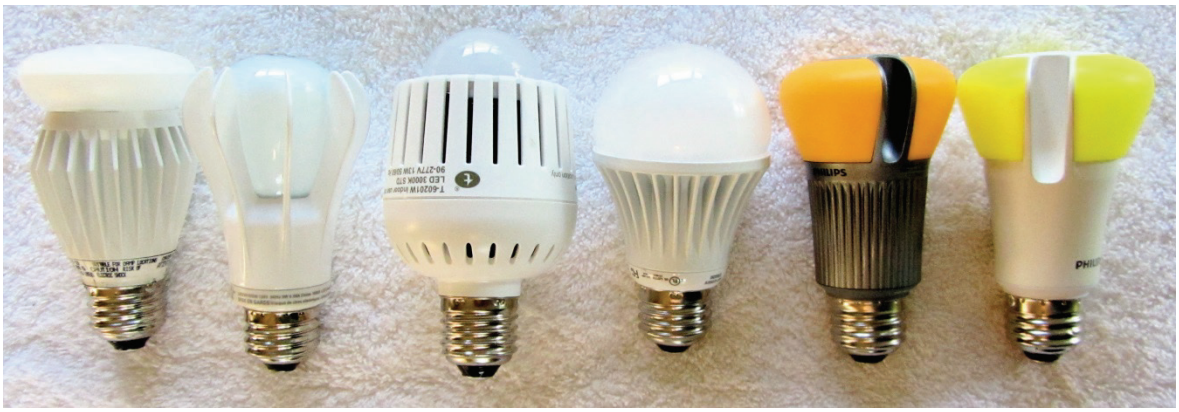
California Public Utilities Commission

REGULATING ENERGY EFFICIENCY



February 2016

A Primer on the CPUC's Energy Efficiency Programs

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I. Introduction

California has been a pioneer in Energy Efficiency since the 1970s, and has been at the forefront of mandatory energy efficient building and equipment standards and voluntary customer programs to encourage customers to use less energy. When California makes plans for new energy resources, energy efficiency is the state's first priority. There are also numerous laws requiring state agencies to increase energy efficiency in all sectors of the economy. Our programs have achieved significant energy savings. From 2010 – 2012 our voluntary customer programs, which are available to about 75 percent of Californians, saved enough electricity to power 800,000 homes for a year, and reduce carbon emissions the equivalent of taking 1 million cars off the road.

Energy efficiency in California benefits our state in a number of ways. First, energy efficiency is an integral part of California's efforts to lead the nation in fighting climate change by reducing greenhouse gas emissions. Efficiency is the cleanest form of energy we have. It also helps the economy by putting people to work and helping California residents and business owners lower their monthly utility bills. And lastly, it saves money by avoiding the need to build expensive power plants and transmission lines.

The top three reasons for California's publicly-funded energy efficiency programs are:

1. **To help reduce greenhouse gas emissions**
   - Energy efficiency is expected to make up 15% of the state's greenhouse gas emission reductions, according to the California Air Resource Board's *AB32 Scoping Plan*.
2. **To help the economy**
   - If Californian homes and businesses are paying less for energy because they're using less energy, that's more money to invest elsewhere.
3. **To avoid new power plants and transmission lines**

Despite the benefits, many people in California don't know much about how energy efficiency works in our state. This primer describes how energy efficiency works, how the California Public Utilities Commission (CPUC) regulates and evaluates efficiency programs, and why it's so challenging and important that we estimate efficiency savings accurately.

II. How Energy Efficiency Programs Work in California: An Overview

California's commitment to energy efficiency has resulted in many different efficiency programs across the state. The programs span a variety of sectors encompassing residential homes and commercial buildings, large and small appliances, lighting and HVAC, industrial

manufacturers, and agriculture. Within those sectors, efficiency programs may use any number of different tools: financial incentives and rebates, research and development for energy efficiency technologies, financing mechanisms, codes and standards development, education and public outreach, marketing, and others.

Each of these programs helps California be more energy efficient, and collectively, these programs result in significant reductions in California's greenhouse gas emissions. In total, energy efficiency is expected to make up 15 percent of the state's greenhouse gas emission reduction targets.

