and construction and development organizations, should promote the use of building

commissioning, retro-commissioning, and ongoing building measurement and verification to validate the building performance goals of integrated design teams.

- California's "Path to Zero" campaign and associated task force described in the Residential Chapter will lend real-world experience and data on emerging technologies, practices, and designs to deliver zero net and ultra-low energy commercial buildings.
- Financial tools supporting Commercial ZNE investments will be essential. The Finance Task Force discussed in the Residential Chapter will also focus on solutions for the commercial sector. These include appraisal, insurance, and operations pass-through mechanisms that reflect lower operating costs, higher property values, and substantial non-energy occupancy benefits from green buildings.

Goal 1: ZNE Commercial Buildings

Implementation Plan and Timeline					
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**	**2021 – 2030**
1-1: Establish a long-term progressive path of higher minimum codes and standards ending with ZNE codes and standards for all new buildings by 2030.	Energy Commission Utilities BSC A&E firms Building industry	• Establish one- or two-tiered voluntary EE standards, coordinated with green building rating systems. • Align Title 24 targets with goals of AB 32 and carbon reduction.	• Develop/adopt process to adjust the code on a triennial schedule on a "fixed" trajectory.	• RD&D • Title 24 updates	• RD&D • Title 24 updates
1-2: Expand Titles 20 and 24 to address all significant energy end uses.	Energy Commission Utilities Building industry BCS	• Develop and adopt broader codes and standards for plug loads, such as copy machines, printers, battery chargers, televisions. • Expand Title 24 to include whole building approaches including metering and data management; automated diagnostic systems; and sub-metering for tenant-occupied space. • Adopt progressive codes and standards for high performance commercial lighting applications.	• Develop and adopt broader codes and standards for plug loads and sub-metering and automated self diagnostic controls. • Expand Title 20 and Title 24 to cover additional uses such as server farms, process loads and water use. • Develop building standards to better integrate on-site clean distributed generation	• Develop and adopt broader codes and standards for other end uses and devices.	• Develop and adopt broader codes and standards for other end uses and devices.
1-3 Establish a "Path to Zero" Campaign to create demand for high-efficiency buildings.	DOE and other ZNE efforts Building industries Building owners A&E firms Local and regional governments Utilities	• Convene leading building industry associations to plan and conduct campaign. • Organize forums to develop and exchange experience and data on emerging technologies, practices and designs that deliver ultra-low and ZNE buildings.	• Develop companion strategies to create demand in the marketplace for high-scoring buildings. • Stimulate rapid innovation toward ZNE among design, engineering, and construction professionals via competitions or other recognition.	• Continue and refine Campaign	• Conduct expanded Campaign

Implementation Plan and Timeline					
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**	**2021 – 2030**
1-4: Develop innovative financial tools for ZNE and ultra-low energy *new* buildings.	Finance Task Force Financial and Investment community, Commercial developers and Trade groups Utilities	• Develop and pilot innovative financial tools. • Identify building performance metrics or documentation needed to inform building performance and valuation. • Develop performance data.	• Disseminate performance information on new financing, insurance, and property valuation instruments to increase awareness and utilization within financial and real estate markets including owners/investors. • Implement most effective funding mechanisms.	• Expand Implementation of innovative financing mechanisms. • Promote benefits via benchmarks, labeling, and case studies.	• On-going expansion of most useful mechanisms.
1-5: Create additional investment incentives and leverage other funding.	Finance Task Force Utilities Financial and Investment community Building trade groups	• Investigate other funding support that might be offered such as local government "feebates" for EE/green construction, Federal funding, Federal or State tax incentives, GHG reduction benefits, e.g. via carbon offsets.	• Secure governmental support for most promising supplemental funds or investment support.	• Ongoing expansion of these options.	• Ongoing expansion of these options.
1-6: Develop a multi-pronged approach to advance the practice of integrated design.	Integrated Design Working Group Utilities AIA CAB Architectural schools Building and Building products Industry ASHRAE USGBC	• Promote ID development via Title 24 codes/ standards and market activities. • Identify/develop tools and protocols from building commissioning, retro-commissioning and building M&V to enable ID to be deployed. • Form partnerships with industry and architectural/engineering schools to promote the practice of and education in ID. • Provide incentive credits for professionals who maintain their accreditation with ID training.	• Promote widespread adoption of tools and resources that enable ID. • Create market demand for ID as a key strategy to comply with a vastly enhanced Title 24. • Leverage competition between A/E firms to ramp up their ID expertise. (similar to how LEED-AP has become de rigueur) • Implement an integrated design curricula.	• Ongoing curriculum enhancements to promote ID. • Professional boards establish minimum guidelines for A/E and construction firms to require ID skills as a core competency among personnel • Demonstrate how ID, Cx, RCx, and Bldg M&V can produce GHG benefits.	• Ongoing expansion of these options

Goal 2: 50 percent of existing buildings will be retrofit to zero net energy by 2030 through achievement of deep levels of energy efficiency and with the addition of clean distributed generation.

As discussed above, the commercial building industry tends to respond to industry leaders to set the path for action. Therefore, it is critical to lead by example by making public, State-owned and leased buildings benchmarked, sub-metered, and retro-commissioned and energy efficient. In a 2004 Executive Order, Governor Schwarzenegger established the Green Buildings Initiative (GBI) which sets a goal of reducing energy use in State-owned buildings by 20 percent by 2015 (from a 2003 baseline) and encourages the private commercial sector to set the same goal. The Green Action Team (GAT), established by the Order, has carried out efforts over the past three years to promote energy efficiency in State and commercial buildings.[41] Both the University of California and the California State University System have committed to sustainable energy goals for their campuses.

Additionally, the State Architect in cooperation with the Office of Public School Construction is developing a "Grid Neutral by Design" program to encourage schools built and renovated with state funds to achieve higher levels of energy efficiency and produce as much energy as they use over the course of a year. The Grid Neutral schools program will further encourage energy efficient public schools while providing additional opportunities to implement clean on-site generation as new schools are built and the existing schools are renovated.[42]

A wide range of local governments, corporations, and institutions, likewise have committed to attaining certification for energy efficiency (via US EPA's EnergyStar building ratings) and/or the US Green Building Council's LEED system for green buildings. California has by far more qualifying facilities in these programs than any other state.

Goal 2 uses a combination of regulatory and market forces to enable owners and tenants to value the economic and environmental advantages of high-performing (existing) buildings, thereby creating a "market pull" for buildings that are energy efficient.

Goal 2 will also leverage the progress made in mandatory and voluntary codes and standards developed for Goal 1, by lowering the renovation threshold at which minimum codes and standards are applied to an entire existing structure. This effort must be accompanied by appropriate financing tools and robust actions to improve and enforce compliance with existing codes for renovations and by including training of building managers and operators to ensure maximum efficiency from building systems. As discussed in detail in Chapter 6, special attention must be placed on proper design and installation/repair of air conditioning systems.

In 2005, the Energy Commission issued a report titled, *Options for Energy Efficiency in Existing Buildings*,[43] which adopted two strategies for commercial buildings – benchmarking tools and retro-commissioning guidelines and implementation. Elements of the benchmarking strategy are being implemented through AB 1103 (Saldana, 2007) which requires benchmarking of the energy consumption of commercial buildings and disclosure to a prospective buyer, lessee, or lender.[44]

The Energy Commission's benchmarking and retro-commissioning strategies must be further implemented by actions to better align commercial building benchmarking, and operations and maintenance practices with labeling and financial incentives. The IOUs will link their rebate programs to benchmarking to spur market demand for steadily improving benchmarks. During the 2009-2011 periods, the goal is to attain a benchmark score for specified buildings; starting in 2012-2015, the goal is to attain a minimum Energy Star benchmark score. In concert with benchmarking, strategies to increase the role of asset value ratings, similar to the Home Energy Rating System (HERS), provide a potent means to making energy efficiency a key determinant in driving the commercial real estate market.

The EPA Portfolio Manager's Energy Star benchmark rating system is a commonly-used and well-known benchmarking system well-suited to major commercial building types such as offices and schools. California or EPA will need to develop other or expanded tools to rate remaining building types including through the use of asset ratings. Also in the longer term, local governments could adopt ordinances to issue and renew building certificates of occupancy only for buildings meeting minimum energy benchmarks.

The benchmarking and labeling mandates must evolve to include carbon footprint information. Although the US Green Building Council's LEED rating system has become a de facto "green" label, it does not provide specific information on a building's energy or carbon performance. Annual energy and carbon labels are needed for populated buildings to send signals to market players that actual (not just designed) building energy performance is of value in commercial building markets. Protocols for low-carbon and high-efficiency commercial building attributes will be needed to encourage owners and tenants to demand—and, in turn, markets to deliver—highly efficient buildings.

The Energy Commission's 2005 Existing Buildings Report identified development of retro-commissioning guidelines by the Energy Commission as a key step in the strategy for existing buildings. The Energy Commission should develop such guidelines in the near future. The IOUs should strengthen their existing retro-commissioning efforts by using benchmarking information to strategically identify the best candidates for retro-commissioning and promote whole-building approaches and incentives. Collaboration must occur among the Energy Commission, CPUC, the building industry, and national laboratories to develop tools and strategies to further reduce energy consumption via information, behavioral strategies, commissioning and retro-commissioning, and operating practices. An effective communications strategy to make the business and environmental case for owners and tenants to demand high voluntary performance levels must also be delivered.

Achieving the energy savings identified from codes and standards, benchmarking, and commissioning requires further action on three fronts.

- First is to motivate owners and operators to undertake improvements. This will mean presenting compelling business cases to top decision-makers, while strengthening the skills and knowledge of building operators.

- Second is to ensure access to financing mechanisms that effectively surmount capital limitations and cash flow requirements. This means attracting the interest of banking and capital industries to the magnitude of investment and borrowing needs, and identifying finance mechanisms that properly balance recovery of owner costs through rents, operating cost pass-throughs, or sales price premiums as occupants experience reduced utility bills, higher worker productivity, and other benefits.

- Third is to facilitate the existence of knowledgeable energy management service providers that can conveniently arrange comprehensive improvements in buildings. This may require experimentation with incentives or new business model incubation to attract and reward those businesses willing to offer and arrange one-stop comprehensive energy management solutions that achieve deeper levels of savings than more typically obtained from the more specialized businesses primarily operating in energy service markets today.

Goal 2: Existing Buildings

Implementation Plan and Timeline					
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**	**2020-2030**
2-1: Lead by Example: State/local governments and major corporations commit to achieve energy efficiency, EE, (or green) targets in existing buildings.	State of California Green Action Team Local governments Building industry Building owners Business Community	• Ensure all State-owned and leased buildings are benchmarked and retro-commissioned by 2012. • Conduct campaign to have 100 local governments commit to the same target. • Conduct campaign to have 500 million sq. ft of commercial space where owners/tenants pledge to reach the same target by 2015.	• Require all public buildings receiving significant financial support from the State are benchmarked and retro-commissioned by 2015. • All State-owned and leased buildings (on average) reach Energy Star equivalent rating by 2015. • 100 local governments reach the Energy Star target by 2015. • 500 million sq. ft of commercial space where owners/tenants reach the Energy Star target by 2015.	• 250 local governments reach the Energy Star target by 2020. • 2 billion sq. ft. of commercial space reach the Energy Star target by 2020.	• 400 local governments reach the Energy Star target by 2030. • 4 billion sq. ft. of commercial space reach the Energy Star target by 2030.
2-2: Lower the threshold for applying codes to existing buildings.	Energy Commission California Building Standards Commission Building industry Local governments	• Adopt regulations to lower threshold applied to existing building renovations.	• Implement lower threshold for renovations.	• If necessary, adopt regulations to further lower threshold applied to existing building renovations.	
2-3: Ensure compliance with minimum Title 24 codes and standards for building renovations and expansion.	Energy Commission BSC Contractors State Licensing Board Professional licensing/ Registration agencies Local governments	• Analyze and adopt best options to ensure compliance with minimum standards. • Establish accepted certification methods for voluntary levels of high-performance buildings. • Fifteen percent of HVAC sales by 2015 are for advanced air conditioning technologies optimized for climate variations.	• Fifty percent of HVAC installations comply with codes via permits by 2015. (See implementation details in Chapter 6, Goal 1)	• By 2020, 90 percent of HAVC systems are installed to code and optimally maintained for systems' useful life.	
2-4: Establish mandatory energy and carbon labeling and benchmarks.	Legislature Energy Commission Utilities Research institutions Building owners and operators Industry stakeholders State agencies	• Mandate benchmarking for all commercial buildings, triggered by changes in building ownership, financing or tenancy. • Develop or approve protocols for benchmarking and compliance options. • Incorporate carbon footprint into labeling. • Link IOU and other incentives to benchmarks.	• Implement mandatory energy and carbon labeling and benchmarks. • Promote national labeling and benchmarking standards and protocols. • Develop minimum levels of benchmarks to maintain future certificates of occupancy.	• Require minimum levels of benchmarks to maintain future certificates of occupancy. • Establish change of ownership as a trigger for updated benchmarking requirements.	• Establish change in tenancy/lease as a trigger for updated benchmarking requirements.

Implementation Plan and Timeline					
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**	**2020-2030**
2-5: Develop tools and strategies to use information and behavioral strategies, commissioning, and training to reduce energy consumption in commercial buildings.	Building Industry Energy Commission Utilities Research Institutions	• Identify new or improved tools and strategies that apply information and behavioral strategies, including presentation of economic, comfort and productivity cases to owners, occupants, and appraisers. • Strengthen tools and practices for building commissioning. • Strengthen Building Operator Certification (BOC) training for commissioning.	• Quantify and document business case for EE commissioning and operation and maintenance (O&M activities.	• Use business case to expand BOC programs to an increased portion of commercial buildings.	
2-6: Develop effective financial tools for EE improvements to *existing* buildings.	Finance Task Force Utilities Financial and Investment community Building owners and operators Real estate trade organizations Local Governments	• Quantify magnitude of building investment needed in California to meet long-term EE goals, and identify business-types expected to benefit from EE investments. • Build and quantify strong business case for DSM/GHG reduction. • Identify tools, instruments, and information necessary to attract capital to EE. • Explore changes to standard lease terms to address perceived tenant/owner "split incentives" issue. • Explore expanding on-bill financing offerings to other DSM programs.	• Roll out new instruments. • Evaluate instruments and cash flow of transactions. Promote success stories. • Refine or develop most effective EE financial instruments and business capital investment paths.	• Evaluate instruments and cash flow of transactions. Promote success stories.	• Refine or develop most effective EE financing instruments and business capital investment paths.
2-7 Develop business models and supplier infrastructure to deliver integrated and comprehensive "one-stop" energy management solutions	Utilities Energy Service Companies (ESCOs) DSM and solar service providers Venture capital firms Local Governments	• Initiate utility incentive pilots that test the viability of integrated DSM service delivery models (ESCOs, aggregators, etc.) • Explore other mechanisms to more highly reward comprehensive energy management retrofits, e.g. premium incentives for measured performance, local government permits incentives, insurance discounts, etc.	• Identify and promote to venture capital and investment circles business model barriers and opportunities for scalable integrated business models	• Apply branding, certification, marketing, or incentive strategies that best delivery one-stop comprehensive DSM services.	• Refine most effective integrated one-stop delivery models.
2.8. Improve utilization of plug load technologies within the commercial sector.	Utilities Industry Partners	• Test and deploy package of rebates, incentives and voluntary industry agreements to bring significant numbers of the best available technologies for managing plug loads within the commercial sector.	• Incorporate most effective approaches and technologies into building codes and State/Federal equipment standards.	• Promote best practices and fully incorporate into benchmarking and labeling systems.	• Refine and pursue most promising new approaches.

Goal 3: Transform the commercial lighting market through technological advancement and innovative utility initiatives.

Lighting programs have comprised a significant share of savings from the IOU portfolios for the commercial sector over the past several years. This emphasis is largely due to the widespread conclusion that, much as within the residential sector, lighting opportunities are low cost and readily accessible strategies for major, near-term savings.

Recent legislation and broad market trends will affect the context for lighting programs in California for residential and commercial markets alike. Thus, while significant savings potential still exists in lighting applications today, as new trends and policies take effect, utility programs targeting these same applications will provide diminishing incremental benefit. Ratepayer-funded programs must re-orient towards measures which extend beyond these new standards and measures accepted in the marketplace to usher in the next generation of high-efficiency lighting. Accordingly, there is a need to move quickly beyond current lighting programs and towards solutions which focus on multi-year and holistic lighting system strategies, improved conservation actions, and other means of market transformation.

Increasing the market penetration of advanced lighting solutions will require coordinated efforts on a number of interrelated fronts. While the residential and commercial markets are distinct in many ways, there is potential for the commercial lighting sector to leverage the same sorts of efforts referenced in the residential lighting discussion above to advance market transformation: R&D conducted at the National Labs, commercialization support programs, design competitions to engage manufacturers, technology demonstration projects to engage consumers and build buyer confidence, alongside continual upgrades in standards for commercial lighting technology and applications will ensure mature technologies are incorporated universally across California's commercial sector. Differences across segments of the commercial market will require diversified messaging and outreach efforts, and program delivery mechanisms.

Goal 3: High-Performance Commercial Lighting

Implementation Plan and Timeline					
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**	**2020-2030**
3-1 Drive continual advances in lighting technology through research programs and design competitions.	Energy Commission (PIER) Universities National Labs Manufacturers Utilities Retailers	• Work with research organizations to develop lighting products with lower energy requirements and improved spectral performance. • Work with Utilities and Retailers to develop public awareness and demand.	• Continue to work with most promising materials, designs, and/or controls • Incorporate most effective approaches and technology into building codes and State/Federal equipment standards	• Refine R&D focus to areas of greatest future promise. • Update standards	• Ongoing refinements. • Update standards
3-2: Create demand for improved lighting products through demonstration projects, marketing efforts, and utility programs.	Utilities Industry partners	• Deploy package of rebates, incentives and voluntary industry agreements to bring significant numbers of the best available commercial lighting technologies (SSL) to market.	• Phase out incentives for earlier generations of EE technologies • Incorporate most effective approaches and technology into building codes and State/Federal equipment standards	• Target case studies and performance data to lighting buyers • Update standards	• Refine and pursue most promising new approaches • Update Standards
3-3: Coordinated phase out of Utility incentives for purchase of CFLs	Utilities Retailers	• Ensure that big box and home improvement retailers such as Wal-Mart and Home Depot are ready to stock Energy Star price discounted CFLs in CA as IOUs phase CFL programs out. • Utilities engage in negotiations with manufacturers and retailers to buy-down and stock the next generation of high efficiency lighting.	• Incorporate most effective approaches and technology into building codes and State/Federal equipment standards	• Promote best practices and fully incorporate into benchmarking and labeling systems. • Update standards	• Refine and pursue most promising new approaches • Update standards.

4. INDUSTRIAL SECTOR

4.1 VISION

California industry will be vibrant, profitable and exceed national benchmarks for energy efficiency and resource management.

4.2 PROFILE

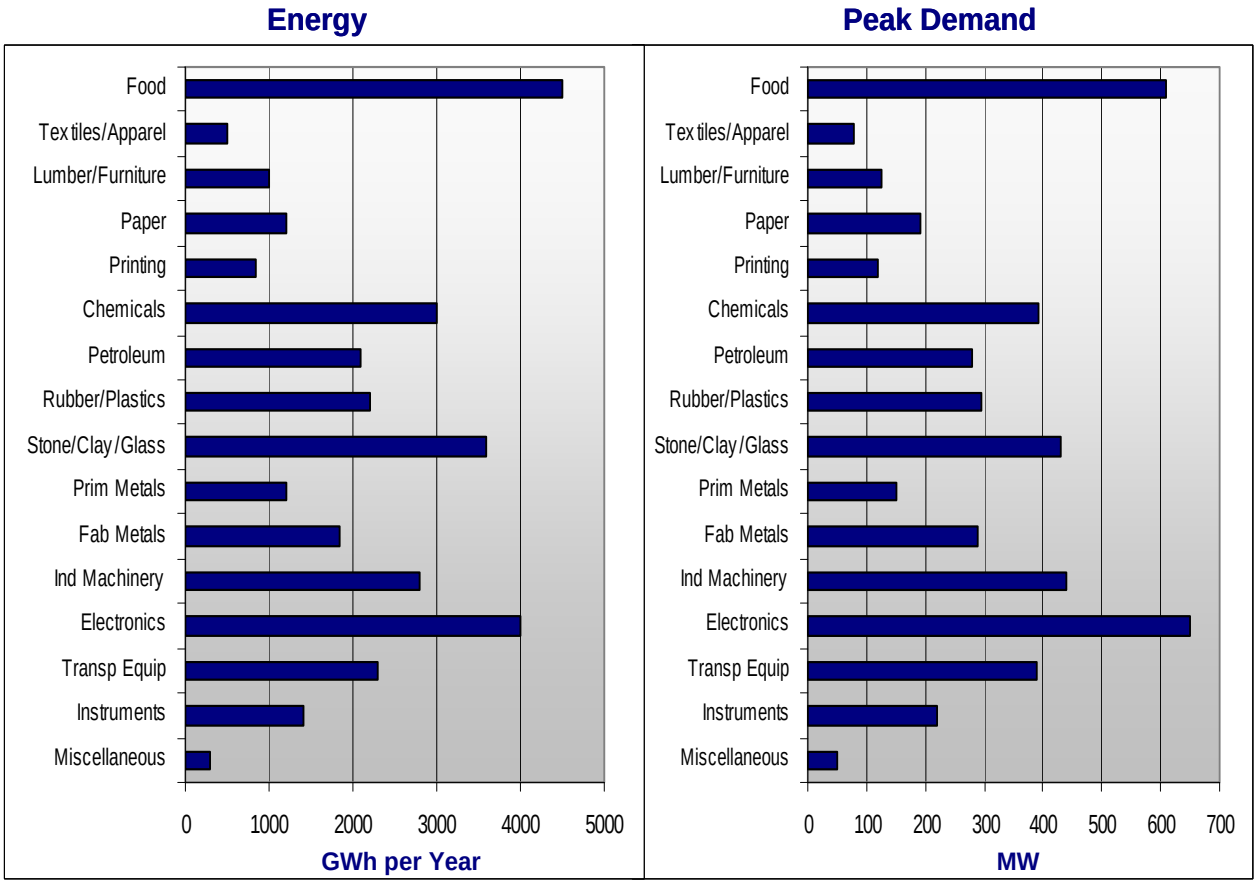
California's industrial sector is both a major driver of California's economy and a major consumer of energy:

Contribution of the Industrial Sector	(% of total in CA)
Electricity use	16
Natural gas use[45]	33
Energy use[46]	22
End use CO2 emissions[47]	20

The treatment, distribution, and use of water in California's industrial sector contributes an additional 3 percent of California's electricity use and 14 percent of its non-power plant natural gas.[48]

Energy consumption in the industrial sector is distributed across a variety of distinct industries and processes. As shown below, the largest industrial users of electricity in California are food processing

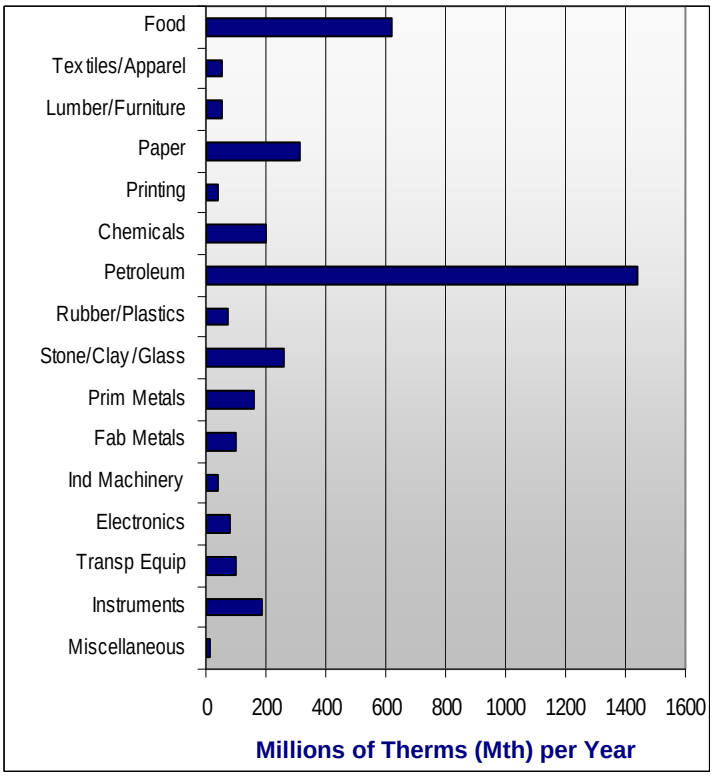
Industrial Electricty Usage by Industry Type, 2003–Overall



and electronics, although a number of other sectors have also reached significant use levels.

The largest user of natural gas is petroleum sector, with about half going to feedstocks, followed by food processing.

Industrial Natural Gas Usage by Industry Type, 2003–Overall



Source: KEMA 2006, California Industrial Existing Construction Energy Efficiency Potential Study

Several factors unique to the industrial sector require an approach to California's energy efficiency and greenhouse gas (GHG) reduction goals different from that used in the commercial and residential sectors:

- Industry uses a large quantity of energy and other resources via complex and proprietary processes to create and bring products to market. Products, to varying degrees, have embedded energy that traditionally cannot be "zeroed out", although technology is changing (e.g., the developing technologies for "zero energy" cement, dry walls, etc.)
- Industrial facilities in California are increasingly managed by corporations that reside outside of the state or outside of the country and that view these facilities as mobile assets in a competitive global marketplace.
- California industry is highly diverse in type, size, and operation; uniform programs often will not match corporate or facility needs.
- Industries are subject to multiple policies and rules in resource areas (e.g. air quality, water quality, energy efficiency, GHG reductions, solid waste management), where compliance can raise competing objectives and outcomes.

4.3 GOALS

Goal		Goals Results
1. Support California industry's adoption of energy efficiency by integrating energy efficiency savings with achievement of GHG goals and other resource management objectives.	➡	By 2012, the goals, program designs and funding of industrial resource management programs are fully coordinated.
2. Build market value of and demand for energy efficiency through branding and certification.	➡	Energy efficiency certification and benchmarking will become a standard industrial practice for businesses that are responsible for 80 percent of the sectoral energy usage by 2020. By 2020, Energy intensity (per gross dollar of production value) will be reduced at least 25 percent. There will be a trained workforce in energy management and systems energy efficiency.
3. Provide centralized technical and public policy guidance for resource efficiency and workforce training.	➡	Industrial consumers will use this knowledge base to inform energy efficiency actions and manage their energy and resource use by adopting best practices.

4.4 STRATEGIES

Industry has the capacity to significantly improve its overall energy performance and help meet both private-sector and national goals for energy and the environment. There are a multitude of significant barriers, however, to achieving the full technical or economic potential for energy efficiency in the industrial sector. These barriers are predominantly institutional and behavioral, not technical. They include:

- Lack of awareness of energy efficiency opportunities by industry personnel consultants, and suppliers.
- Difficulty in accessing industry-relevant technical assistance.
- Inadequate availability of qualified personnel and consistent organizational structure oriented towards energy use management.
- Primary business focus on optimizing industrial output, not energy throughput.
- Risk aversion to investing in new technologies and processes which may impact industrial output or quality.
- Resource limitations of both time and capital for assessment and implementation of energy efficiency projects.
- Internal hurdle rates that often limit capital available for energy efficiency projects with paybacks longer than two years.
- Utility program parameters that can be at odds with industry practice (e.g. limitations due to "free-rider shop" rules, lack of recognition of savings from process or operational changes, limits on funding for large projects).

This *Plan* will use the following strategies to address these barriers:

1. **Integrated Solutions**: Provide integrated energy solutions and products through a "one-stop shop" approach.
2. **Education and Outreach**: Provide energy efficiency education and outreach to create awareness of and demand for continuous energy efficiency improvements.
3. **Branding and Certification**: Promote commonly accepted metrics to document corporate and facility attainment of resource management levels, gaining market recognition, spurring peer competition, and facilitating engagement in market trading mechanisms.
4. **Workforce Training**: Leverage existing training initiatives and technical exchange forums so that California industries have access to highly-skilled professionals who are fully knowledgeable in the areas of system energy efficiency and energy management

4.5 IMPLEMENTATION PLAN

Goal 1: Support California industry's adoption of energy efficiency by integrating energy efficiency savings with achievement of GHG goals and other resource goals.

Ideally, this Goal will be integrated with the CARB's AB 32 requirements so that industrial facilities use energy efficiency to meet or exceed regulatory requirements for GHG emission reductions (as well as water conservation, waste disposal, and air quality). Properly structured, a coordinated regulatory framework could be coupled with incentives to actively promote and reward measured performance improvements across energy, water, GHG emissions, waste disposal, and air quality.

A major strategy will be to directly engage industry in coordinated interagency planning for the energy efficiency portions of AB 32. This effort will include examining the potential benefits of negotiated, legally binding agreements with the chief operating officers of industrial corporations as a policy mechanism to promote energy efficiency in industry and corresponding reductions in GHG emissions. The United Kingdom, the Netherlands, Sweden, and a number of other countries have negotiated agreements programs in place, and such a strategy may work in California. DOE has begun development of national voluntary agreement programs as well. A multi-stakeholder alliance focused on knowledge sharing and capacity building could further aid in the adoption of changes in industrial operations and processes.

While the CPUC and IOU utilities could potentially develop such a program focused only on energy efficiency savings, a program approach covering all energy resource utilization, including energy efficiency, demand response, energy storage, combined heat and power, distributed generation, renewables and emerging technologies will provide the greatest benefit.

The food processing industry, with the leadership of the California League of Food Processors in partnerships with the Manufacturers Council of the Central Valley, has proposed such a pilot demonstration project that could be initiated in 2009.

This effort will also enable broadening utility program incentives from the current focus on energy efficient projects to include energy efficient processes (defined as documented, measurable evidence of energy management resulting in improved energy efficiency via projects, process, and operational improvements). The focus must move to delivered energy savings, either from hardware installations or documented permanent changes in operational processes. Utility program rules must become more flexible and find ways to work with the reality of industrial decision-making, particularly regarding early replacement of equipment.

Goal 1: Integration with Other Resource Strategies

Implementation Plan and Timeline				
Strategy	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Develop coordinated energy and resource management program for CA's industrial sector, to enhance use of energy efficiency	CARB CEC State Agencies for water, solid waste, and toxic substances Utilities Industry Reps.	• Establish CARB AB 32 Industry Team • Study feasibility of implementing negotiated agreements • Undertake pilot program with food processing sector	• Analyze results of pilot program. • If favorable, negotiate agreements with other key sectors	• Implement statewide

Goal 2: Build market value and demand for continuous improvement in industrial efficiency through branding and certification.

Goal 1 above focused on strategies that will support development of minimum regulatory energy efficiency requirements for either individual company or industrial sub-sectors as a whole, preferably integrated with the State's AB 32 program. Goal 2 is focused on companies that seek to exceed either minimum regulatory requirements or any negotiated bilateral agreement targets for industries as a whole, by actively managing their energy use over time.

In order for industry to make significant gains in energy efficiency, there must be greater awareness and knowledge sharing about programs, resources, and practical methods that can help industrial plants identify, develop, and document energy efficiency improvements and their economic benefits. Technologies common to many industries offer opportunities to increase efficiency. Significant knowledge sharing opportunities exist across firms and industries in the areas of combustion, industrial distributed energy, energy-intensive processes, fuel and feedstock flexibility, materials, sensors and automation, and combined heat and power.

The development of a national standard for industrial energy efficiency is currently under way. The Superior Energy Performance (SEP) partnership is a collaboration of industry, government, and non-profit organizations seeking to improve the energy intensity of U.S. manufacturing through a series of initiatives, most notably, by developing the standardized Plant Certification program.[49] The development of this American National Standards Institute (ANSI) accredited standard will help individual companies certify energy efficiency improvements, independently verify resulting energy savings, receive public recognition for achievements, and "raise the bar" for industrial energy efficiency overall.[50] Building on the ANSI standards, the SEP partnership is also helping to coordinate US participation in the development of an international ISO energy management standard. A representative from PG&E has been selected as the lead on the national ANSI effort, which positions California to play a critical role in the development of this important national and international standard. California's engagement in the partnership would ensure that the elements of the certification program, including the monitoring and verification methodology, are compatible with other California industrial energy efficiency and GHG emission reduction program regulations.

By participating in a recognized national effort to certify industrial facilities for energy efficiency, California will be assisting its industries to:

- More easily reach their GHG emission reductions targets via a supported, structured program based on proven best practices;
- Develop wide market recognition for their efforts through third-party certification, thus increasing global competitiveness

- Ensure corporate attention to a uniform national approach; and
- Provide a tangible way to encourage greater energy efficiency through their supply chain.

Programs such as those offered through DOE's Industrial Technologies Program (DOE/ITP) and EPA could provide substantial cost-share opportunities and in-kind assistance, especially if linked to certification.

To meet the near-term needs for a branding and certification program, California industries must have ready access to highly-skilled professionals who are trained in energy management and systems efficiency. Key areas include training industry professionals (consultants, plant engineers, and equipment suppliers) to provide energy management assistance, in-depth system assessment services, and in later phases, multi-resource utilization assistance, including waste reduction, water efficiency and air quality. California can leverage the workforce training element of the SEPP program to achieve this goal.

Goal 2: Certification Program for Continuous Improvement

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-1: Participate in DOE/EPA's national Plant Energy Efficiency Certification Program (E^2).	DOE/EPA SEPP participants Utilities Industry	• Participate in planning process.		
2-2: Implement certification	E^2 Program Utilities Industry	• Plan pilot and recruit host sites (8-10 facilities). • Implement and analyze pilots.	• If successful, launch broader program for priority industry segments.	• Refine and obtain widespread industrial enrollment and certifications.
2-3: Develop and implement workforce training program (integrated with national training effort).	E^2 Program WE&T Task Force Utilities Industry Universities	• Adopt the national curriculum for certification. • Consider curriculum enhancements for awareness-level training on integrating energy efficiency into the workplace and developing a new curriculum to fast track for future energy management professionals • Begin pilot courses with key industry segments.	• Expand to wider industry segments.	• Expand to industries statewide • Maintain and update curriculum.
2-4: Create tracking and scoring systems to measure resource efficiency improvements. (integrate w/ nat'l effort)	Utilities Industry	• Develop systems. • Implement on test basis.	• Modify and roll-out to industry segments on a phased schedule statewide. • Coordinate with ME&O program.	• Maintain and improve systems based on feedback.
2-5: Implement ME&O program to educate industry and consumers	ME&O Task Force Utilities Industry	• Form industrial collaboration mechanisms. • Develop plan.	• Launch w/ priority industry segments.	• Modify and roll-out statewide on a phased schedule. • Maintain and improve systems based on feedback.

Goal 3: Provide centralized technical and public policy guidance for California industrial energy and resource efficiency.

The purpose of this goal is to facilitate adoption of energy efficiency through centralized and easily accessed information and resources.

Industrial facilities are not just large buildings that can be effectively served by uniform programs designed for the commercial sector. The principal use of energy in industrial facilities is to create proprietary products or transform materials. Most industrial facilities have management systems in place for materials and labor but many are still lagging on optimizing energy or resource utilization. The goal is to provide a single clearinghouse of technical and resource management regulatory assistance that industries can use for more effective utilization of energy and environmental resources. Ideally, there would be a single source of knowledge that builds on and fills in the gaps in existing partnerships and relationships in the industrial sector. The goal is to provide access for industrial personnel and service businesses to technical information that can be applied in a practical way to industry needs.

The clearinghouse will also include information on emerging technologies, and industry-specific research. The clearinghouse will leverage knowledge developed through other organizations, including DOE and EPA. Both agencies have developed extensive expertise in industrial energy efficiency through a host of industry-specific programs and partnerships, including a Data Center Efficiency program under DOE's Save Energy Now initiative and Laboratories for the 21st Century (Labs21) a partnership program co-sponsored by DOE and EPA.[51]

Goal 3: Single Clearinghouse

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Short Term 2012 – 2015**	**Medium Term 2016 – 2020**
3-1: Compile technical and resource management regulatory materials into centralized assistance repository	Utilities Industry Associations	• Inventory existing sources for technical and regulatory assistance for industrial energy efficiency and other environmental resource targets. • Identify and incorporate priority energy and other data • Develop clearinghouse or integration system.	• Update and expand industry segment coverage as needed. • Extend to GHG and water.	• Extend info to include waste disposal and air quality.
3-2: Conduct statewide marketing and education effort to create demand for Industrial Information clearinghouse.	Utilities Industry Associations	• Develop ME&O Plan. • Implement plan.	• Publicize results of pilots. • Extend statewide.	• Update and maintain.

5. AGRICULTURAL SECTOR

5.1 VISION

Energy efficiency will support the long-term economic and environmental success of California agriculture.

5.2 PROFILE

The agricultural sector accounts for about 7 percent of California's overall energy,[52] a similar percentage of its private sector jobs, and around 1.5 percent of the gross state product. In terms of energy efficiency (and renewable energy), this sector has seven key end-use subsectors:

- Irrigated Agriculture
- Dairies
- Refrigerated Warehouses
- Vineyards & Wineries
- Greenhouses & Nurseries
- Post-Harvest Processing (on and near-frame)
- Confined Animal Feeding Operations (feedlots)

Energy consumption in the agricultural sector is concentrated in three end uses: irrigation, process heat applications, and refrigeration. Of these end uses, irrigation pumping accounts for 80 percent of electric energy use in the agricultural sector and has average pumping efficiencies of only about 53 percent.

Opportunities, barriers, and uncertainties that affect the success of energy efficiency in this sector include:

- Continuing consolidation of farming into agribusiness enterprises, concentrating decisions affecting energy consumption in the hands of fewer decision makers.
- Agricultural operators relying on commodity-specific and often local networks for information on technologies, practices and programs.
- Lack of up-to-date, statewide, segment-specific data on energy consumption and the potential for energy efficiency (and renewable generation) across the sector.
- Reluctance to accept higher first costs required to realize longer-term financial benefits, and to bear production risks associated with emerging or unproven technologies and practices.
- Continuing rapid evolution of regulations - including new requirements of the State Water Resources Control Board and Regional Water Quality Controls Boards, and the Air Resources Board and Regional Air Quality Control Boards, - that have no compliance coordination and which can slow the impetus to adopt energy efficiency technologies and practices, as well as the unknown structure of the AB 32 regulatory scheme.
- Expected reductions in surface water supplies due to climate change that will increase demand for energy-intensive groundwater pumping, making energy efficiency both critical and cost-compelling.

Beyond energy efficiency, agriculture offers a unique opportunity to integrate on-site renewable energy in the form of biomass from agricultural field crop residues and biogas from animal wastes from dairy, cattle, and poultry farms. While this overall resource management opportunity is highly important, this first *Plan* has not been able to focus specific attention on renewable energy.

5.3 GOALS

Goals	Goal Results
1. Establish and maintain a knowledge base sufficient to support development of all available, cost-effective, reliable, and feasible energy efficiency, demand reduction (and renewable) energy resources.	By 2015 California agriculture will develop and implement action plans, best practices and educational infrastructure to support ongoing improvements in irrigation, refrigeration and process heating efficiency, demand response, and renewable energy production.
2. California regulations, financing mechanisms, and incentives programs affecting the management of energy, air and water resources, solid waste, and climate change will be coordinated to mutual advantage.	By 2010, key stakeholders will develop a roadmap for agricultural regulatory and incentives coordination. By 2012, the goals, program designs and funding of such programs for energy, air and water improvements will be fully coordinated.
3. Achieve significant increases in the efficiency of electricity and natural gas use and on-site renewable energy utilization.	California agriculture will reduce production energy intensity by 15% from 2008 levels by 2020 for non-renewable energy.

5.4 STRATEGIES

A central challenge to achieving broader energy efficiency in the agricultural sector is elevating energy as a business priority. Demonstrating how energy efficiency contributes to increased competitiveness or profitability and to compliance with environmental requirements (e.g., impending AB 32 regulations) will be essential.

The overall strategic approach will be to focus on the largest energy end users first, while also capitalizing on consolidating companies and entities that address energy decision making within the sector. The initial emphasis will be on the most energy intensive end uses—irrigation, process heating and refrigeration. However, this emphasis will be supported by an integrated "whole farm" approach that evaluates and addresses energy resource management comprehensively.

Strategies will expand to target progressively smaller energy consumers, especially early movers and opinion influencers. Success stories from both large- and smaller-scale agricultural enterprises will be widely disseminated throughout the sector to build both awareness of and enthusiasm for whole farm approaches targeting energy efficiency.

Success in carrying out these strategies will require the collaboration and active engagement of numerous stakeholders. Among State agencies, key players will be the Department of Food and Agriculture (DFA), Department of Water Resources (DWR), the Energy Commission, and others. At the Federal level, the Department of Agriculture (USDA) and the Bureau of Reclamation are significant players. The agriculture industry associations obviously will be leaders in this effort, supported by educational institutions, the USDA Cooperative Extension service, and the investor-owned and publicly-owned utilities serving agricultural energy users. Local government agricultural commissioners' offices likely will drive some of the marketing education and outreach efforts in tandem with the statewide ME&O Task Force.