The investor-owned utility (IOU) programs are funded by a small portion of electricity and gas rates included in customer bills, which provides over $1 billion per year to fund IOU energy efficiency programs. These publicly-funded energy efficiency programs are usually administered by the state's four IOUs: Pacific Gas and Electric Company(PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), and Southern California Gas Company. Some programs are administered by Marin Clean Energy or through two "Regional Energy Networks" in the Bay Area and Southern California. All of the programs administered by these different entities are regulated by the CPUC to ensure they are meeting the goals and cost-effectiveness metrics the CPUC is statutorily required to set for the IOU efficiency portfolios.

III. The CPUC's Role

As the public watchdog of these funds, it is the CPUC's job to ensure that the money is well spent. It is critical that this money pay for technologies and strategies that reduce energy usage and that we get the most "bang for the buck" for the funds being spent. Specifically, the CPUC is mandated by the legislature (Public Utility Code Section 454.5) to: "meet unmet resource needs with all available energy efficiency and demand reduction that is cost-effective, reliable, and feasible." To do that, the CPUC sets goals for energy efficiency programs and directs the IOUs to design programs that motivate customers to take energy efficiency actions that wouldn't have happened without the program.

Building Codes Includes:

- Windows
- Insulation
- Heating and Air Conditioning Systems
- Lighting

Appliance Standards Include:

- Kitchen appliances
- TVs and Other Electronics
- Water heaters
- Faucets

The CPUC also measures the energy savings and cost effectiveness of energy efficiency programs. Measuring energy efficiency is very complicated by its nature; it depends on millions of small, hard-to-observe actions being taken by Californians across the state. Assessing the impact of all those actions and figuring out which actions would or

would not have been taken *without* the efficiency program is difficult.

The CPUC's Energy Efficiency Branch, with a staff of about 25 analysts plus a team of independent evaluation consultants, assesses how much energy these programs save and how much those savings cost. This information helps inform the CPUC's Commissioners so they can determine how best to allocate California's large, publicly funded energy efficiency budget.

IV. Appliance and Building Codes

One of the largest factors in California's energy efficiency success story is progressive appliance codes (Title 20) and building codes (Title 24). Every few years, the state issues a new set of rules and regulations that are designed to reduce energy usage while increasing customers' comfort, safety, and health. The CPUC authorizes the IOUs to advocate for energy saving codes and standards at both the state and Federal level. This is because the IOUs are on the front lines of energy savings programs, and are well positioned to advise state agencies to adjust building and appliance codes. The CPUC also authorizes the IOUs and local governments to implement programs that assist builders with building codes implementation and compliance improvement.

Building codes are especially relevant for new construction or major remodeling jobs – times when contractors are required by law to build to code. Code requirements can also be triggered by certain smaller events too, such as equipment replacement or other smaller projects like Heating, Ventilation and Air Conditioning (HVAC) or lighting retrofits.

Some of the technologies that eventually become building code are first introduced to customers through energy efficiency programs that use incentives and rebates funded by public money. At first, a technology determined to be a good investment is offered to customers along with a rebate to encourage customers to purchase it. The rebate may be offered directly to the customer or through an upstream payment to a manufacturer, distributor, or retailer, which lowers the retail price of the technology to the customer. This rebate is usually part of the initial energy efficiency program for that product.

After that technology has reached large market penetration and the costs are reduced, it may be adopted in the building or appliance code, meaning it is now required by law. For example, since the 1970s, there has been a series of refrigerator incentives to encourage more efficient refrigerators. These more efficient refrigerators were then adopted in the appliance code. The average refrigerator today uses 75 percent less energy than one in 1975 (see http://aceee.org/files/proceedings/1980-82/data/papers/1982_020.pdf).

Incentive payments for customer programs are gradually reduced as a technology becomes mainstream, and when a technology is required by code, the incentive is discontinued. Generally speaking, continuing to incentivize something that is required would be like using the public's money to pay drivers to drive the speed limit. IOUs, however, do have a mechanism to provide customers with richer incentives for replacing

inefficient equipment with long lives, provided the utility can prove that its program was responsible for the "early retirement" of that equipment, similar to Cash for Clunkers. The CPUC is currently exploring ways to expedite replacement of old, existing equipment that is below code.