Agricultural sector stakeholders have identified the single highest priority is to conduct baseline studies to understand the energy usage patterns in California's agricultural sector, forecast likely changes in the future, determine the energy efficiency potential in the seven sub-energy

sectors, and evaluate the cost-effectiveness of measures and programs, best practices, etc. Without this basic information, it is impossible to design a cohesive strategy to pursue all cost-effective energy efficiency in California.

Two additional items are central to the success of all three goals:

1. **Marketing, Education and Outreach**: There must be a defined, comprehensive, long-term marketing, education, and outreach program to inform the agricultural sector and consumers regarding the goal and key strategies.
2. **Workforce Training**: There must be a statewide focus on the workforce needs to achieve the goal, with adequate funding and support for development of the needed workforce.

5.5 IMPLEMENTATION PLAN

Goal 1: Establish and maintain a knowledge base sufficient to support development of all available, cost-effective, reliable, and feasible energy efficiency, demand reduction (and renewable) energy resources.

Absent a better understanding of the current and forecasted energy use in California's agricultural sector, energy efficiency potential, successes and failures to date, it will be impossible to implement significant energy efficiency in this sector, much less provide the cost-saving opportunities that energy efficiency offers. Therefore, the single most important step – which is needed immediately – is to conduct energy use and efficiency potential studies that will provide critical information on a statewide basis.

Once developed, this information must be accessible to agricultural professionals and operators through appropriate education, training, and field-based extension activities. This will require a needs assessment, followed by development of curricula, training modules, and supportive tools that can access and leverage the content of the newly created knowledge base. Trained and experienced advisors and farm operators can then be developed and recognized for their knowledge in how to apply efficiency and resource solutions to individual agri-business operations.

The search for solutions will not stop with existing technologies and practices. There will be a focused effort to develop new technologies and applications that can help achieve multiple resource management goals. For example, opportunities exist to leverage knowledge from the industrial sector to apply to key processes driving energy consumption in the agricultural sector – such as for pumping, boiler operations and refrigeration. Another strategy will be better coordination of knowledge being developed by the Federal and State agricultural and energy research programs, agricultural equipment manufacturers, utility promotion of emerging technologies, and agricultural extension programs to individual farms and production facilities.

Goal 1: Energy Efficiency Knowledge Data Base

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Develop knowledge base of efficiency solutions	Utilities CDFA DWR Agriculture Industry	• Conduct an energy use characterization and efficiency potential study for the statewide agricultural market. Include potential for waste streams to offset energy consumption. Study plan (6/2009) and study completed (12/2010). • Collect data on key programs and measures, best practices for energy efficiency in the agricultural sector. Study complete (6/10)	• Develop framework for common agricultural data base. • Establish central clearinghouse for technical, program, regulatory, and incentive information.	• Ongoing refinement and maintenance.
1-2: Ensure workforce has information and training necessary to apply efficiency solutions	Utilities WE&T Task Force Educational Institutions Agricultural industry	• Conduct workforce training needs assessment and next steps (12/2010) • Develop training curricula and modules identified by needs assessment. (12/2011)	• Develop training and education tools for use of date base and benchmarking methods • Begin pilot training & education programs.	• Training & education activities are fully rolled-out. • Certification programs are in place.
1-3: Conduct research & development of new technologies and practices for agricultural efficiency	Energy Commission Utilities National Labs Agriculture Industry	• Conduct an Energy Technologies/ RD&D gap analysis. Identify and prioritize needed RD&D/ET projects. (12/2011) • Coordinate research activities across government, utilities, agricultural extension and university programs, and equipment manufacturer proprietary efforts.	• Ongoing identification, prioritization and execution of ET/RD&D projects.	• Ongoing identification, prioritization and execution of ET/RD&D projects.

Goal 2: California regulations, financing mechanisms, and incentives programs affecting the management of energy, air and water resources, solid waste, and climate change will be coordinated to mutual advantage.

The agricultural sector is subject to water use, water quality, air quality, solid waste, and soon global warming requirements. Energy efficiency, particularly when linked to water conservation, can be a key strategy to achieve goals in these other areas. Yet there is currently no coordination at the State, local or Federal level to optimize the use of energy efficiency in meeting multiple resource objectives.

A multitude of programs – currently uncoordinated – operate in the agricultural sector that address the sector's use of energy, air and water. Better coordination of these programs would lead to enhanced use of energy efficiency as a successful strategy to implement the goals across all programs. Specific programs warranting coordination are: water conservation and quality improvement funding, Energy Commission PIER funds, local air quality improvement funds, Federal tax credits, Rural Energy for America Program (REAP) under the Federal Food, Conservation and Energy Act of 2008 (Farm Bill) and utility energy efficiency and renewable energy incentives.

One of the most important goals for agriculture is to develop a forum or process involving multiple stakeholders to coordinate technical energy efficiency solutions and program designs (e.g., knowledge bases, technical assistance, financing, and financial incentives) across the range of environmental management policies and goals.

Strategies will include:

- **Integrated Resource Management**: Setting up a common framework for resource management that can better leverage and "piggyback" multiple resource management programs to support increased adoption of energy efficiency, demand response and onsite generation opportunities integrated with efforts to attain air, water, and solid waste objectives.
- **Financing**: Developing common technical and financial assistance energy efficiency strategies most appropriate in the agricultural sector for achieving specific program objectives (e.g. deciding among grants vs. loans vs. rebates; structuring financial programs sensitive to preferences between traditional financing vs. performance contracting; and utilizing technical assistance advisors and expertise to deliver integrated solutions across multiple objectives).

The ultimate goal of this *Plan* is to provide "one-stop-shopping" assistance to both program sponsors and the agricultural operators targeted by energy, air and water programs. This will assist program sponsors in tailoring their programs to the unique needs and preferences of agricultural operators, and prospective program participants in understanding opportunities, requirements and how to efficiently participate in programs.

A task force including representatives of all major sources of agricultural expertise, financing, and incentives targeting energy, air, water and solid waste concerns is envisioned as the mechanism for implementing the strategy. The task force will provide both a forum for alignment and leveraging of program goals, designs and funding, and a clearinghouse for program information and coordination. The California Department of Food and Agriculture (CDFA) is developing a California Agricultural Vision through 2030, which may provide a useful opportunity to launch this forum.[53]

The immediate focus of the task force will be on identifying and mitigating existing conflicts in programs operating across energy, air, water and solid waste concerns within the agricultural sector.

Goal 2: Coordination of Programs and Funding

Implementation Plan and Timeline				
Strategies	**Non-CPUC Parties**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-1: Set objectives and framework for agriculture to attain multi-resource management goals	Utilities CDFA DWR Industry participants	• Establish a task force to coordinate resource management policies, action goals, and program designs targeting California's agricultural sector. • Identify where goal conflicts arise and resolve these conflicts. • Assess potential for integrated approaches.	• Establish a central database to track and coordinate resource policies and initiatives. • Undertake pilot integrated approaches. • Refine program designs and support based on experience.	• Continue to modify and refine approaches for integrated solutions.

Implementation Plan and Timeline				
Strategies	**Non-CPUC Parties**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-2 Coordinate technical assistance, funding, and incentive mechanisms	Financing Task Force Utilities Financial Institutions Agriculture Industry	• Identify the programs and major funding sources affecting the management of energy, air and water resources, and climate change. • Create a collaborative forum to facilitate sharing of information and coordination of programs.	Identify approaches to cross-market and leverage resource management goals across programs, funding, and technical assistance.	Continue to modify and refine approaches for integrated solutions.

Goal 3: Achieve significant increases in the efficiency of electricity and natural gas use and on-site renewable energy utilization, including setting a specific target for irrigation efficiency.

Because irrigation accounts for 80 percent of the electricity used in the agricultural sector and current pumping efficiencies are so low, a specific goal targeting improvement in this area is warranted. Two other areas that warrant specific focus are higher efficiency with refrigeration and process heating from natural gas.

Strategies needed to achieve this goal include identification and adoption of management best practices and highly efficiency equipment. Specific areas of focus will include targeting energy efficiency opportunities from:

- Onsite source-water reduction
- Retro-commissioning
- Precision agriculture
- Advanced irrigation systems
- Pressure reduction in irrigation
- Waste heat recovery and other gas-savings measures
- Improved industrial refrigeration practices and technologies.

One of the emerging energy efficiency practices to guide end users in their efficiency actions is the use of "benchmarking". This requires developing a best practice standard and supporting systems that enables individual end users to analyze their energy usage compared to the benchmark. Development of benchmarking tools for each agricultural sub-sector – starting first with the irrigated agriculture subsector and then expanding to other subsectors – would be an important strategy in identifying profitable opportunities for efficiency improvements.

Achieving real savings in agriculture will be founded upon a compelling business case to decision-makers in agricultural sub-sectors and individual companies. The strategy will identify the most effective communication channels, partners, and messages to deliver to these decision-makers.

Recognizing that irrigation accounts for the predominant share of electricity, both on-farm and in the statewide delivery of water, pilot programs and evaluation will be used to identify the embodied energy savings associated with water efficiency gains. This will be a critical step in linking energy and water efficiency strategies.

Goal 3: Capturing Energy Efficiency

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Medium Term 2016 – 2020**
3-1 Make information on efficiency solutions readily available to motivate efficiency improvements	Utilities Agricultural Industry	• Develop benchmarking resources, tools and methods for the agricultural sub-sectors. • Design and launch focused program for irrigation efficiency, refrigeration, and process heating	• Apply feedback and refine benchmarking tools. • Expand programs to wider audience and promising end uses.	• Ongoing refinement and maintenance
3-2 Conduct marketing & outreach to stimulate efficiency actions	ME&O Task Force Utilities Agriculture Industry	• Develop ME&O strategy, addressing communication channels, partners, and effective messaging. • Begin pilot implementation	• Launch statewide program	• Ongoing refinement and maintenance
3-3 Resolve metrics for embedded energy in water savings	State water agencies Agriculture Industry Energy and Water utilities	• Update evaluation measurement & verification protocols to define energy impacts of water efficiency actions. • Design and conduct appropriate water/energy efficiency pilots for agriculture.	• Measure and report all embedded energy savings associated with irrigation and process efficiency. • Incorporate findings into business case messages and policies for water and energy efficiency.	• Ongoing application to policies and programs.

6. HEATING, VENTILATION AND AIR CONDITIONING[54]

6.1 VISION

The residential and small commercial heating, ventilation, and air conditioning (HVAC) industry will be transformed to ensure that technology, equipment, installation, and maintenance are of the highest quality to promote energy efficiency and peak load reduction in California's climate.

6.2 PROFILE

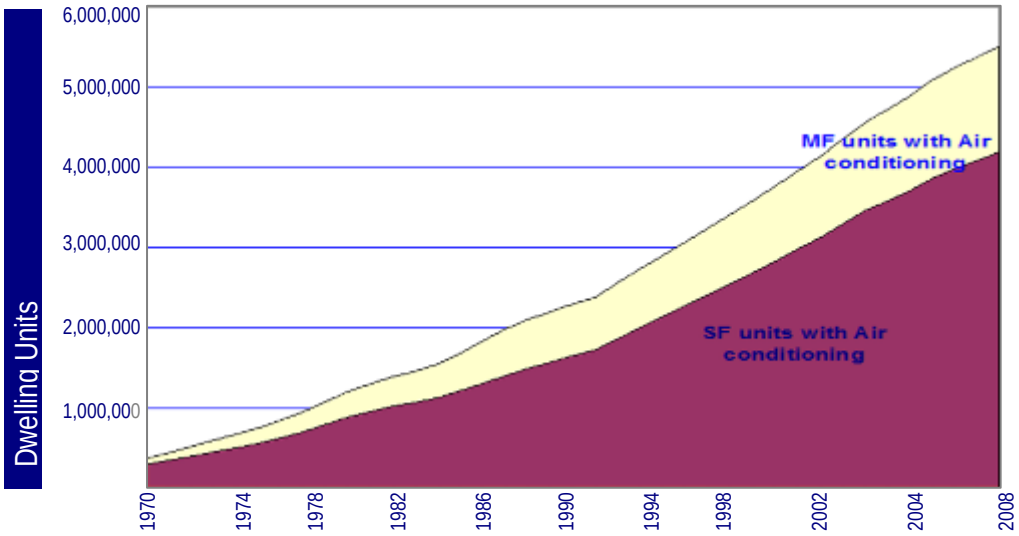
One of the Big/Bold Strategies adopted by the Commission in October 2007 is to "reshape residential and small commercial HVAC to ensure optimal equipment performance." This initiative targets a 50 percent improvement in efficiency in the HVAC sector by 2020, and a 75 % improvement by 2030.

The rapid growth in air conditioning in California's commercial buildings and homes has made it one of the state's largest energy-consuming end uses and the single largest contributor to peak demand—and a leading opportunity to improve energy efficiency and reduce peak power demand.

In 1976, 25 percent of new California homes had central air conditioning. Today, it is 95 percent: new home size has increased by more than 50 percent and new homes are concentrated in hot inland communities. These increases have resulted in a greater than seven-fold increase in the electricity capacity to meet this load.

By 2006, peak demand for residential air conditioning units was 14,316 MW. When small commercial air conditioning is added to the residential share, air conditioning loads cause over 30 percent of California's total peak power demand in the summer—with an enormous and costly impact on the need for generation, transmission, and distribution resources and a concurrent lowering of utility load factors.

Growth in Residential Dwellings with Central Air Conditioning - Single Family and Multi Family Units from 1970 to 2007



Unfortunately, as air conditioning was becoming nearly ubiquitous in new California buildings, installation and maintenance practices suffered substantially. The HVAC industry has struggled to provide qualified technicians, and market conditions rarely value quality installation and maintenance (QI/QM). Less than 10 percent of HVAC systems obtain legally required pre-installation local building permits and 30-50 percent of new central air conditioning systems are not being properly installed. As a result, Californians pay a large price for the lack of quality installation and maintenance, with commensurate poor performance. The factors that have led to a 20-30 percent increase in the peak energy needed to provide consumers with the cooling and comfort they demand on hot summer afternoons[55] has been accompanied by an estimated 30 percent increase in carbon emissions.

AB 2021 (Levine, 2006) required the Energy Commission to investigate options and develop a plan to improve the energy efficiency of, and to decrease the peak electricity demand of, air-conditioners." The Energy Commission's subsequent report, "Strategic Plan to Reduce the Energy Impact of Air Conditioners",[56] estimated potential cumulative savings from higher quality installation in the residential and small commercial markets at 1,216 GWh and 1,096 MW by 2020. The estimated cumulative savings from accelerated introduction of more efficient and properly installed cooling technologies is 1,272 MW and peak shifting technologies is 2,299 MW by 2020. The content of this chapter draws heavily from the CEC report, and the strategies set forth in this plan mirror those of the report's recommendations.

HVAC is regulated in California by the Energy Commission's Title 20 and Title 24 appliance and building codes and by Federal appliance standards. These codes and standards have become increasingly stringent in recent years, along with related activities such as the promotion of Energy Star-compliant units. But numerous barriers reduce the effectiveness of the codes and standards including:

- The Federal standards use a single, national air conditioning metric that does not robustly measure—never mind promote—the performance of air conditioners in hot, dry conditions such as California.
- Federal law pre-empts California's ability to set its own air conditioning efficiency standards.[57]
- Consumer markets focus on lowest first cost, and ignoring operating costs, making it difficult for quality contractors to compete.
- Installation and maintenance practices are inadequate, driven by cost competition and the "invisibility" of quality work to consumers.
- Building design practices do not take an integrated systems approach to lessen the size or need for HVAC.

6.3 GOALS

Goal	Goal Results
1. Consistent and effective compliance, enforcement, and verification of HVAC-related building and appliance standards.	HVAC-related permits are obtained for 50 percent of installations by 2015 and 90+ percent by 2020.
2. Quality installation and maintenance becomes the industry and market norm.	By 2020 100 percent of systems are installed to quality standards and optimally maintained throughout their useful life.
3. Whole building design and construction practices fully integrate building performance objectives to reduce cooling and heating loads.	Integrated design and construction practices are standard practice by 2020.
4. New climate-appropriate HVAC technologies (equipment and controls, including system diagnostics) are developed with accelerated market penetration.	At least 15 percent of equipment shipments are optimized for California's climate by 2015 and 70 percent by 2020.

6.4 STRATEGIES

To achieve the Commission's adopted Programmatic Initiative of transforming the HVAC market and the four specific goals identified above, broad-based and aggressive strategies are needed that involve many stakeholders beyond the Commission and IOUs. An HVAC Advisory Group should be chartered to involve high-level HVAC industry stakeholders—such as manufacturers, distributors, and contractors—to coordinate industry sponsorship of and participation in HVAC strategies. Membership should also include other key players, such as the CPUC, Energy Commission, utilities, local building officials, building owners/managers, consumers, and the Federal government.

6.5 IMPLEMENTATION PLAN

Goal 1: Consistent and effective compliance, enforcement, and verification of applicable building and appliance standards.

California law requires contractors to obtain a permit for the installation of new HVAC equipment (including replacements of existing equipments) and to perform quality control checks. Yet fewer than 10 percent of contractors obtain such permits, perform quality control checks, or have their work verified by third-party raters. Failure to ensure quality at the time of cooling system installations results in a 20 to 30 percent increase in the peak energy needed by systems.

This problem is exacerbated by Title 24 provisions that allow optional compliance with HVAC quality control requirements; a contractor may install higher efficiency measures in a new building in lieu of the quality installation and control requirements, absent any performance verification. The Air Conditioning Contractors of America (ACCA) recently developed a quality installation (QI) specification for air conditioning equipment that has become an American National Standards Institute (ANSI) standard. It is comprehensive, addressing all aspects of HVAC quality installation, including equipment, installation and ducts. The Energy Commission's June 2008 HVAC report recommended that the Energy Commission consider making the ACCA or similar requirements mandatory for all HVAC installations, in lieu of Title 24's current optional requirement. Energy Commission action to change its optional standards to mandatory quality control provisions is critical.

Changing the status quo will require significant effort, since contractors who comply with HVAC code provisions incur higher costs that are difficult to pass onto customers in a highly competitive market. Such contractors may also experience delays due to local government permit timelines. Local building officials may not have the resources or knowledge to establish streamlined permitting systems to support quality HVAC installations or penalize contractors who do not comply.

Strategies to achieve significantly improved compliance include:

- **Permitting Reform.** Streamlining local government permitting and State licensing processes, beginning with pilot programs.
- **Mandatory Requirements**. Changing the building code by replacing the current optional quality control requirements with mandatory requirements.
- **Verification**. Improving the current processes for inspecting and verifying compliant system installations, such as tracking the installation of all new and replacement equipment to ensure they are installed in compliance with all applicable State energy codes, or developing lower-cost compliance verification mechanisms.

- **Enforcement.** Actively enforcing penalties for contractors who do not pull required permits or who operate without the appropriate licenses.

Goal 1: Improve Code Compliance

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Develop streamlined local government HVAC permitting systems, including on-line HVAC replacement permitting.	Local Governments CALBO Utilities Distributors Contractors	• Convene an industry/local government stakeholder group; develop proposed new system; pilot test with local governments.	• Revise pilots and expand to other cities; develop framework for statewide program.	• Expand statewide.
1-2: Streamline process for obtaining and overseeing contractor business licenses.	Local Governments CALBO Calif. Contractor State License Board	• Pilot test streamlined process with local building departments. • Explore possible common business licenses for multiple jurisdictions.	• Revise pilot and expand pilot testing to other cities; develop framework for statewide program.	• Expand statewide.
1-3: Replace Title 24's current optional quality control requirements with mandatory requirements (ACCA/ANSI QI/QM specification).	Energy Commission ACCA/ANSI Utilities Contractors	• Adopt ANSI standards into Title 24; integrate into existing utility program designs.	• Explore steadily higher QI/QM standards as baseline becomes commonplace.	• Ongoing
1-4: Develop affordable standards and quality compliance solutions.	Utilities Local Governments CALBO Distributors Contractors	• Convene stakeholder group; develop details of proposed system and determine whether to proceed. • Consider developing an internet-based system that tracks the status of equipment, from the initial sale to final quality check in the field	• If recommended for development; pilot test.	• Expand statewide if pilot testing is successful.
1-5: Enforce penalties for contractors who do not pull permits or operate without the appropriate license.	Local Governments CA Contractor State License Board Contractors Utilities	• Pilot test local government fines in lieu of contractor license suspension; expand SMUD program to IOUs (proof of quality installation req'd for rebate); identify local govn't resources needed for enforcement; establish action plan to phase-in mandatory enforcement.	• Expand pilot programs; Continue phase-in of mandatory enforcement activities.	• Fully implement mandatory enforcement.

Goal 2: Quality HVAC installation and maintenance becomes the norm. The marketplace understands and values the performance benefits of quality installation and maintenance.

Quality HVAC installation and maintenance (QI/QM) is currently the exception, not the norm. Achieving this goal will require a major transformation in both markets and behavior. Consumers need education on the value of properly installed and maintained systems in order to demand quality installations, and the service industry needs proper education, training, and certification to then meet consumer demand.

Beyond Strategy 1-3 under Goal 1 above, a logical next step is to develop a label that would

be attached to residential or small commercial HVAC installations by a third-party rater.

Even before a change in the Title 24 requirements occurs, a statewide brand program could be developed to benchmark and recognize and/or certify quality installation and maintenance and high levels of HVAC technician competence. This effort could be conducted by California alone, with other southwestern states, or on a national basis. The brand would be used in at least two ways: (1) affixed to equipment to certify the equipment has been installed pursuant to QI/QM requirements and, (2) made available to contractors who voluntarily ensure a high proportion (perhaps 90 percent) of their workers have received high-quality certification from North American Technician Excellence or other industry groups. This branding effort could be tied to utility programs, such that only customers or contractors who use the brand receive incentives.

A consumer marketing and education campaign about the value of HVAC QI/QM can introduce and stimulate the demand for the new brand—communicating that quality work results in increased comfort, improved air quality and higher energy and cost savings. Development and launch of the quality brand should be supported with the appropriate level of behavioral studies to assess the market transformation impacts of the brand and ensure that utility incentives linked to use of a statewide brand are effective in changing consumer and contractor behavior.

A necessary concurrent strategy is the development of adequate workforce education and training for HVAC contractor/owners, service and installation technicians, sales representatives and building officials. This requires a comprehensive needs assessment to identify industry skill gaps and form the basis of an effective action plan to address these gaps. After this assessment is completed, support should be provided to certify new trainers and courses and provide incentives directly to technicians who complete training.

Goal 2: Quality HVAC Installation and Maintenance

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012-2015**	**Long Term 2016 – 2020**
2-1: Create a statewide Quality Installation and Maintenance (QI/QM) brand that will be attached to systems/installations/ contractors that meet quality standards.	ME&O Task Force Utilities HVAC industry Retailers	• Create and launch statewide quality brand and/or align with national brand. • Develop operating and lifecycle data on economic and comfort benefits.	• Ongoing	• Ongoing
2-2: Launch a consumer marketing and education campaign to support the brand and stimulate market demand	Utilities HVAC industry Retailers Local Governments	• Develop and launch campaign.	• Conduct ongoing behavioral studies to ensure strategies are effective	• Conduct ongoing behavioral studies to ensure strategies are effective

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012-2015**	**Long Term 2016 – 2020**
2-3: Develop and provide expanded QI/QM training for contractors, technicians and sales agents.	WE&T Task Force Utilities HVAC Industry Educational institutions Labor Unions CSLB NATE	• Conduct comprehensive training needs assessment to indentify industry skill gaps; begin expanded training programs.	• Assess impact of training activities and update needs assessment as required. • Expand training programs statewide, particularly at the vocational/technical and community college levels.	• Ongoing
2-4: Develop and implement comprehensive contractor accreditation program	HVAC Industry Energy Commission Labor Unions CSLB WE&T Task Force Educational institutions NATE	• Develop accreditation program requirements; begin implementation.	• Expand program	• Statewide certification program

Goal 3: Building industry design and construction practices that fully integrate building performance to reduce cooling and heating loads.

Both the Residential and Commercial Sector Chapters address the need for "whole building" design and implementation in California, in order to achieve truly aggressive energy efficiency savings. One key goal of this overall effort must be building performance that improves space conditioning, by dramatically reducing cooling and heating loads. Fundamental changes will be needed in current design and building practices.

Specific design and building changes addressing HVAC performance include:

- Placing more emphasis on the whole building as a complete interactive system and improving the thermal integrity of the building shell to reduce heating and cooling loads.
- Moving ducts and equipment off the roof and out of hot attics.
- Incorporating ductless systems, radiant heating and cooling, ground source heat pumps and thermal energy storage technologies with overall higher efficiencies.

The Residential and Commercial Sector Chapters address behavioral change strategies to promote whole building design and implementation. Those strategies must include a focus on the HVAC industry in particular.

Goal 3: Whole-Building Design

Implementation Plan and Timeline				
Strategy	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
3-1: Aggressively promote whole building design concepts that improve the overall thermal integrity of new and existing structures.	CEC HVAC industry Architects Builders and Contractors Utilities Local Governments	• Pilot targeted programs. • Incorporate radiant cooling, ductless systems, ground source heat pumps, etc. into 5 percent of new and existing construction by 2011. • Review priorities of PIER and Emerging Technologies program activities to more fully support newer HVAC technologies and systems.	• Include standard program offerings that emphasize HVAC-related elements to whole building approaches. Incorporate radiant cooling, ductless systems, ground source heat pumps, etc. into 25 percent or more of new and existing construction by 2015.	• Incorporate radiant cooling, ductless systems, ground source heat pumps, etc. into 50 percent or more of new and existing construction by 2020.
3-2: Accelerate activities related to HVAC aspects of whole building industry design standards.	ASHRAE Energy Commission Utilities Manufacturers AHRI	• Evaluate and update existing standards to include increased emphasis on HVAC aspects of whole building approaches.	• Ongoing	• Ongoing
3-3: Accelerate HVAC related aspects of whole building design in the educational and professional communities.	Colleges/ Universities Utilities Department of Education	• Develop continuing education programs. Begin curriculum use.	• Expand statewide. Develop university degree level programs.	• Ongoing
3-4: Accelerate code-based solutions to improving the thermal structural integrity and incorporating alternative cooling methods into building designs.	Energy Commission Local Governments Utilities	• Implement optional code improvements necessary to facilitate moves to whole building design approaches	• Establish mandatory whole building code-based solutions.	• Ongoing
3-5. Sponsor design competitions to encourage builders to design and build homes with net zero peak demands	Utilities Foundations Industry Builders and Contractors	• Conduct first competition in 2010 and annually thereafter.	• Annually	• Annually

Goal 4: New climate-appropriate HVAC technologies (equipment and controls, including system diagnostics) are developed with accelerated marketplace penetration.

Goal 4 requires coordinated development and use of new and improved HVAC technologies (equipment *and* controls, including two-way demand response and onboard diagnostics) that are adapted to California's climate zones.

The strategies to achieve this goal include:

- **Develop a regional (southwest) strategy**: Because advanced technology development and market penetration has a regional impact, it would be advantageous to draw participants from other states experiencing similar increasing air conditioning loads (e.g., Nevada, Arizona, New Mexico and perhaps Texas). The focus would be on working with DOE to develop new cooling systems with technology and designs that reflect California and similar hot/dry climate conditions.
- **Expand HVAC-related R&D**: Past improvements in HVAC energy efficiency have been the result of R&D by the HVAC manufacturers, utilities, government, and academia. There needs to be a new focus on hot dry climate solutions.
- **Support incremental improvements to HVAC equipment.** Because highly advanced cooling technologies will only penetrate small portions of the total market at a time, incremental improvements in standard HVAC equipment are also necessary, including continued upgrading of codes and standards. Any cost-benefit analysis for State or Federal regulations must include on-peak energy resource values and resulting peak-specific standards.
- **Commercialize on-board diagnostic systems**: Such systems automatically collect data and alert consumers and/or contractors when a fault or negative performance trend is detected. These diagnostics will result in energy benefits by helping ensure that HVAC systems are maintained and operate within design specifications. While many manufacturers currently offer either "on board" systems or hand-held ones that work with all systems, none are widely used by consumers or contractors. Actions to accelerate the commercialization of such diagnostics include:

1. Prioritizing in-field diagnostic and maintenance approaches based on the anticipated size of savings, cost of repairs, and the frequency of faults occurring
2. Benchmarking of existing diagnostic, repair and maintenance protocols
3. Developing nationwide standards and/or guidelines for onboard diagnostic functionality and specifications for designated sensor mount locations.
4. Aggressive promotion of diagnostic systems as a standard offering on all HVAC equipment.

In addition to technology development, a key strategy to achieve this goal is education of contractors and consumers about the advanced technologies' availability and value, as well as education and training of service technicians, particularly on the use of diagnostic systems.

Goal 4: New HVAC Technologies and System Diagnostics

Implementation Plan and Timeline				
Strategies	**Non -CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
4-1: Pursue regional climate optimized equipment standards through DOE rulemaking process.	DOE Utilities Nat'l Labs NBI HVAC industry	• Develop recommended standards and present to DOE.	• Regional climate optimized standards adopted by DOE.	• Ongoing
4-2: Update "Total Avoided Cost Model" and Title 24 "Time Dependent Valuation" calculations, including use of peak energy values.	Energy Commission Utilities	• Evaluate, revise and update as needed in State and Federal applications.	• On-going.	• On-going.
4-3: Accelerate market penetration of advanced technologies by HVAC industry promotions and updating/expanding current utility programs to include the new technologies as appropriate.	Utilities Energy Commission	• Conduct a comprehensive cost-benefit analysis of leading and prospective advanced technologies, and use to prioritize utility incentive offerings and HVAC industry deployment strategies • Establish an incubator program to accelerate commercialization of most promising technologies.	• Provide necessary program incentives to ensure that advanced technologies represent 30 percent of the systems sold by 2015.	• Continue to provide necessary program incentives to ensure that advanced technologies represent 50 percent of systems sold by 2020.
4-4: Adopt a progressive set of building codes that support the deployment of peak efficient equipment.	Energy Commission Utilities AHRI ASHRAE ACCA	• Enhance and accelerate the deployment of Title 20/24 codes.	• Ongoing	• Ongoing
4-5: Develop nationwide standards and/or guidelines for onboard diagnostic functionality and specifications for designated sensor mount locations.	Manufacturers Utilities Trade Associations AHRI ASHRAE	• Establish an industry-wide task force to develop national standard diagnostic protocols. • Begin implementation. • Incorporate into HVAC industry and utility programs.	• Incorporate diagnostic standards into equipment codes.	• Ongoing
4-6: Prioritize in-field diagnostic and maintenance approaches based on the anticipated size of savings, cost of repairs, and the frequency of faults occurring.	Manufacturers Utilities Trade Associations AHRI ASHRAE	• Benchmark existing diagnostic, repair and maintenance protocols and develop appropriate products.	• Commercialize on-board diagnostic systems.	• Incorporate mandatory onboard diagnostic systems in California building codes.

7. CODES AND STANDARDS

7.1 VISION

A broad range of aggressive and continually improving minimum and higher voluntary sets of energy codes and standards will be adopted to greatly accelerate the wide-spread deployment of zero-net energy and highly efficient buildings and equipment. The effectiveness of codes and standards will be enhanced by improved code compliance as well as coordinated voluntary efficiency activities.

The ambitious goals of this *Plan* as well as greenhouse gas imperatives place an unprecedented reliance on mandatory codes and standards—both on energy codes for new and renovated buildings and on efficiency standards for appliances and equipment—and pressure for them to perform.

PROFILE

There is no policy tool more essential for the widespread and persistent transformation of energy performance in California than energy codes and standards. For thirty years, California has aggressively and successfully used its two principal frameworks for regulating minimum energy performance—Title 24 building energy codes and Title 20 appliance standards[58]—to cost-effectively reduce the energy consumption of commercial buildings, homes, and appliances. The effectiveness of energy codes and standards is beyond debate—the Energy Commission's 2007 Integrated Energy Policy Report[59] finds that: "California's building and appliance standards have saved consumers more than $56 billion in electricity and natural gas costs since 1978 and averted building 15 large power plants. It is estimated the current standards will save an additional $23 billion by 2013."

The appeal of codes and standards for promoting energy efficiency is simple: they make better energy performance mandatory, and not just for early adopters or self-selected consumers but for all users of regulated products and structures.

Codes and standards' impact, while enormous, can be enhanced and made even more successful and cost-effective if they are:

- Capturing a wide range of economically viable technologies and building practices, including integrated DSM approaches.
- Coordinated with non-regulatory market transformation efforts, such as utility incentives and rebates, Energy Star and other benchmarking programs, and builder and consumer education efforts that pave the way for successive strengthening of codes and standards.
- Optimized with other regulations, especially Federal efficiency standards, non-California State efficiency standards, AB 32, ambient air quality

rules and local government development policies.

- Applied more comprehensively to end uses, including plug loads and building operations.
- Supported by better enforcement and compliance at local levels.
- Reliant on more sophisticated design principles and analytics regarding whole buildings and measures.
- Encouraging of building industry players to design or manufacture new energy solutions

7.3 GOALS

Goal		Goal Results
1. Continually strengthen and expand building and appliance codes and standards as market experience reveals greater efficiency opportunities and compelling economic benefits.	➡	California's codes and standards will support this *Plan's* residential, commercial, and HVAC sector goals.
2. Dramatically improve code compliance and enforcement.	➡	Energy savings from codes and standards will be fully realized.

7.4 STRATEGIES

The Energy Commission re-visits and tightens Title 24 energy efficiency codes on a triennial basis. However, the scale of the goals and challenges at hand—including that of putting all new commercial buildings on a path to zero net energy by 2030, and meeting AB 32's emission reduction targets—prompts an accelerated strategy to make the codes more stringent and cover more end uses and measures.

The strategies described below pursue both sides of the codes and standards coin: they develop enhanced regulations "on paper;" and they improve their real world effectiveness, cost-effectiveness, and compliance. Although the strategies place greater emphasis on building codes than on appliance/equipment standards—as the former are principally regulated at the State level and the latter principally at the Federal level—there is nonetheless a tremendous opportunity for appliance regulation to increase energy savings.

The Energy Commission is a key leader in this effort, along with the California Building Standards Commission. The Federal government, utilities, research organizations (Energy Commission-PIER, national labs), trade and professional licensing/registration agencies, the building/developer/contractor/ manufacturers industry and realtors must work cooperatively to develop common goals and provide the technical support for this effort.

These strategies are intentionally presented at a high level in this Chapter. The Residential, Commercial and HVAC Chapters provide greater detail on codes and standards goals and strategies applicable to those sectors

7.5 IMPLEMENTATION PLAN

There is a de facto symbiotic relationship between more stringent codes and standards and improvements in technology, products and practices (the former prods the latter, while the latter helps allow the former) that will need to strengthen and accelerate in the coming years.

More than most other efficiency policy areas, codes and standards demand coordination with other efforts and parties—from regulators to the regulated—to be optimal. Both the Energy Commission and the IOUs have played a major role in coordination, and must be committed to

playing an even larger role in the future to support and/or facilitate future efforts. Such coordination has two major components: one, coordinating with other relevant governmental regulations; and two, coordinating with relevant programs, incentives, market dynamics, research and other non-regulatory initiatives.

Many other governmental entities can impact the effectiveness of California's codes and standards. For example, the Federal government (i.e., DOE) has primary responsibility for appliance/equipment standards. Local governments play an important role, both in the enforcement of Title 24 for building construction and renovation and in the development of local "reach" codes that can serve as pilots for statewide codes. California's newly-adopted Green Building Standards along with San Francisco and Los Angeles' recent Green Building Ordinances, referenced earlier, represent recent "beyond code" efforts. These important efforts serve to continually "raise the bar" for California's statewide standards. Coordination among such "reach" codes and the statewide efforts, as well as among non-governmental building rating and certification systems frequently embraced by local government development policies, is critical.

Coordination with other programs and laws is also critical. Codes and standards are more focused on eliminating inefficient products and practices than on developing or popularizing new highly efficient ones. Accordingly, codes and standards should be coordinated with public and private efficiency programs that develop and commercialize new products and building design solutions.

While efforts to leverage efficiency investments at times of sale and/or major retrofit labeling or other requirements provide important opportunities for efficiency gains, excessive "trigger" requirements can serve as a disincentive to undertaking beneficial investments. Interagency collaboration is needed to identify solutions to such challenges and develop and prioritize action paths towards California's energy and GHG goals.

Goal 1: Code Enhancement and Expansion

Implementation Plan and Timeline				
Strategies	**Near-Term (2009-2011)**	**Mid-Term (2012-2015)**	**Long-Term (2016-2020)**	**2021 – Beyond**
1.1: Develop a phased and accelerated approach to more stringent codes and standards.	• Adopt a progressive set of building codes; including one or two voluntary "reach" code tiers for residential and commercial sectors. • Lower the renovation threshold at which the code applies to an entire existing structure • Identify local code or ordinance opportunities as pilots or where local conditions may support accelerated action.	• Develop road map for accelerating Title 20 standards and Title 24 codes in a "top-down" approach • Increase use of building commissioning requirements for new buildings and retrofits. • Identify analysis, case study, R&D, and other activities necessary to support progressive strengthening of codes and standards.	• Develop "reach" codes for buildings as "net producers" of energy (ZNE). • Codes and Standards require net zero residential buildings by 2020.	• Codes and Standards require net zero commercial buildings by 2030.

Implementation Plan and Timeline				
Strategies	**Near-Term (2009-2011)**	**Mid-Term (2012-2015)**	**Long-Term (2016-2020)**	**2021 – Beyond**
1.2: Expand Titles 24 and 20 to address all significant energy end uses	• Expand Title 20 to cover additional plug loads such as copy machines, printers, battery chargers, televisions. • Enhance Title 24 to include whole building approaches including metering and data management; automated diagnostic systems; and sub-metering for tenant-occupied space. • Pursue greater alignment of national and localized green building codes with energy codes. • Integrate AB 32 standards with energy efficiency goals.	• Expand Title 20 and Title 24 to cover additional uses such as server farms, process loads and water use. • Develop building standards to better integrate on-site clean distributed generation. • Investigate establishing energy and green building codes on a community and/or city level that may include infrastructure issues such as transportation, wastewater treatment, solid waste disposal.	• Investigate expansion of Titles 24 and 20 to address all significant energy end uses (manufacturing, agricultural, healthcare, etc.). • Evaluate including land development in energy standards and regulations.	• Continue to develop and refine approaches from experience.
1-3: Improve code research and analysis.	• Conduct analysis that will help the code move toward a zero-based approach. • Analyze approaches for whole buildings, non-covered end uses and measures that are not currently credited by Title 24. • Conduct tests and evaluations of potential code change measures. • Increase research and analysis regarding how behavior affects use of buildings and code compliance. • Evaluate and develop appropriate approaches to include DR standards in C&S. • Continue exploration and adoption of improved building energy simulation and compliance tools.	• Continue research to improve program impact and processes. • Conduct analysis of embedded energy savings with transportation, wastewater, and solid waste options for green building standards. • Investigate the balance between mandatory, prescriptive, and beyond-code "reach" standards to achieve more effective codes, greater compliance rates, and more innovation in the marketplace.	• Continue research. • Conduct research on revising and updating the cost-effectiveness, including the potential for using non-energy benefits as a component of cost effectiveness.	• Continue research based on promising next steps.
1-4: Improve coordination of State energy codes and standards with other state and Federal regulations.	• Continue to develop appliance standards to influence the market prior to preemption by DOE. • Coordinate Title 24 goals with 1992 Energy Policy Act requirements for meeting/exceeding Federal code. • Coordinate development and adoption of California Green Building Standards with Title 20/24 and ASHRAE Standard 189, CHPS.	• Coordinate development of related codes and standards such as the California Green Building Standards, ASHRAE 90.1 and 189.1, ICC, CHPS, etc. • Coordinate/support implementation of legislation impacting C&S program such as AB 32. • Coordinate development of codes and standards with State and voluntary programs such as Energy Star, LEED, Flex Your Power, etc.	• Pursue remaining priorities as identified.	• Pursue remaining priorities as identified

Implementation Plan and Timeline				
Strategies	**Near-Term (2009-2011)**	**Mid-Term (2012-2015)**	**Long-Term (2016-2020)**	**2021 – Beyond**
1-5: Improve coordination of energy codes and standards with utility programs.	• Develop and implement plan for enhanced coordination and integration of codes and standards with full spectrum of EE market transformation, including Emerging Technologies promotion, deployment, incentives, consumer education, etc.	• Investigate ways to integrate C&S with other DSM by offering tiered incentives (financial and other) and technical assistance for more comprehensive and inclusive definitions of codes and standards.	• Investigate a greater convergence of the C&S and other DSM through non-code mechanisms and utility program integration.	• Investigate the integration of utility infrastructure planning with potential community-based codes.

Goal 2: Improve code compliance and enforcement.

Compliance with California's efficiency codes and standards varies enormously, especially with respect to building codes. For example, fewer than 10 percent of HVAC systems installed have permits pulled and 30-50 percent of new central air conditioning systems are not being installed properly. This compliance failure comes at considerable cost to Californians—the HVAC compliance shortcomings have led to an estimated 20-30 percent increase in the peak energy needed on hot summer afternoons.[60] It has been estimated that at least 30 percent of the technical energy savings potential of energy codes is lost due to non-compliance—but in reality there is inadequate understanding of code compliance rates or the resulting degradation in performance.[61]

This strategy will require a strong, coordinated effort among Federal, State and local entities, the utilities, California building officials (and their association, CALBO) and other code compliance organizations, trade and professional licensing/ registration agencies, and building/developer/ contractor/ manufacturers associations.

Goal 2: Compliance and Enforcement

Implementation Plan and Timeline				
Strategies	**Near-Term (2009-2011)**	**Mid-Term (2012-2015)**	**Long Term (2016-2020)**	**2021 – Beyond**
2-1: Improve code compliance and enforcement.	• Conduct research to determine high-priority tactical solutions for code compliance and focus efforts accordingly. • Increase training and support for local building code officials. • Investigate regulatory tools such as licensing/ registration enforcement. • Evaluate proposed changes to the code and compliance approaches to simplify and expedite compliance. • Work with local governments to improve code compliance, adopt above code ordinances, and provide training/education.	• Continue to conduct further research relating to code compliance. Refocus efforts as needed. • Pursue appropriate involvement of HERS raters. • Pursue trade associations to improve "self-policing" of membership. • Investigate tools, software programs, "incentives", and policies to simplify and streamline permit process. • Apply feasible mechanisms to prove code compliance as a pre-requisite for partnership funding or incentives from the IOUs.	• Continue to conduct research. • Investigate aggressive "stick" and "carrot" programs with monetary penalties and incentives. • Investigate greatest opportunities of compliance improvement of appliances (Title 20) in the upstream and midstream markets, including working directly with manufacturers and distributors to improve appliance and equipment compliance.	• Continue to conduct research. Investigate and pursue solutions to the perceived and real "penalties" associated with non-compliance. • Investigate codes and standards that would regulate the operation of buildings that may include such things as maintenance requirements, regular updates to operating schedules, mandatory monitoring and controls points, system reporting requirements, etc.

8. DSM COORDINATION AND INTEGRATION

8.1 VISION

Energy efficiency, energy conservation, demand response, advanced metering, and distributed generation technologies are offered as elements of an integrated solution that supports energy and carbon reduction goals immediately, and eventually water and other resource conservation goals in the future.

8.2 PROFILE

Historically, demand side management (DSM) options for energy consumers have been ”siloed” activities within regulatory bodies, utilities, environmental organizations, and among private sector service providers. The programs are focused on mass delivery and promotion of individual products, for example efficient air conditioners, rather than on integrated packages of measures, for example, air conditioner rebates with duct sealing, weather-stripping, programmable thermostats, and advanced meters. This current narrow focus on a single product offering does not maximize energy savings nor minimize the costs of program delivery.

A narrow, single-product approach also results in customer confusion by requiring the customer to seek out information on a wide array of different programs with multiple points of contact in order to acquire a basic understanding of the DSM options available and the various benefits they offer. Most energy users across all economic sectors do not have the time or expertise to seek this information; as a result, many opportunities to accomplish DSM actions are lost.

At the CPUC, a number of individual proceedings relate to DSM, including energy efficiency, demand response, advanced metering, combined heat and power/distributed generation, and the California Solar Initiative (CSI), in addition to an upcoming Smart Grid rulemaking.[62] The CPUC should integrate the DSM programs within its jurisdiction – including the harmonization of cost-effectiveness methodologies and metrics – in order to enable offerings of integrated packages that will maximize savings and efficiencies of utility program overhead.

The development of Smart Grid technologies that enable active, real-time energy management in homes and businesses also will play a critical role in the packaging of integrated DSM services. A recent report by IBM, *Plugging in the Consumer*, demonstrates that we are poised for the uptake of advanced energy management systems.[63] Activities to plan for Smart Grid integration are underway in a number of venues, including on-going R&D at the CEC[64], and the upcoming Smart Grid rulemaking at the CPUC. These efforts will lead to deployment of new grid and metering technologies. These, in turn, will help to optimize energy system performance, and encourage behavioral changes in energy use.

The goal of this *Plan* is to build on successes from initial efforts such as PG&E’s Market Integrated DSM Initiative and the SCE and Sempra Sustainable Communities Initiative to offer integrated DSM solutions to maximize energy savings. A related goal is to design policies and programs in research and development, commercialization, deployment, and codes and standards that reinforce each other and use feedback loops to constantly improve energy efficiency programs.

8.3 GOAL

Goal		Goal Results
Deliver integrated DSM options that include efficiency, demand response, energy management and self generation measures, through coordinated marketing and regulatory integration.	➡	Customers realize increased energy savings at lower cost through the implementation of a menu of DSM options.

There are three levels of integration for DSM options:

- **Comprehensive and Coordinated Marketing**: Outreach and consumer education, and DSM program options must be offered in a unified fashion so that energy users receive complete DSM information with minimum effort , preferably through single points of contact.
- **Program Delivery Coordination**: Combined DSM audits and recommendations across all relevant energy management opportunities will be offered to customers, including advice on energy efficiency, demand response, distributed generation, Permanent Load Shifting (PLS), solar rebates, and other applicable measures.
- **Technology and Systems Integration**: This includes equipment and information systems that enable achievement of multiple DSM options (energy efficiency, demand response, etc.) and synergies across DSM program types (e.g., addressable electronic ballasts that both save energy and manage demand during utility peak hours).

Integrated packages of DSM solutions are a consistent theme throughout each of the Chapters in this *Plan*. This Chapter describes augmented, not duplicate, strategies described elsewhere.

8.4 STRATEGIES

This *Plan* contains four overarching strategies for DSM integration:

1. **Pilot Programs**: The best short-term path to promote integration is to continue successful efforts by the IOUs and pursue an expanded series of pilot projects as part of the IOUs' efficiency and demand response 2009-2011 portfolios. These pilots will (a) be designed to inform future program and policy submissions regarding the value and best methods and targets of integration, (b) offer a bundled product that includes elements of energy efficiency and conservation, consumer generation, demand response, and the best available AMI technology and, (c) offer different forms of delivery (including third-party and local government platforms) and information access.
2. **Stakeholder Coordination**: For the longer term, the CPUC will work with key stakeholders to develop and implement a comprehensive, coordinated long-term approach to effective utilization of energy resources while also achieving GHG emissions reductions, water conservation, waste disposal, and air quality requirements.
3. **New Technology**: Technology is a fundamental element in achieving the CPUC's Big/ Bold Strategies and maximizing the contribution of energy efficiency in meeting the State's energy and environmental goals. A major effort is needed to develop new technologies and systems that enable multiple DSM options and provide synergy across DSM program types. The CPUC has already approved installation of AMI throughout IOU service areas and will soon initiate a Smart Grid proceeding which will likely spur development of new, integrated DSM technologies.

4. **Coordinated DSM Marketing**: Coordinated marketing will be an essential component in achieving greater up-take of integrated DSM programs. "Smart meter" systems and associated dynamic pricing tariffs also are important tools for customers to monitor and reduce their energy consumption. The majority of these systems will be deployed statewide during 2009-2011. This present a unique near-term opportunity to promote integrated demand-side management programs. Program administrators should streamline and integrate the marketing of DSM programs in conjunction with smart meter deployment.

8.5 IMPLEMENTATION PLAN

Historically, resource efficiency messages, programs, and initiatives have been promoted as separate and largely independent activities. Energy, air quality, water, and waste regulations are under the jurisdictions of separate agencies and commissions. It is critical to develop a shared vision and process for regulatory coordination in California to support the energy savings benefits of DSM coordination/integration and to ensure consistent and mutually supportive energy, water, air, and GHG policy and regulations. Enhancing utility programs, technology advancement and general education and training objectives depends on coordinated regulation and voluntary efforts across the spectrum of DSM activities. In addition, the implementation of AB 32 will require additional coordination by all agencies to achieve a common goal.

Achieving this vision will require new forms of government agency collaboration, mechanisms to quantify and value multiple resource benefits, and fundamental changes to the standard business and service delivery practices of utilities, energy service companies and building contractors.

Goal: Integrated DSM Programs, Messages, and Technologies

Implementation Plan and Timeline			
Strategies	**Near-Term (2009-2011)**	**Mid-Term (2012-2015)**	**Long Term (2016-2020)**
1.1: Carry out integrated marketing of DSM opportunities across all customer classes.	• IOUs adopt marketing integration plans, by sector • Streamline and integrate EE, DR, and DG program outreach • Coordinate integrated marketing with AMI deployment • Offer audits and technical assistance that address combined DSM opportunities	• Continue integrated marketing through AMI full deployment • Leverage lessons learned to other general marketing materials	• Incorporate output of other integration strategies and pilot programs into marketing materials
1-2: Conduct integrated DSM delivery *pilots* in the Residential, Commercial, Industrial and Agricultural sectors.	Propose and launch program delivery pilots testing capabilities and effectiveness in the marketplace, including EE, DR, AMI and DG	• Apply lessons from pilots to full scale implementation • Develop new pilots "smart buildings", building operator training, and solar PV and hot water.	• Expand successful activities statewide
1.3: Develop *integrated* DSM programs across resources, including energy, water, and transportation.	• Establish on-going working group to develop and implement blueprint for integration.	• Implement pilot programs that integrate solutions across resources.	• Expand successful approaches.
1.4: Promote development and support of new technologies that enable or facilitate DSM Coordination and Integration	• Assess the current state of integration-enabling technology and develop a guidance document detailing a technology development path for fuller integration. (2009) • Prioritize integration-enabling technologies in RD&D and ET programs based on the technology assessment.	• Update biennially.	• Update biennially.

9. WORKFORCE EDUCATION AND TRAINING

9.1 VISION

By 2020, California's workforce is trained and fully engaged to provide the human capital necessary to achieve California's economic energy efficiency and demand-side management potential.

9.2 PROFILE

Workforce Education and Training (WE&T) focuses on educating and training people to perform the jobs needed to reach California's clean energy goals. The IOUs currently provide efficiency-specific training and education courses to fulfill needs associated with implementing IOU programs; efficiency-specific course materials; training for third-party program implementers; and energy efficiency and sustainability curricula at K-12 schools.

In order to accommodate the dramatic increase in energy efficiency activities envisioned by this *Plan* and required by AB 32, California must develop a trained workforce, including people qualified in energy-efficiency engineering, construction, maintenance, program design and implementation, and financial analysis. Meeting the goals established in the *Plan* will require at least two categories of personnel development: completely new types of jobs that do not exist today (e.g., corporate emissions manager) and supplemental training for existing positions (e.g., training engineers to enhance energy efficiency).

This cross-cutting sector demands a truly statewide coordination effort that integrates energy efficiency training into a wide range of public and private programs. This effort will include the California Department of Education, the Department of Employment Development, industry and labor associations, educational institutions at all levels, technical and vocational training organizations, community based non-profit organizations, and the business community.

9.3 GOALS

Goals		Goal Results
1. Establish energy efficiency education and training at all levels of California's educational systems.	➡	Students develop careers and existing workers develop skills and knowledge that advance DSM businesses, policy, research and development, and education.
2. Ensure that minority, low income and disadvantaged communities fully participate in training and education programs at all levels of the DSM and energy efficiency industry.	➡	Individuals from the targeted communities take advantage of programs that specialize in energy disciplines at all levels of the educational system and successfully advance themselves into rewarding careers in the energy services fields.

9.4 STRATEGIES

An effective, comprehensive WE&T program for a new energy efficient economy requires collaborative efforts by many entities. It is not the core mission of utilities to effectuate the level of change needed to create a comprehensive WE&T program, nor can ratepayers fully fund the effort. In addition to the educational institutions themselves, participants in defining and/or providing energy efficiency WE&T resources include:

- **Government.** California Department of Education and the Department of Employment Development, Federal government (e.g., Department of Labor), specialized State agencies (e.g., licensing boards) and local governments (e.g., building departments) to recruit train and prepare workforce candidates for technical and professional careers.
- **Educational Institutions.** The University of California, the California State University, community colleges, school districts and private colleges, universities, and technical schools.
- **Community-based and non-profit organizations.** Organizations funded to provide education, career development and workforce training programs (i.e., Greenlining Institute, Apollo Alliance).
- **Industry and labor organizations.** Trade unions, the Sheet Metal and Air Conditioning Contractors' National Association, the California Building Performance Contractors Association, home rating organizations, and energy efficiency associations.

Several strategies must be initiated or completed in the near term to more thoroughly define, initiate and drive long-term WE&T development and strategic planning.

1. **WE&T Needs Assessment**. An in-depth formal statewide training and education resource inventory and needs assessment is necessary for long-range strategic planning and delivery. The needs assessment and resource inventory will be structured to produce short-, near- and long-term workforce strategies to support each sector defined in the *Plan*. Information in the WE&T Convener Report[65] provides an excellent start for the assessment. The assessment will be completed by a third-party with its process managed by the CPUC and IOUs, in collaboration with the California Department of Education.
2. **WE&T Web Portal.** The web portal will include links to various demand-side management (DSM) related training programs and will allow for a single point of communication. The portal will also serve as a repository for all demand-side management and energy efficiency training, educational conferences, and career opportunities. This portal will be created and funded in collaboration with other appropriate entities, and linked to the statewide energy efficiency web portal.
3. **Energy Efficiency WE&T Task Force.** The Task Force, comprised of energy efficiency program administrators, the CPUC, and educational experts, will fulfill administrative functions including: developing a needs assessment RFP; selecting the third party to conduct the needs assessment; and managing the needs assessment evaluation. The Task Force members will continue to help implement the goals and strategies set forth in this *Plan.*
4. **Identify And Implement Specific Programs For Each Educational Sector.** WE&T needs are best organized and approached by identifying the enabling or supporting educational sectors. Thus, five educational sectors have been defined for addressing WE&T needs and opportunities: Kindergarten through high school, adult education and community colleges, technical training, colleges and universities, and minority, low income and disadvantaged communities.

These actions will also support development of funding streams other than ratepayer funding, identify market sector specific needs, and inform short-term actions to initiate longer-term strategies for each market and educational sector.

WE&T measures that are specific to particular industries or economic sectors are included in the appropriate Chapters of this *Plan*. For example, the HVAC Chapter addresses training for technicians and installers and building code officials. Similarly, the Commercial Chapter contains a strategy for expanded building operator certification training and integrated training of architects and engineers for the design of zero net energy buildings. This Chapter focuses on cross-cutting workforce development measures.

9.5 IMPLEMENTATION PLAN

Goal 1. Establish energy efficiency education and training at all levels of California's educational system.

This *Plan* envisions that the IOUs will act as a catalyst to action by sponsoring several foundational activities that are necessary to accurately identify specific WE&T needs and recommendations for action. These activities will also enable the IOUs to review their existing programs and better align them within the context of a comprehensive WE&T strategy.

The most critical near term activity is a comprehensive needs assessment to evaluate energy efficiency workforce requirements through 2020 that are necessary to sustain a robust and effective industry to accomplish the goals set forth in this *Plan*. This needs assessment will solicit broad input from organizations identified above.

Goal 1: Energy Efficiency Education and Training

Implementation Plan and Timeline			
Key Actions	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Define, initiate and drive long-term WE&T development and strategic planning, including identification of funding streams and market sector specific needs.	• Conduct an in-depth formal statewide energy efficiency training and education resource inventory and needs assessment. • Assess current and alternative funding mechanisms for WE&T activities. • Create a WE&T-specific web portal and identify entities to co-fund and co-sponsor the web portal with utilities. • Initiate on-going dialogue with broad group of market participant and education stakeholders to inform the overall plan. • Establish task force to oversee utility specific WE&T activities.	• Update assessment as needed. • Maintain and update web portal. • Maintain ongoing dialogue with actors positioned to lead priority educational and workforce development initiatives. • Continue to oversee utility specific WE&T activities.	• Update assessment as needed. • Maintain and update web portal. • Maintain ongoing dialogue. • Continue to oversee utility specific WE&T activities.

Implementation Plan and Timeline			
Key Actions	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-2: Support the community college and adult education efforts to support students to develop their education based on visible career paths in energy efficiency and related fields.	• Utilize community colleges to provide technical training such as HVAC maintenance and building operator certification. • Develop appropriate linkages with K-12 programs. • Coordinate with the community colleges and adult education sector to incorporate an energy component into their career laddering concept.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and funding and placement partnerships.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.
1-3: Incorporate energy efficiency and demand side energy management into traditional contractor and technician training, such as for plumbers and electricians, and expand training resources to produce target numbers of trained workers.	• Expand or establish training curricula, and training and professional career development programs in building construction, services, building operator and other energy efficiency technical fields. • Establish or expand key financial and placement partnerships that demonstrate employment prospects for trained personnel.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.
1-4: Create or expand college and university programs with energy efficiency focus and foster green campus efforts to apply this knowledge in clear view of students and faculty.	• Utilize existing UC/CSU extension programs to incorporate a continuing education curriculum component. • Work with Universities and colleges to expand professional energy related degree offerings and contribute to tailored curriculum.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.
1-5: Develop K-12 curriculum to include energy efficiency fundamentals (e.g. math, science, behavior) and identify career options in energy-related fields.	• Identify opportunities to leverage governor's career technical initiative. • Identify opportunities to work with the California Department of Education to develop curricula with specific content for energy and GHG issues. • Support outreach into K-12 schools on energy, water and environmental issues.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.

Goal 2: Ensure that minority, low income and disadvantaged communities fully participate in training and education programs at all levels of the DSM and the energy efficiency industry.

Coordination of LIEE workforce training with other energy efficiency training programs is essential. This includes coordination with The Green Jobs Act of 2007 as well as with existing programs associated with State agencies such as the Employment Development Department (EDD) and the Department of Social Services (DSS). The Green Jobs Act of 2007, approved as part of the recent Federal Energy Bill, authorizes funding up to $125 million annually for job training in the energy efficiency and renewable energy industries and facilitates economic development within minority, low-income, and economically disadvantaged communities. The IOUs will work to coordinate both the federally-supported training to be offered under this Act, as well as other State employment training resources, with the LIEE workforce training. Recruiting for trainees may be accomplished within the targeted communities served by LIEE contractors. This coordination should expand employment options for those in disadvantaged communities beyond the LIEE program itself. Finally, as new legislation is adopted and AB 32 begins implementation, additional funding and programs from those activities need to be leveraged to the advantage of the energy efficiency WE&T effort.

Goal 2: Disadvantaged Communities

Implementation Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-1: Collaboratively identify appropriate goals and strategies to build California's energy efficiency workforce through 2020, focusing on training that increases participation from within minority, low-income and disadvantaged communities in achieving California's economic energy efficiency potential.	• Leverage Marketing Education & Outreach and WE&T task forces to partner w/ community-based organizations and provide targeted outreach on employment opportunities with energy efficiency. • Develop Low Income WE&T Plan • Train qualified diverse business enterprises from minority, low-income and disadvantaged communities to undertake or expand efficiency services.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships.	• Implement programs. • Evaluate progress and refine strategy. • Find opportunities to expand programs and partnerships

10. MARKETING, EDUCATION AND OUTREACH

10. 1 VISION

Californians will be engaged as partners in the state's energy efficiency, demand-side management and clean energy efforts by becoming fully informed of the importance of energy efficiency and their opportunities to act.

10.2 PROFILE

The purpose of Marketing, Education and Outreach (ME&O) is to increase consumer awareness and participation in demand side management activities and to encourage behavior changes that save energy, reduce greenhouse gas emissions, and support clean energy solutions. A highly successful ME&O program is a fundamental part of many of the strategies and programs presented in this *Plan* as well as the overarching goals of behavior and market transformation for energy efficiency. A successful ME&O must move consumers through a transitional process from awareness, to attitude change, to action.

Californians are currently engaged in a broad public discussion about energy use and its relationship to global warming and the environment. AB 32 set the stage for a statewide transition to a clean energy future by requiring the reduction of greenhouse gas emissions to 1990 levels by 2020. Across numerous studies, energy efficiency strategies consistently are identified as uniquely able to significantly reduce GHG emissions and do so with a net economic savings. As a result, there is increased awareness of the value of energy efficiency and interest among consumers and businesses to do their part. This discussion presents a strategic window of opportunity to use ratepayer-funded ME&O to leverage public and private messages on global warming to achieve greater impact on consumer awareness of, and demand for, energy efficiency actions.

Between 2006 and 2008, California IOU ratepayers will have funded approximately $300 million for public education, marketing, and outreach to support customer demand-side programs. Of this amount, $176 million funds public education and outreach for IOU energy efficiency programs.[66]

The majority of these outreach efforts have focused primarily on promoting isolated consumer actions, such as buying energy efficient clothes washers or compact fluorescent light bulbs, or reducing usage to prevent outages during peak periods. By and large, ME&O messages have lacked the comprehensive focus necessary to engage consumers in adopting energy efficiency broadly as a way of life. While messaging that differentiates program and service area issues will remain an important aspect of overall ME&O efforts, the launch of a coherent statewide campaign will be instrumental in bringing consumer awareness of the value of energy efficiency to the next level. Accordingly, it is a top-level priority for the next round of efficiency investment.

The CPUC's Decision 07-10-032 directed that the current approach be changed significantly, under Commission direction and oversight, beginning in 2009 in order to better leverage ratepayer ME&O funding for more effective results.

10.3 GOALS

Goal		Goal Results
Create and launch an integrated, statewide Marketing, Education and Outreach effort for energy efficiency, including an energy efficiency brand.	➡	High levels of awareness statewide of the value of energy efficiency that leads to strong demand for energy efficient products, homes and services.

The ME&O effort will:

- Create instant brand recognition for energy efficiency in California, similar to the US EPA's EnergyStar label, and expanded to reflect GHG benefits.
- Utilize appropriate channels to create effective "demand pull" for efficiency actions that are necessary for achieving the goals set forth elsewhere in this *Plan*.
- Motivate consumers to reduce energy consumption on a daily basis.

10.4 STRATEGIES

The ME&O goal will be achieved through four strategies:

1. **An Energy Efficiency Brand:** Creation of an instantly recognized brand for "California Energy Efficiency" with clear delineation of what the brand encompasses, including reducing GHG.
2. **Integrated Marketing**: Development of marketing messages that offer bundles of DSM programs targeted to specific customer groups and delivery of effective messages using partnerships with a range of energy efficiency participants, including local governments, retailers and manufacturers.
3. **Social Marketing:** Use of social marketing techniques to create emotional and intellectual drivers for consumers to make a commitment to change and participate in energy efficiency.
4. **Internet-Based Networking:** Creation of a web portal that allows energy efficiency practitioners and consumers to exchange information and solutions on implementing energy efficiency programs and measures.

The key to the next generation of ME&O is to create a consumer experience that offers an integrated set of DSM information and program options that are clear, relevant to the consumer, and accessible to all Californians. By beginning with a systematic approach to branding energy efficiency that is rooted in effective message research, evaluation, social marketing, behavioral science, and targeted segmentation, California will lay a framework for successful integration of ME&O across all clean energy programs. Under Commission direction and oversight, a statewide brand will establish a clear, consistent message about the individual and social value of energy efficiency, and set a foundation for consumers to receive targeted information on efficiency programs, products, and incentives. Next, segmentation research will be used to develop a wide range of appropriate messages designed to build on the brand and connect with specific groups of consumers, including low income and other hard to reach populations. Additional highly-targeted program marketing efforts will be conducted that focus on consumer segments with the highest propensity to participate in clean energy programs in order

to create a strong base of early adopters. These efforts will use multiple channels and leverage strategic partners across the spectrum. All messages will be components of an integrated marketing strategy that will provide consumers with an increased understanding of the full array of energy efficiency and DSM options.

California's businesses and educational institutions (public and private) with excellent channels to further leverage energy efficiency messaging and create the next generation of energy ambassadors. The statewide ME&O effort will work with both sectors to leverage their resources and utilize them fully in the statewide campaigns.

The Internet offers powerful, cost-effective opportunities as a clearinghouse for energy efficiency programs and promoting behavior change. As required by D.07-10-032, the ME&O effort will include development of an interactive Energy Efficiency Web Portal that provides one integrated point of access to a multitude of energy efficiency information. The web portal will be a user-centered, interactive resource that allows users to easily navigate multiple points of data, applications, and information systems.[67]

The portal will have two development stages and functions. The first stage will be a website for energy efficiency professionals such as program designers, implementation practitioners, evaluators, marketers, and policy makers to share information and best practices on implementing energy efficiency measures, policies and programs. The second stage will be development of an online resource for individual consumers (and businesses) that provides easy access to information on products, programs, services, practices and tools to manage their energy usage. This consumer web platform will be designed to facilitate peer-to-peer information exchange.

Peer-to-peer and word-of-mouth contact are proven modes of information exchange that heighten motivation for action. The ME&O effort will maximize these and other social marketing techniques to motivate consumers and achieve goals for changes in energy use behaviors, attitudes and perceptions. The practice of energy efficiency requires a sustained effort on the part of the consumer, both in information acquisition (i.e., what are the most effective efficiency methods and techniques) and in implementation and ongoing practice. Therefore, an approach based on increased access to information and behavior-based marketing techniques will both educate *and* inspire consumers to make a long-term change in how they think about and use energy.

For all of these strategies to be effective, clear objectives and metrics for the statewide campaign will be established prior to its launch, including an appropriate evaluation mechanism to measure results. The ME&O Task Force will continue to function in an advisory capacity, leveraging inputs and expertise from key stakeholders whose contributions collectively are vital to the successful implementation of the goals and strategies envisioned in this *Plan*. The CPUC will guide the process for developing and implementing the ME&O effort and integrating strategic adjustments and improvements over time to ensure the achievement of goals and benchmarks.

The result of these efforts will be a coordinated, comprehensive system of communicating with Californians and delivering an array of effective messages and valuable information resources. This system will prove essential for engaging the public to help achieve California's aggressive energy efficiency goals and global warming solutions.

Goal 1: Comprehensive ME&O Effort

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid-Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Establish a recognizable and trustworthy brand for California's Energy Efficiency and other DSM consumer products and services.	• Research appropriate look and meaning of a California efficiency/ GHG reduction Brand • Launch integrated energy efficiency/DSM Brand. • Evaluate progress and refine strategy.	• Evaluate progress and refine strategy.	• Evaluate progress and refine strategy.
1-2: Develop an integrated marketing plan for all Californians.	• Conduct statewide segmentation research, including LIEE and other hard to reach groups, on interests, awareness, and attitudes/perceptions related to energy efficiency and global warming messaging. • Establish objectives and metrics for public campaign • Develop targeted and highly relevant energy efficiency and DSM marketing messages to incite behavior change/action. • Create partnerships with private industry and businesses to help motivate consumer and business sector action. • Define deliverables for each strategy	• Evaluate progress and refine segmentation research.	• Evaluate progress and refine segmentation research.
1-3: Use social marketing techniques to build awareness and change consumer attitudes and perceptions.	• Develop a roadmap for a social marketing approach including exploration of behavioral science principles.	• Implement social marketing approach. • Establish partnerships with community, social, and other institutions and networks to convey the action messages	• Evaluate progress and refine strategy
1-4: Develop a California Energy Efficiency web portal with statewide Information on GHG reductions, efficiency and DSM awareness and options.	• Develop initial website/portal for the energy efficiency/DSM industry. • Begin pilot programs in using web portal.	• Add consumer and business end use function to website/portal.	• Evaluate progress and refine strategy.
1-5: Conduct public communications campaigns, alongside longer-term supporting school education initiatives to deliver the efficiency message	• Implement integrated public communications and marketing campaigns. • Identify or develop curriculum for K-12 education, and work with State Board of Education to integrate into State requirements.	• Refine campaign based on ongoing research and evaluation insights (above) • Initiate K-12 curriculum in initial locations • Evaluate and refine, as appropriate	• Continue to refine and deliver public communication campaign to support targeted actions • Expand K-12 curriculum applications statewide and further integrate into State curriculum requirements

11. RESEARCH AND TECHNOLOGY

11. 1 VISION

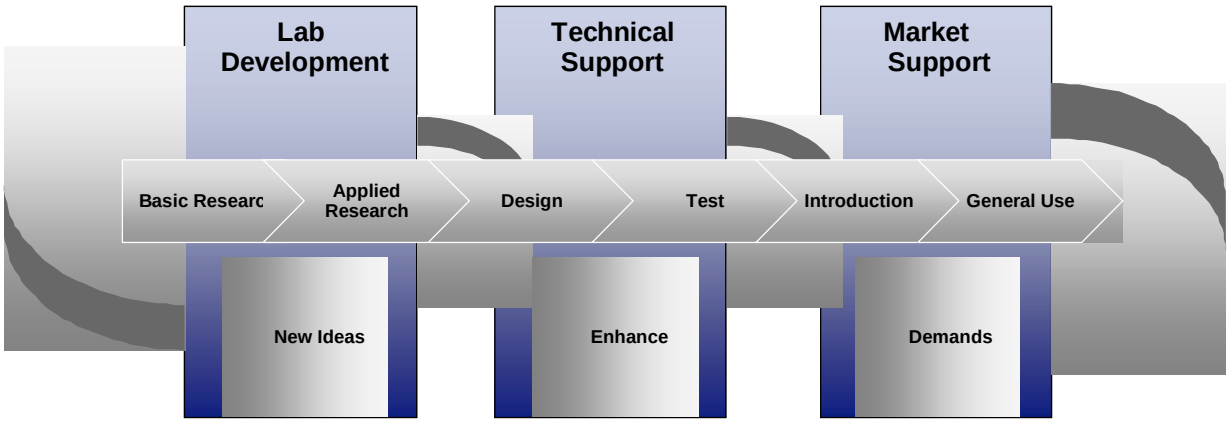
Technology advancement related to energy use and demand will match—or even eclipse— the consumer electronics industry in innovation, time to market, and consumer acceptance.

11.2 PROFILE

The development, enhancement, deployment, and operation of more and better energy efficiency related technology is fundamental to achieving California's energy efficiency vision and goals. The time frame of California's goals demands a targeted focus on moving innovative technologies more quickly into the marketplace. Since most demand-side technologies involve a human interface, increased knowledge of human behavior and social science is also necessary—as is the infusion of that knowledge into technology development, deployment, and integration. Finally, establishing a robust and vibrant evaluation and user feedback loop is crucial to advancing technology development.

Technology progresses along a continuum from basic research to general use, as suggested by the graphic below.[68] The advancement process comprises several stages and is not strictly linear. It also includes several feedback loops, restarts and early terminations.

Technology Advancement Continuum



Historically, the Energy Commission's Public Interest Energy Research (PIER) program has funded technology development primarily prior to market readiness, corresponding to the "Applied Research", "Design" and "Test" phases above. In 2000, the CPUC, utilities and the Energy Commission started the Emerging Technologies Coordinating Council (ETCC) to coordinate statewide market promotion of emerging technology efforts. That program's has been on supporting energy efficiency technologies that are market ready but not commonly accepted (moving technologies from the "Test" and "Introduction" phases toward "General Use", as displayed in the diagram above). To achieve the next level of energy

efficiency, the *Plan* is looking beyond that historical focus.

Innovation in building design, materials, and construction practice emanates from national laboratories, such as the National Renewable Energy Laboratory (NREL) and the Lawrence Berkeley National Laboratory (LBNL). Major portions of their work are funded by DOE, while LBNL receives substantial PIER funding. Further applied research occurs with proprietary funding from equipment and building materials manufacturers. Additionally, at the national level, leading edge energy efficiency initiatives are now often led by entities like the America Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE), the American Institute of Architects (AIA), Architecture 2030, the New Buildings Institute, other State organizations like the New York Energy Research and Development Authority (NYSERDA), and large municipalities like New York City. On an international level, the leadership of the United Kingdom and the European Commission is critical. Within California, agencies like the Sacramento Municipal Utility District (SMUD) and progressive municipalities are also often on the leading edge. California will benefit greatly from deliberate efforts to secure better integration and leverage across these activities.

While new buildings and industrial facilities offer good opportunities to adopt new advanced technologies, this construction replaces only 1-2% of the existing stock each year. To make rapid progress with energy efficiency will also require making incremental technology improvements that can be inserted into California's existing buildings and industrial facilities. It will be important that research on advanced technologies pursue paths that target both breakthrough as well as incremental technologies and their performance gains.

11.3 GOALS

New technologies that use minimum energy as well as new energy efficiency enabling technologies (e.g., nanotechnology, wireless sensors, DC Power Architecture) are fundamental to a transformed energy market. However, neither utility-funded ETCC programs, nor PIER by themselves create technology or drive technology advancement; rather they support the commercialization process and create an element of market pull.

Utility and Energy Commission energy efficiency technology programs must be refocused to catalyze research, development and commercialization of technologies that support the Big/Bold Strategies and integrated energy solutions initiatives. As noted above, research and technology strategies must include the entire technology advancement continuum as well as the operational and behavioral factors that influence technology usage. This will require greater attention to, and prioritization of, DOE and privately-funded Research and Development (R&D) activities, and more explicit commercialization and utilization strategies.

Goal		Goal Results
1. Refocus utility and Energy Commission energy efficiency research and technology support to create demand pull and set the research agenda for both incremental and game-changing energy efficiency technology innovations.	➡	Ratepayer-funded R&D programs will explicitly support widely applicable whole-building improvement, lighting, and plug load solutions envisioned in this Plan and will be used to leverage other private and public funds for the deployment of new technologies.
2. Conduct targeted emerging technologies R&D to support the Big, Bold Energy Efficiency Strategies and integrated energy solutions goals.	➡	Profound improvement in equipment efficiency as well as new building materials and designs aimed at achieving more efficiency from new buildings than technically feasible today, and necessary to achieve Zero Net Energy and hot/dry climate HVAC outcomes

11.4 STRATEGIES

California's energy efficiency goals require substantial changes in all stages of the technology advancement cycle including technology research and development, marketing, and operations. Strategies must harness private market forces – as well as regulatory-directed efforts - to foster the development and deployment of technologies and methods that promote and support a comprehensive adoption of energy efficiency practices. Key research and technology strategies are:

1. Engage the full-range of participants – private entities, national labs, clean energy and environmental groups, green venture capital firms, Federal, State and local governments, utilities and consumers.
2. Identify new technologies and enhance existing technologies to make them better and improve their uptake and use.
3. Employ a systems approach to establishing research priorities.
4. Facilitate paths-to-market for technologies and enabling/supporting practices through, directed research and technology investment, market push/pull techniques, and targeted product distribution methods.
5. Apply social and behavioral science theory to encourage the adoption and best use of resources and energy efficient technology.

11.5 IMPLEMENTATION PLAN

Goal 1: Create demand pull and set the research agenda to pursue both incremental and game-changing energy efficiency technology innovations.

To stimulate transformations in technology and related market dynamics, ratepayer-funded emerging technologies programs must be focused on creating demand pull for the emerging technologies that support the goals of this *Plan*. Key to this effort is a focused effort to leverage the R&D resources of both the public and private sectors.

Private industry's enormous investment in technology development and its ability to respond quickly to changing economic priorities and to capture opportunities is needed to realize the goals of the *Plan*. Federal R&D funding, particularly its role in supporting for national laboratories, also plays a critical role in early-stage R&D activities for emerging technologies.

Academic research (both public and private) is a third major technology development and advancement force, while the efforts of other State or regional entities that utilize energy efficiency as a means to achieve their goals (e.g., CARB, South Coast Air Quality Management District) provide additional resources.

Better coordination among these activities will ensure both incremental and game-changing energy efficiency technologies, while at the same time creating sustained demand pull for the technologies that emerge.

Strategies to tap incremental technology gains will draw on collaboration with technology providers and the R&D community to promote performance enhancements of existing technologies. This work will include targeting leading opportunities for energy management, such as with plug-loads (e.g., High Definition Television), one of the major growth areas in demand. In addition, targeted R&D is required for commercial and residential lighting, as well as energy management control systems.

Goal 1: Create Demand Pull for New Technologies

Implementation Plan and Timeline			
Strategies	**Near-Term**	**Mid-Term**	**Long Term**
1-1 Apply systems approaches to establishing research priorities	• Collaborate with regional and national labs, manufacturers, universities to develop and enhance technologies that can help meet the statewide strategic EE/DR goals. • Form Utility advisory group to formally provide input into PIER research strategies and programs and coordinate with ETCC promotion process. • Target most promising opportunities for improving plug-loads, lighting, and integrated DSM information & control systems. • Refine ET and PIER process to encourage more rapid evaluation of emerging technologies.	• Maintain coordination and collaboration process • Apply findings and insights to steer research agendas of collaborating parties	• Ongoing
1-2: Leverage private industry and Federally funded technology research and investment	• Expand Federal government R&D support for and integration with California's efforts. • Create an investor-ET network to share market information, technology assessment results, and expedited access to incentive programs. • Pilot incubator program to fast-track ET deployment. • Expand upstream relationships and channels to effectively target and generate support for energy-related technology.	• Improve and evolve enabling mechanisms. Continuous improvement, including lessons learned. • Create mechanisms for enabling technology development and support to technology incubators, inventors at the development stage. • Deploy statewide EE-based technology incubation process.	• Continuous improvement, including lessons learned. • Create mechanisms for enabling technology development and support to technology incubators, inventors at the development stage. • Ongoing
1-3: Enhance market intelligence and behavioral research activities related to energy efficient technologies.	• Develop road map to identify and prioritize consumer needs, behavioral drivers and decision processes. • Develop and launch behavior and market research agenda • Integrate customer influences in emerging technologies project screening. • Assess technology specific market potential using secondary market research to obtain technical and economic potential on new and emerging technologies and market segments.	• Integrate research and 2009-2011 M&V studies for continuous improvement. • Ongoing research on customer choices, acceptance, experiences with new technologies. • Where secondary research is lacking, perform primary market research on specific applications and technologies.	• Integrate research and 2012-2014 M&V studies for continuous improvement. • Ongoing research on customer choices, acceptance, experiences with new technologies. • Where secondary research is lacking, perform primary market research on specific applications and technologies.

Implementation Plan and Timeline			
Strategies	**Near-Term**	**Mid-Term**	**Long Term**
1-4: Expand activities to create market pull for energy-efficient technologies	• Plan and launch knowledge management systems. • Explore customer/manufacturer targeted strategies for creating pull.	Continuous improvement of knowledge system, including lessons learned. Increase scope of reference material where needed.	Continuous improvement of knowledge system, including lessons learned. Increase scope of reference material where needed.

Goal 2: Conduct targeted emerging technologies R&D to support the Big, Bold Energy Efficiency Strategies/Programmatic Initiatives and integrated energy solutions goals.

While Goal 1 calls for reshaping the overall focus and direction of ratepayer-funded energy efficiency R&D programs, in the near term, it is critical that work progress rapidly on specific areas to support the Big/Bold Strategies for Zero Net Energy buildings and hot-dry climate-appropriate HVAC technologies described in this *Plan*.

To stimulate major breakthroughs in support of Big, Bold initiatives there must be an intensive focus on the technologies, products, and practices driving the majority of building energy use, as well as integrated building design approaches and dynamic diagnostic and energy management control systems that take a holistic view of building design, delivery and operations.

A focus of Goal 2 will be on ZNE homes, commercial buildings, and HVAC technology performance best suited to California's climate. This approach must extend beyond equipment components and building systems to encompass whole building, integrated approaches. Initial work may call upon pilot efforts, to be followed later my larger scale market transformation strategies. One example of this type of pilot is a DOE-led effort at UC Merced, being executed by a team composed of LBNL, United Technologies Research Center, UC Berkeley, and UC Merced, directed at the identification and maturation of key technologies for integrated building operation. This effort aims to reduce energy demand by nearly 30 percent by using systems technologies for real-time energy performance diagnostics.

Goal 2: Targeted R&D

Implementation Plan and Timeline			
Strategies	**Near-Term**	**Mid-Term**	**Long Term**
2-1: Develop general R&D community support for support Big Bold Initiatives	Convene collaboration among researchers and their funders to ensure alignment of activities with big, bold focus areas for ZNE buildings and hot-dry climate HVAC technologies and systems.	• Continue involvement and collaboration with R&D community, including input to ensure alignment.	• Continue involvement and collaboration with R&D community, including input to ensure alignment.

2-2: Promote cost-effective near-term performance enhancements of existing technologies	• Target building shell, HVAC, lighting and supporting areas, such as real-time energy performance monitoring and automated building commissioning technologies. • Collaborate with manufacturers to improve performance of existing technologies. • Develop specifications to drive / guide improvement activities. Provide technology feedback through ET assessments. • Explore longer term strategies to increase saturation of new big and bold measures and technologies.	• Target additional big, bold focus areas • Continuous improvement, including lessons learned. • Continue collaborations with designers, builders, and manufacturers to bring more efficient technologies into the market.	• Continue previous efforts with higher levels of attention to net-zero residential goals. • Continuous improvement, including lessons learned. • Continue collaborations with manufacturers to bring more efficient technologies into the market.
2-3: Develop initiatives aimed at PIER to support larger gains in support of Big Bold Initiatives.	• Provide stakeholder input to ensure alignment of PIER activities with Big, Bold Initiatives. • Collaborate with PIER to develop a formal process to roll PIER developed technologies into ET.	• Continue collaboration with PIER, including input to ensure alignment.	• Continue collaboration with PIER, including input to ensure alignment.
2-4: Develop initiatives aimed at ET to support Big Bold Initiatives.	• Initiate upstream technology program activities, including whole building integrated solutions. • Embark on plan to demonstrate big bold measures in customer sites and seed the market. • Conduct "pilot" programs of new technology seeding and market uptake through subsidies and incentives. • Collaborate with manufacturers in new ambitious pilot programs, including full-scale demonstration programs to mature innovative system technologies.	• Continue to drive efforts aimed at non-mainstream technologies. Improve and evolve upstream programs. • Continue to collaborate with manufacturers in new ambitious pilot programs.	• Continue to drive efforts aimed at non-mainstream technologies.

12. LOCAL GOVERNMENTS

12.1 VISION

By 2020, California's local governments will be leaders in using energy efficiency to reduce energy use and global warming emissions both in their own facilities and throughout their communities.

12.2 PROFILE

California's 600-plus local governments are remarkably diverse—they range from the largest county in the United States to small towns; from busy agricultural centers to residential suburbs to world-renowned cities.[69] This diversity includes energy efficiency: California's local governments and their communities face different circumstances and have different constituencies, and are at different levels of commitment and capacity. Many of them, however, are paying significant attention to energy efficiency and climate change and are interested in doing what they can, as quickly as they can, and in collaboration with their residents, other local governments, State government, utilities and other key participants.

Local governments share a broad array of energy-related authorities and opportunities:

Regulatory Authority. Local governments have significant powers that can improve the energy efficiency of new and existing buildings. These include:

- Ensuring compliance and enforcement of the Title 24 energy code for residential and commercial buildings.
- Adopting building codes beyond Title 24's energy requirements (and potentially other "green" requirements).
- Supporting highly efficient projects that voluntarily exceed minimum energy codes through favorable fee structures, fast-tracked permitting and other innovative and locally appropriate approaches.
- Enacting ordinances with point-of-sale or other approaches that spur efficiency actions in existing privately owned buildings.
- Applying efficiency-related "carrots" and "sticks" using local zoning and development authority.

Energy Use for Government Facilities. Local governments can be significant energy end users in their own buildings and facilities, from public schools to wastewater treatment plants to City Hall. These facilities provide an opportunity to "lead by example" by improving energy efficiency, reducing CO_2 emissions, and cutting government energy bills. They can also use these facilities to showcase the products and practices that will become commonplace in a "zero net energy" world.

Energy Leadership in Local Communities. Local governments often can play an important role in influencing the energy attitudes and actions of their citizens and businesses. This can take on many forms, from public education to adopting innovative policies and initiatives to integrating actions addressing energy efficiency, climate change and sustainability.

The CPUC has long-recognized the unique role of local governments in fostering innovation. Almost ten years ago, the CPUC directed utilities to consider programs that take advantage of the unique expertise, relationships with customers, and ability to coordinate among related activities offered by individual or groups of local government.[70] So too have there been local governments leading innovation with efficiency on their own, as well as through their associations – the League of California Cities, California State Association of Counties, Local Government Commission. More recently the State Attorney General's Office has called upon local governments to use their CEQA[71] compliance responsibilities to address greenhouse gas impacts and mitigation strategies of local development policies. Energy efficiency policies and initiatives are among the options available to communities.

12.3 GOALS

Goals	Goal Results
1. Local governments lead adoption and implementation of "reach" codes stronger than Title 24, on both mandatory basis and voluntary bases.	At least 5 percent of California's local governments (representing at least 5 percent of CA total population) each year adopt "reach" codes. By 2020, the majority of local governments have adopted incentives or mandates to achieve above-code levels of energy efficiency (or DSM) in their communities, or have led statewide adoption of these higher codes.
2. Strong support from local governments for energy code compliance enforcement.	The current rate of non-compliance with codes and standards is halved by 2012, halved again by 2016, and there is full compliance by 2020.
3. Local governments lead by example with their own facilities and energy usage practices.	The energy usage footprint of local government buildings is 20% below 2003 levels by 2015 and 20 percent below 1990 levels by 2020.
4. Local governments lead their communities with innovative programs for energy efficiency, sustainability and climate change.	By 2015, 50 percent of local governments have adopted energy efficiency/sustainability/climate change action plans for their communities and 100 percent by 2020, with implementation and tracking of achievements.
5. Local government energy efficiency expertise becomes widespread and typical.	By 2020, 100 percent of local governments have in-house capabilities devoted to achieving all cost-effective energy efficiency in their facilities and stimulating the same throughout the communities.

12.4 STRATEGIES

The three key strategies for local government action are:

1. **Tap Local Government Authority:** Use local government authority over planning and development policy to maximize energy efficiency in privately owned new construction and existing buildings.
2. **Lead by Example:** Showcase with local governments' facilities achieving economic energy efficiency, reducing CO_2 emissions, and showcasing promising energy efficiency, DSM and renewables products and practices.
3. **Community Leadership:** Local governments lead their communities to support clean energy goals.

There are five important associations of local governments that are key to these strategies: the California State Association of Counties (CSAC), League of California Cities (League), Local Governments for Sustainability (ICLEI), the Institute for Local Government (Institute), and the Local Government Commission (LGC). A task force should be formed consisting of leaders from each of these organizations, the CPUC, the Energy Commission, and utilities to develop and implement the strategies listed for Local Government listed in this *Plan*.

12.5 IMPLEMENTATION PLAN

Goal 1: Local governments are leaders in adopting and implementing "reach" codes.

Local governments can adopt building standards more stringent than State and Federal mandates. As mentioned in the residential ZNE discussion above, over the past year both the City of San Francisco and the City of Los Angeles have adopted Green Building Ordinances for new buildings in the respective cities. However, with over 400 cites and counties in the state, relatively few local governments have adopted local ordinances that exceed Title 24 requirements. Much more can, and should, be done at the local level.

In addition, local governments can adopt "point of sale" requirements. For example, the City of Berkeley for over two decades has had residential and commercial building ordinances requiring basic efficiency improvements, triggered at the time of property sale or significant renovations. Sacramento and San Francisco have applied similar requirements at various times.

Several foundational activities will assist local governments in this effort:

- Development of model (mandatory) local government codes, ordinances and programs that local governments can modify as needed, adopt, and implement. These would include tiers of codes beyond Title 24 (see the Residential and Commercial Chapters.)
- Development of sample local ordinances for point-of-sale and other point-of-transaction energy efficiency requirements and building energy ratings that must be disclosed at these points. (This strategy may require additional legal authorization.)
- Development of sample local government programs to reward projects that voluntarily exceed State and local minimum energy codes by expedited permitting, entitlement approval processes, favorable fee structures, and other favorable actions for qualifying green buildings and developments.
- Focused and sustained outreach support for local governments to inform them about the model standards and ordinances and provide assistance in developing, adopting, and implementing "reach" standards.
- Networking tools to allow local governments on a peer-to-peer basis to share information and experiences on adopting and implementing "reach" standards and programs.
- Policies that support utility efforts to assist local government development and implementation of "reach" standards or point of sale ordinances.
- Leadership recognition of elected officials and local governments that adopt and implement "reach" standards and other programs.
- Linkage of emission reductions from "reach" standards and programs to CARB's AB 32 implementation strategies.

Goal 1: "Reach" Codes

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Develop, adopt and implement model building energy codes (and/or other green codes) more stringent than Title 24's requirements, on both a mandatory and voluntary basis; adopt one or two additional tiers of increasing stringency.	• Develop model codes and tiers in conjunction with existing energy and green building rating systems. • Gain consensus of leading designers and builders on "reach" levels • Launch statewide campaign for adoption	• Expand percent of cities and counties adopting codes; monitor effectiveness and upgrade model codes.	• Expand to statewide program.
1-2: Establish expedited permitting and entitlement approval processes, fee structures and other incentives for green buildings and other above-code developments.	• Develop sample programs • Enact needed local laws; • Put implementing processes, fee structures, and other incentives in place statewide by 12/2011.	• Ongoing improvement and refinement.	• Ongoing improvement and refinement.
1-3: Develop, adopt and implement model point-of-sale and other point-of transactions relying on building ratings to increase efficiency in existing buildings.	• Develop model codes and programs in 2009. • Launch pilot programs in 2010.	• Implement statewide building energy ratings disclosure system by 6/2012.	• Implement requirements beyond disclosure, such as ratings and/or energy upgrades at sale of properties by 1/2013.
1-4: Create assessment districts or other mechanisms so property owners can fund EE through local bonds and pay back on property taxes; develop other local EE financing tools.	• Develop model mechanisms for funding sources. • Establish model loan mechanisms. • Launch in pilot cities.	• Expand percent of cities and counties adopting local financing mechanisms.	• Expand statewide
1-5: Develop broad education program and peer-to-peer support to local govt's to adopt and implement model "reach" codes and/or point of sale policies.	• Fund statewide energy efficiency liaison to local gov't associations • Develop information campaign on mechanics and benefits of model programs, targeting local gov't decision-makers and community leaders. • Establish leadership recognition programs.	• Expand content and geographical reach of information campaign.	• Ongoing
1-6: Link emission reductions from "reach" codes and similar programs to CARB's AB 32 program and to local gov't CEQA responsibilities.	• CARB adopts regulation providing local gov't emission reduction credit for "reach" standards • State Attorney General and Office of Planning & Research provide guidance on using CEQA authority to target energy and GHG savings in LG development authority	• Identify best practices and incorporate into local programs and policies	• Ongoing

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-7: Develop energy efficiency-related "carrots" and "sticks" using local zoning and development authority.	• Plan approaches by 12/2009. Launch approaches by 12/2010. • Approach in place by 6/2009. Requirement in place by 12/2010.	• Ongoing refinement of approaches based on feedback from implementation efforts.	• Ongoing implementation

Goal 2: Strong support from local governments for energy code compliance enforcement.

Under State law, local governments, through their building permit and inspection processes, are responsible for enforcement of Titles 20 and 24. While there is inadequate understanding of code compliance rates and the resulting degradation in performance, more than 30 percent of the technical energy savings from California's statewide energy codes may be lost due to non-compliance. A 2007 study estimated noncompliance rates with the Energy Commission statewide building measures ranging from 28 to 100% and with appliances standards from 0% to 63%.[72]

Generally, the lack of financial resources (e.g., funds to send an inspector to training) is a barrier to enforcement. Inspections and enforcement are funded through local permit fees. However, local governments are often reluctant to raise fees to cover full costs of standards compliance if those fee levels would rise above neighboring jurisdictions.

A comprehensive, adequately funded statewide program for State building code compliance that strongly supports local government compliance responsibilities is key to obtaining full savings from California's aggressive building and appliance standards.

Goal 2: Code Compliance

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
2-1: Statewide assessment of local government code enforcement and recommendations for change.	• Develop and conduct assessment; develop set of recommended improvements (e.g. via compliance tools, information, training, modified standards, and/or funding)	• Ongoing	• Ongoing
2-2: Dramatically improve compliance with and enforcement of Title 24, including HVAC permitting and inspection requirements (including focus on peak load reductions in inland areas).	• Develop strategies • Test pilot programs in 2010; • Put initial improvements in place statewide by 12/2010.	• Expand statewide • Strengthen compliance solutions	• Ongoing
2-3: Local inspectors and contractors hired by local governments shall meet the requirements of the energy component of their professional licensing (as such energy components are adopted).	• Update and/or incorporate energy components in licensing requirements. • Adopt requirements	• Ongoing	• Ongoing

Goal 3: Local governments lead by example with their own facilities and energy usage practices.

Cities and counties can lead by example by embracing energy efficiency in their facilities. There are many examples of local governments undertaking major actions to reduce energy usage in their own facilities. Examples of specific goals that local governments can set for their buildings include:

- Requiring all local government owned and leased buildings to be benchmarked, sub-metered, commissioned by 2012, and upgraded to the next level of energy efficiency by 2015.
- Requiring LEED Certified and LEED Silver (or their equivalents) for all new local government facilities.
- Requiring LEED Existing Building Silver for existing facilities, by a specified date.
- Achieving all cost-effective or economic energy efficiency in their facilities (e.g. 20-40% efficiency gains), by a specified date.
- Requiring commissioning for new buildings, and re-commissioning and retro-commissioning of existing buildings.

A sustained, comprehensive effort to extend these efforts statewide should be undertaken. In order to accomplish this goal, providing local government facility personnel with additional staff, expert assistance and/or technical resources is needed.

Goal 3: Lead by Example

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
3-1: Adopt specific goals for efficiency of local new and existing government buildings.	• Showcase innovative EE and other DSM relevant to achieving ZNE buildings. • Implement local policies for LEED new construction and existing buildings.	• Complete benchmarking and LEED policy implementation. • Launch statewide program.	• Implement statewide.
3-2: Require commissioning for new buildings, and re-commissioning and retro-commissioning of existing buildings.	• Benchmark existing buildings against ratings such as Energy Star and its Portfolio Manager • Test commissioning programs on selected high-use buildings. • Adopt mandatory benchmarking and commissioning requirements for local government facilities statewide by 12/2011.	• Ongoing refinement and improvement.	• Ongoing
3-3: Improve access to favorable financing terms that create positive cash flow from energy efficiency/DSM savings,	• Identify various financing tools available to local governments. (e.g. such as expanding the Energy Commission's loan fund, seeking federal or state support for lower interest rate loans, third-party financing, and utility on-bill financing. • Modify as appropriate to increase utilization.	• Ongoing implementation.	• Ongoing

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
3-4: Promote local gov't adoption of policies for a budget line item fir energy management or other options that allow energy efficiency cost savings to be returned to the host facility or department and/or as a revolving fund for additional energy projects	• Explore and document model policies and mechanisms complete by 12/2009. • Implementation plan in place by 6/2010 for mechanisms warranted.	• Ongoing implementation.	• Ongoing
3-5: Develop an innovation incubator that competitively selects energy design, technology, and system initiatives for local government pilot projects.	• Coordinate this approach with Research & Technology activities; • Develop and begin first projects by 12/2009.	• Ongoing refinement and expansion.	• Ongoing

Goal 4: Local governments lead their communities with innovative programs for energy efficiency, sustainability, and climate change.

Local governments are in a unique position to implement innovative, long-term, cross-cutting programs promoting energy efficiency, sustainability, and reduced carbon emissions. Their ability to interact with businesses and residents to work towards integrated sustainable communities is unique and needs to be engaged far beyond current efforts, to support California's aggressive energy efficiency and global warming goals.

There are various resources available to aid local governments. Non-profit associations, for-profits, State agencies, utilities and others can give technical assistance; offer targeted online and written tools; and share an over-arching vision and best practices in conferences and workshops. One example of an innovative local government initiative is the Cambridge Energy Alliance effort in Cambridge, MA. The Alliance is a city-sponsored non-profit group established to identify and arrange financing for unprecedented levels of gas, electricity and water savings by retrofitting buildings and installing renewable technologies across the community.[73] Another effort is California Sustainable Communities Initiative sponsored by the Department of Conservation (DOC) which seeks to expand the DOC's recycling experience with local governments into a more comprehensive statewide initiative that promotes innovative and coordinated programs for energy efficiency, sustainability, and climate change at the local level, using public-private partnerships.

Additionally, local governments can and do commit themselves and/or their communities to externally developed relevant commitments, such as the United Nation's Urban Environmental Accord or the Local Governments for Sustainability (ICLEI) Cities for Climate Protection campaign.

Local governments also have a number of regulatory carrots and sticks including: community design requirements; land use and zoning policies that promote energy efficiency and smart growth; requiring redevelopment agencies to address energy efficiency in development contracts, and; negotiating energy efficiency into developer agreements on major projects.

Recent legislation in CA has increased the role of local government in facilitating efficiency investments and ensuring sustainable planning. AB 811 (Levine, 2008) authorizes cities to provide low-interest loans to property owners with long-term repayments added to their annual property tax bills to help finance energy efficiency improvements and distributed

generation installations.[74] Similarly, SB 375 (Steinberg, 2008) requires metropolitan planning organizations to include "sustainable communities strategies" in their regional transportation plans and creates specified incentives for the implementation of such sustainable communities strategies.[75]

The success of this goal will require not only resources from the State, utilities, non-profits and the business community but the commitment of local governments and their leaders to use their leadership and legal authority in new and often challenging ways. A necessary step is to support organizations serving local governments at the state level (e.g., League of California Cities; California State Association of Counties; Institute for Local Government), regional levels (e.g., Association of Bay Area Governments, Association of Monterrey Bay Area Governments, San Diego Association of Governments, Southern California Association of Governments), and non-profits so they can leverage their activities with other local governments on energy and environmental issues. This includes: creating a statewide liaison resource by local government focused on energy efficiency programs; enhanced and expanded technical assistance; targeted online tools; information on best practices; and conference and workshop activities.

Goal 4: Community Leadership

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
4-1: Local governments commit to clean energy/climate change leadership.	• Assist initial set of local governments in commitments; develop and communicate appropriate messages.	• Expand local government participation statewide.	• Ongoing implementation.
4-2: Use local governments' general plan to promote energy efficiency, sustainability and climate change.	• Develop model General Plan amendments. • Leaders among local governments adopt policies in General Plan elements. • Publicize to other local governments.	• Expand inclusion in general plans. By 2015, inclusion in all local gov't plans.	• Ongoing implementation.
4-3: Statewide liaison to assist local governments in energy efficiency, sustainability, and climate change programs	• Provide energy efficiency liaison funded via IOU ratepayer funds. • Provide climate change liaison as part of ARB AB32 activities.	• Ongoing implementation.	• Ongoing implementation.
4-4: Develop local projects that integrate energy efficiency, DSM, and water/wastewater end uses.	• Identify opportunities and challenges for more energy/environmentally integrated development and infrastructure • Develop and implement pilot projects, such as the California Sustainable Communities Initiative.	• Expand implementation.	• Ongoing implementation

Goal 5: Local government energy efficiency expertise becomes widespread and typical.

Many local governments do not have adequate dedicated staff or resources to move proactively on energy efficiency in their own or community buildings. They also often lack capacity or awareness to promote building and zoning codes that would dramatically accelerate green, efficient buildings within their jurisdictions.

The workforce education and training strategies outlined elsewhere in this *Plan* are one vehicle for attacking these issues. Another is the standardization of tiered voluntary building codes across the state (as described in Strategy 1) which will be easier for local governments to embrace and promote than if codes are developed independently each time.

Even so, a focused effort on development of local government energy efficiency expertise is critical to the State's energy efficiency goals. Programs such as the regional technical assistance and education centers in Marin, Ventura, and Humboldt that work with local governments, schools, and special districts in their areas, are an example of effective training programs.

Goal 5: Local Government Energy Efficiency Expertise

Implementation Plan and Timeline			
Strategies	**Near Term 2009 – 2011**	**Short Term 2012 – 2015**	**Long Term 2016 – 2020**
5-1: Create a menu of products, services, approved technologies and implementation channels to guide local governments that currently lack deep expertise in energy efficiency.	• Identify menu by 9/2009. • Plan for provision of menu in place by 12/2009. • Begin to provide menu content by 3/2010.	• Ongoing implementation.	• Ongoing implementation.
5-2: Develop model approaches to assist local governments participating in regional coordinated efforts for energy efficiency, DSM, renewables, green buildings, and zoning.	• Complete model approaches (e.g. joint powers authorities, memoranda of understanding, regional councils) by 2009. • Leader governments begin pilots. • Communicate information on a peer-to-peer basis.	• Expand outreach on benefits of regional approaches to wider range of local governments • Identify funding sources to support wider utilization.	• Ongoing implementation.
5-3: Establish a statewide effort to facilitate peer-to-peer learning, such as a "local champions" program or a governor's invitation-only local government leaders' summit.	• Identify the most suitable peer-to-peer learning vehicle by 6/2009. • Launch peer-to-peer learning vehicle by 12/2009.	• Ongoing refinement and improvement.	• Ongoing implementation.
5-4: Create a statewide technical assistance program for local governments, including peer-to-peer expertise exchange.	• Develop program in 2009.	• Implement statewide in 2010.	• Ongoing implementation.

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LIST OF ACRONYMS

AB 32	Assembly Bill 32/California Global Warming Solutions Act of 2006 *www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf*
ABAG	Association of Bay Area Governments *www.abag.ca.gov*
AC	Air Conditioning
ACCA	Air Conditioning Contractors of America *www.acca.org*
ACEEE	American Council for an Energy-Efficient Economy *www.aceee.org*
ACR	Assigned Commissioner Ruling
AHRI	Air Conditioning, Heating and Refrigeration Institute *www.ahridirectory.org/ahridirectory/pages/ariDirectoryMain.aspx*
AIA	American Institute of Architects *www.aia.org*
AMBAG	The Association of Monterey Bay Area Governments *www.ambag.org*
AMI	Advanced Metering Infrastructure
ANSI	American National Standards Institute *www.ansi.org*
ASAP	Appliance Standards Awareness Project *www.standardsasap.org*
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers *www.ashrae.org*
BBEES	Big Bold Energy Efficiency Strategies *Three programmatic initiatives identified by the California Public Utilities Commission in Decision 07-10-032*
BIRA	Building Industry Research Alliance *www.bira.ws*
BOC	Building Operator Certification
BTH	Business, Transportation and Housing Agency *www.bth.ca.gov*
BuRec	Bureau of Reclamation *www.usbr.gov*
C&S	Codes and Standards
CAB	California Architects Board *www.cab.ca.gov*
CAIA	California Agricultural Irrigation Association *www.caia-irrigation.org*
CAISO (or ISO)	California Independent System Operator *www.caiso.com*
CALBO	California Building Officials *www.calbo.org*
CalWORKS	California Work Opportunities and Responsibility to Kids *www.ladpss.org/dpss/calworks/default.cfm*
CARB (or ARB)	California Air Resources Board *www.arb.ca.gov*
CBO	Community-based Organization
CDFA	California Department of Food and Agriculture *www.cdfa.ca.gov*

CDE	California Department of Education www.cde.ca.gov
Energy Commission	California Energy Commission www.energy.ca.gov
CEE	Consortium for Energy Efficiency www.cee1.org
CEEA	California Energy Efficiency Alliance
CEESP	California Energy Efficiency Strategic Plan www.californiaenergyefficiency.com
CFL	Compact Fluorescent Lamp or Light
CO_2	Carbon Dioxide
CPUC	California Public Utilities Commission www.cpuc.ca.gov/puc
CSAC	California State Association of Counties
CSI	California Solar Initiative www.gosolarcalifornia.ca.gov/csi/index.html
CSLB	California State License Board www.cslb.ca.gov
CSU	California State University
Cx	Commissioning
DC	Direct Current
DCSD	Department of Community Services and Development www.csd.ca.gov/default.aspx
DEER	Database for Energy Efficient Resources www.energy.ca.gov/deer
DG	Distributed Generation
DOE	U.S. Department of Energy www.energy.gov
DR	Demand Response
DRA	Division of Ratepayer Advocates www.dra.ca.gov
DSM	Demand-Side Management
DSS	Department of Social Services www.dss.cahwnet.gov/cdssweb/default.htm
DWR	California Department of Water Resources www.water.ca.gov
EAP	California Energy Action Plan www.energy.ca.gov/energy_action_plan/index.html
ED	California Public Utilities Energy Division
EDD	Employment Development Department www.edd.ca.gov
EE	Energy Efficiency
EM&V	Evaluation, Measurement and Verification
EMS	Energy Management System
EPA	U.S. Environmental Protection Agency www.epa.gov
EPRI	Electric Power Research Institute www.epri.com
ESCO	Energy Service Company
ET	Emerging Technology or Emerging Technologies
ETAAC	Economic and Technology Advancement Advisory Committee www.etaac.org/jsp/genericdoc.jsp
ETCC	Emerging Technologies Coordinating Council www.etcc-ca.com
ETP	California Employment Training Panel www.etp.ca.gov

FSEC	Florida Solar Energy Center www.fsec.ucf.edu/en
GAIN	Greater Avenues for Independence www.ladpss.org/dpss/gain/default.cfm
GHG	Greenhouse Gas
GWh	Gigawatt Hour
HARDI	Heating, Air Conditioning and Refrigeration Distributors International www.hardinet.org
HDTV	High Definition Television
HERS	Home Energy Rating System www.energy.ca.gov/HERS
HVAC	Heating, Ventilation and Air Conditioning
ICLEI	International Council for Local Environmental Initiatives www.iclei.org
ID	Irrigation Districts or Integrated Design
IEPR	Integrated Energy Policy Report www.energy.ca.gov/2007_energypolicy/index.html
IOU	Investor-Owned Utility
ISO	See CAISO or International Organization for Standardization
ITP	U.S. Department of Energy's Industrial Technologies Program www1.eere.energy.gov/industry
kWh	Kilowatt Hour
LBNL	Lawrence Berkeley National Laboratory www.lbl.gov
LCD	Liquid Crystal Display
LEED	Leadership in Energy and Environmental Design www.usgbc.org/leed
LG	Local Government
LGC	Local Government Commission www.lgc.org
LIEE	Low Income Energy Efficiency
LIOB	Low Income Oversight Board www.ligb.org
LOC	League of California Cities www.cacities.org/index.jsp?zone=locc
ME&O	Marketing, Education and Outreach
Mth	Million Therms
MW	Megawatt
MWh	Megawatt Hour
NATE	North American Technician Excellence *www.natex.org*
NBI	New Buildings Institute www.newbuildings.org
NIST	U.S. Department of Commerce's National Institute of Standards and Technology www.nist.gov
NRCS	Natural Resources Conservation Service www.nrcs.usda.gov
NREL	National Renewable Energy Laboratory www.nrel.gov
NWEEA	Northwest Energy Efficiency Alliance www.nwalliance.org
O&M	Operations and Maintenance
PA	Program Administrator
PDA	Personal Digital Assistant
PG&E	Pacific Gas and Electric Company www.pge.com

PIER	Public Interest Energy Research *www.energy.ca.gov/pier*
POU	Publicly Owned Utility
PV	Photovoltaic
QI/QM	Quality Improvement/Quality Management
R&D	Research and Development
RCx	Retrocommissioning
RD&D	Research, Development and Demonstration
RECO	Residential Energy Conservation Ordinances
RFP	Request for Proposals
RH	Relative Humidity
SanDAG	San Diego Association of Governments *www.sandag.cog.ca.us*
SCAG	Southern California Association of Governments *www.scag.ca.gov*
SCE	Southern California Edison *www.sce.com*
SCG (or SoCalGas)	Southern California Gas Company *www.socalgas.com*
SDG&E	San Diego Gas & Electric Company *www.sdge.com/index.shtm*
SFLI	Single Family Low Income
SGIP	Self-Generation Incentive Program *www.cpuc.ca.gov/PUC/energy/051005_sgip.htm*
SMJU	Small and Multijurisdictional Utility
SMUD	Sacramento Municipal Utility District *www.smud.org*
SWEEP	Southwest Energy Efficiency Project *www.swenergy.org*
TURN	The Utility Reform Network *www.turn.org*
TRC	Total Resource Cost
UC	University of California
USDA	U.S. Department of Agriculture *www.usda.gov*
USGBC	U.S. Green Building Council *www.usgbc.org*
WCEC	Western Cooling Efficiency Center *wcec.ucdavis.edu*
WE&T	Workforce Education and Training
WWD	Wind Wave Direction
ZNE	Zero Net Energy

ENDNOTES

[1] California Public Utilities Commission Decision 07-10-032. (D.07-10-023) Available at: http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/74107.pdf

[2] Extensive documentation of the materials developed though the strategic planning process is available at: www.californiaenergyefficiency.com

[3] The last State effort of this nature was the California Conservation Collaborative, which in 1990 restored emphasis and funding to utility energy efficiency programs and established new design principles for programs and utility regulation, in response to a drop-off in utility energy efficiency efforts in the late 1980s.

[4] "Energy Action Plan II, Implementation Roadmap for Energy Policies", California Energy Commission and California Public Utilities Commission, September 21, 2005. Available at: http://docs.cpuc.ca.gov/word_pdf/REPORT/51604.pdf

[5] "Energy Action Plan I", California Energy Commission, California Public Utilities Commission and Consumer Power and Conservation Financing Authority. May 8, 2003. Available at: http://docs.cpuc.ca.gov/word_pdf/REPORT/28715.pdf

[6] California Energy Commission, 2007 Integrated Energy Policy Report (2007 IEPR), adopted December 5, 2007. CEC-100-2007-008-CMF. Available at: http://www.energy.ca.gov/2007_energypolicy/documents/index.html

[7] California Air Resources Board "Climate Change Draft Scoping Plan: A Framework for Change" June 2008 Discussion Draft. (CARB Scoping Plan) p. 7. Available at: http://www.arb.ca.gov/cc/scopingplan/document/draftscopingplan.pdf

[8] 2007 IEPR.

[9] McKinsey & Company. "Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost? U.S. Greenhouse Gas Abatement Mapping Initiative" Executive Report, December 2007. Available at: http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf

[10] Assembly Bill No. 32 (Pavley, 2006) California Health and Safety Code, §§ 38500 et seq. Available at: http://www.climatechange.ca.gov/publications/legislation/ab_32_bill_20060927_chaptered.pdf

[11] CARB Scoping Plan p. 13.

[12] Ibid. pp 21-22. The Draft Plan Appendices also consider a more stringent target for energy savings of 40,000 GWh.

[13] Ibid. p.22. Assembly Bill 1493 (Pavley, 2002) directed ARB to adopt vehicle standards that lower greenhouse gas emissions to the maximum extent technologically feasible, beginning with the 2009 model year. ARB plans to adopt a second, more stringent, phase of the Pavley regulations. Over the 2020 timeframe these measures are expected to yield over 30 million metric tons of GHG reductions. ARB adopted regulations in 2004 and applied to the U.S. Environmental Protection Agency (U.S. EPA) for a waiver under the federal Clean Air Act to implement the regulation. While initially denied, it is likely that ARB will ultimately be permitted to implement the Pavley regulations. If not, they plan to pursue other avenues to realize the vast potential for GHG reductions in the transportation sector.

[14] http://www.green.ca.gov/GreenActionTeam/default.htm

[15] California Public Utilities Commission Decision 08-07-047. (D.08-07-047) Available at: http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/85995.pdf

[16] Energy Independence and Security Act of 2007. (EISA 2007) Public Law 110–140. Dec. 19, 2007. Available at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ140.110.pdf

[17] D.07-10-032, p.33.

[18] Ibid. , p. 33

[19] California Public Utilities Commission Decision 98-04-063, Appendix A.

[20] D.07-10-032, p.150.

[21] As an example, the Northeast Energy Efficiency Partnership (NEEP) sets market transformation goals for its programs, and then measures progress towards the goals by determining the extent to which various barriers have been overcome in a given market. Such barrier criteria include: consumer awareness, product/service availability, pricing, purchasing behavior, customer satisfaction, and future customer actions. Measures and programs that have achieved their goals are phased out of utility energy efficiency portfolios to make room for new measures.

[22] Transcripts of the three stakeholder workshops—as well as the written comments submitted—are available on the strategic planning website: www.californiaenergyefficiency.com.

[23] 2007 IEPR

[24] California is served by well over 60 electricity and natural gas distribution companies. (Energy Commission at http://www.energy.ca.gov/electricity/utilities.html#300; and U.S. Census Bureau, 1997 Economic Census December 29, 1999, which counts over 200 utilities) Some smaller utilities may not offer residential customers opportunities to participate in energy efficiency programs. However, a large majority of California residents are served by utilities that do offer energy efficiency programs. (See also endnote 3 below.)

[25] Thirty percent (30%) is the proportion of IOU-served residential households qualifying for Low Income Energy Efficiency (LIEE) programs. IOUs serve about 10.5 million residential customers (CPUC at http://www.cpuc.ca.gov/PUC/energy/), or approximately 83% of California households. The proportion of LIEE-qualifying households served by publicly-owned utilities is assumed to be similar.

[26] Title 20, Cal. Code Regs., Sections 1601 – 1608, http://www.energy.ca.gov/appliances/; Title 24, Cal.Code Regs. Part 6, http://www.energy.ca.gov/title24/.

[27] Assembly Bill No. 1109 (Huffman, 2007) Public Resources Code §§ 25402 et seq. Available at: http://www.leginfo.ca.gov/pub/07-08/bill/asm/ab_1101-1150/ab_1109_bill_20071012_chaptered.pdf

[28] 2007 IEPR, pp. 88.

[29] Several green building standards take embodied energy into account. See, for instance, US Green Building Council Leadership in Environmental and Environmental Design (LEED) (http://www.usgbc.org) or UK Code for Sustainable Homes (http://www.planningportal.gov.uk/england/professionals/en/1115314116927.html)

[30] In establishing the New Solar Homes Partnership (NSHP), the Energy Commission requires that new residential buildings granted an incentive under the NSHP exceed California's Title 24 Building Energy Efficiency Standards. This helps the combined energy efficiency and solar project to be as affordable as possible over the life of the home. To qualify for "Tier II" incentives, the home must exceed Title 24 standards by 35%. For more information regarding the Energy Commission's New Solar Homes Partnership and qualifying energy efficiency standards, go to: http://www.gosolarcalifornia.org

[31] BSC Green Building Standards. Available at: http://www.documents.dgs.ca.gov/bsc/prpsd_stds/2007/combined_approved_green_code_pt11.pdf

[32] San Francisco 2008 Green Building Ordinance, Available at: http://www.sfenvironment.org/downloads/library/sf_green_building_ordinance_2008.pdf

[33] Los Angeles 2008 Green Building Ordinance, Available at: http://cityplanning.lacity.org/Code_Studies/GreenLA/greenbuildingordinance.pdf

[34]At the end of 2007 (prior to the mortgage crisis), only one-in-three of the state's households could afford a conventional entry level home, an improvement from one-in-four a year earlier, but still challenging for prospective home buyers. See: "Housing Affordability Improves as Prices and Rates Decline", Robert A. Kleinhenz, California Association of Realtors, February 2008.

[35] United States Department of Energy. "Residential Energy Consumption Survey." 2001. Available at: http://www.eia.doe.gov/emeu/recs/recs2001/enduse2001/enduse2001.html

[36] For more information on UC Davis's California Lighting Technology Center. go to: http://cltc.ucdavis.edu

[37] For more information on DOE's L-Prize, go to: http://www.lightingprize.org/

[38] Federal, state and local governmental buildings and facilities are categorized as "commercial" and implicitly included in the strategies of this Chapter and periodically differentiated as warranted; additionally, local governmental buildings are discussed extensively in the Local Government Chapter of this Strategic Plan.

[39] For more information on the 2030 Challenge go to: http://www.zeroenergycbi.org/

[40] For more information on this Initiative go to: http://www.eere.energy.gov/news/daily.cfm/hp_news_id=129

[41] For more information on California's Green Buildings Initiative, go to: http://www.dgs.ca.gov/GB%20Program.htm

[42] For more information on California's Grid Neutral Schools Program, go to: http://www.green-technology.org/green_technology_magazine/images/grid_neutral.pdf

[43] California Energy Commission, *Options for Energy Efficiency in Existing Buildings.* December 2005. CEC-400-2005-039-CMF. Available at: http://www.energy.ca.gov/2005publications/CEC-400-2005-039/CEC-400-2005-039-CMF.PDF

[44] Assembly Bill 1103 (Saldana, 2007) Public Resourc eCode, §§ 25402 et seq. Available at: http://www.leginfo.ca.gov/pub/07-08/bill/asm/ab_1101-1150/ab_1103_bill_20071012_chaptered.pdf

[45] California Energy Commission, http://www.energy.ca.gov/electricity/consumption_by_sector.html

[46] 2007 IEPR.

[47] CARB Scoping Plan, p.7.

[48] 2007 IEPR.

[49] For more information on the Superior Energy Performance Partnership, go to: http://www.superiorenergyperformance.net/

[50] For more information on the ANSI-accredited Plant Energy Efficiency Certification Program initiated through SEPP go to: http://www.superiorenergyperformance.net/pdfs/Plant-Certification-StrategicPlan-SEP-May-2008.pdf

[51] For more information on these programs, go to: http://www1.eere.energy.gov/industry/saveenergynow/ and http://www.labs21century.gov/

[52] 2007 IEPR, p. 13.

[53] For more information on CDFA's Vision, go to: http://www.cdfa.ca.gov/agvision/.

[54] This Plan examines residential and small commercial HVAC, and therefore implicitly assumes unitary equipment (packaged and split) that is 20 tons and below, rather than large, built-up HVAC. Large systems are an important energy efficiency and peak management issue but, pursuant to the Commission's big, bold Programmatic Initiative in D.07-10-032, are not directly examined in this Chapter as they have a very different marketplace dynamic than

unitary systems. Many of the factors that influence efficiency of large systems are examined in the Commercial Chapter.

[55] Chris Neme, John Proctor, and Steve Nadel, National Energy Savings Potential from Addressing HVAC Installation Problems; (Prepared for the U.S. EPA, February 1999.) Available at: http://www.aceee.org/pubs/a992.htm

[56] "Strategic Plan to Reduce the Energy Impact of Air Conditioners" AB 2021 Report" June 2008. CEC-400-2008-010. Available at: http://www.energy.ca.gov/2008publications/CEC-400-2008-010/CEC-400-2008-010.PDF

[57] Section 306 of EISA 2007 allows, for the first time, for the U.S. Secretary of Energy to set regional standards for certain HVAC equipment.

[58] Appliances are, in fact, primarily regulated at the Federal level; and for any product that is regulated at the Federal level states are preempted from regulating. Buildings are primarily regulated at the state level; notable exceptions are manufactured housing (which is Federally regulated) and hospitals.

[59] 2007 IEPR.

[60] Chris Neme, John Proctor, and Steve Nadel, National Energy Savings Potential from Addressing HVAC Installation Problems (Prepared for the U.S. EPA, February 1999). Available at: http://www.aceee.org/pubs/a992.htm

[61] See for example Quantec, Statewide Codes and Standards Market Adoption and Noncompliance Rates. Prepared for Southern California Edison May 10, 2007.

[62] EISA 2007 requires state to initiate smart grid proceedings by the end of 2008. All of the IOUs have already filed for recovery of infrastructure investments for smart grid.

[63] "Plugging in the Consume: Innovating Utility Business Models for the Future" IBM Institute for Business Value, 2007. Available at: http://www-03.ibm.com/industries/utilities/doc/content/landingdtw/3165578119.html

[64] California Energy Commission recently held on this emerging CEC Smart Grid research initiative, "Defining the Pathway to the California Smart Grid of 2020". Agenda available at: http://www.energy.ca.gov/research/notices/2008-08-05_RFP_smartgrid/2008-08-05_AGENDA.PDF

[65] The topical convener reports are summaries based on the input received at publicly-held workshops attended by stakeholders, experts, IOU staff and others to provide information and discussion in the development of the California Energy Efficiency Strategic Plan. The CPUC convened the workshops and enlisted leading subject matter experts to serve as conveners for each sector and crosscutting issue in this process. The HVAC Convener Report itself can be found on the California Energy Efficiency Strategic Plan site, http://www.californiaenergyefficiency.com

[66] D.07-10-032, p. 59.

[67] D.07-10-032, pp. 64-65.

[68] Johnson, K., N. Bourassa, and M. Seaman. 2008. "New California PIER R&D Product Introduction Process" Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings. 9:162-171. Washington D.C.: American Council for an Energy-Efficient Economy.

[69] "Local governments" primarily refers to cities and counties, which have land use authority. However, there are also important roles for regional government, metropolitan planning organizations, school and special districts and other local and regional government entities.

[70] California Public Utilities Commission Decision 99-08-021, Ordering Para. 11. See also D.01-01-060 directing the utilities to increase partnerships with local governments to achieve energy efficiency at the local level.

[71] California Environmental Quality Act

[72] Quantec, Statewide Codes and Standards Market Adoption and Noncompliance Rates. Prepared for Southern California Edison, May 10, 2007. Available at: http://www.californiaenergyefficiency.com/docs/hvac/references/Codes_and_Standards_Final_Report.pdf

[73] For more information on the Cambridge project, go to: http://www.cambridgeenergyalliance.org/

[74] Assembly Bill 811 (Levine, 2008) Streets and Highway Code, §§ 5898 et seq. Available at: http://info.sen.ca.gov/pub/07-08/bill/asm/ab_0801-0850/ab_811_bill_20080721_chaptered.pdf

[75] Senate Bill 375 (Steinberg, 2008) Available at: http://info.sen.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_bill_20080902_enrolled.pdf