V. How the CPUC Sets Energy Efficiency Goals

The CPUC sets energy savings goals through a periodic analysis called the "Potential and Goals" study. This rigorous study, which is conducted by an independent consulting firm, assesses all of the different technologies and strategies that the utilities could utilize in their energy efficiency programs. The study uses rigorous engineering calculations and policy analysis to determine potential energy efficiency savings. It also assesses the cost effectiveness of those different strategies. The CPUC then uses the findings from this study to set the energy efficiency savings goals for the utilities.

VI. The Importance of Developing Accurate Energy Efficiency Savings Estimates

The CPUC, the California Independent System Operator, and the California Energy Commission (CEC) use energy efficiency savings that result from Codes and Standards and from the IOUs' voluntary energy efficiency programs to plan for future energy needs in order to keep the lights on. This means that when these agencies plan for future electricity generation, renewable energy, and electrical transmission lines, they include projections of the likely energy savings that will come from energy efficiency.

Relying on energy efficiency savings to avoid construction of new energy resources is a tricky process. If a state agency approves a power plant that has a capacity of 500 megawatts (enough to power about 200,000 homes), you can count on those 500 megawatts being available when the power plant is constructed. With energy efficiency we are counting on the promise of energy savings that might rely on the actions of thousands or even millions of individual customers. If future energy efficiency saving assumptions are used to avoid construction of new energy resources, it's critical that our forecast of energy savings is accurate.

In addition to forecasting, the CPUC also evaluates energy efficiency programs to ensure that the savings claimed by the utilities are real and accurate. Overestimating energy savings can have negative consequences for ratepayers and for California's climate change goals and energy security. Accurate and trustworthy forecasts and evaluations help make energy planners as comfortable relying on efficiency savings as they are relying on new power plants.

Costs	Benefits
• Administration • Equipment Paid for by the Program and Customers • Shareholder Incentives • Ongoing Equipment Maintenance Costs	• Avoided Energy and Infrastructure Costs • Environmental • Customer Incentives • Tax Credits

Generally, the program incentives only pay for part of the efficiency action taken or product purchased, and the customer is expected to make up the difference. While it is not easy to get customers to spend money on energy efficiency improvements, it is easy to exaggerate energy efficiency savings, as indicated by the 30 percent discrepancy between the results the IOUs report and those of our independent evaluations. These savings must go beyond the savings that would have occurred as a result of the natural turnover of equipment, technology advances, and customers' own actions. To ensure we don't overestimate how much energy is saved, we must accurately verify the utilities' energy savings claims.

VII. How Energy Efficiency is Evaluated

Four percent of the annual energy efficiency budget of approximately $1.4 billion is dedicated to field-based impact evaluations, market assessment, and other program evaluation activities. Approximately half of this funding is spent by the utilities and the CPUC on market studies, process evaluations, and other studies intended to support existing and future programs. The other half is spent on program impact evaluations (our evaluation research plan is at http://www.cpuc.ca.gov/General.aspx?id=4373). Evaluators are hired through a competitive process, and are among the top energy efficiency evaluators in the field. Per legislative requirement, the CPUC evaluators use field research and current market conditions to verify the utilities' claimed savings, estimate actual program energy savings, and calculate a critical indicator of performance: cost effectiveness.

Cost effectiveness is simply a comparison of a program's costs versus its benefits. The following table shows some examples of what the CPUC evaluators weigh when calculating cost effectiveness. The cost effectiveness policies of the CPUC are outlined in the California Standard Practice Manual (www.cpuc.ca.gov/General.aspx?id=5267), a pioneering efficiency evaluation guide developed in California and used nationwide (National Action Plan for Energy Efficiency, Understanding Cost-Effectiveness of Energy Efficiency Programs, Nov. 2008).

While the concept of evaluating cost effectiveness is simple, the execution is not. Calculating costs and benefits can be a matter of perception and accounting, which means there are often disputes over the overall cost effectiveness of a program. To illustrate this point, imagine an energy efficiency program that pays someone to buy a new washing machine. The benefits of that program depend on how often that household actually uses

the washing machine. The difference between two loads per week and five loads per week, spread over a range of 10,000 households, can really add up.

Another common evaluation challenge deals with questions of who would have upgraded to energy efficiency without the program. For example, if a program offers a $100 rebate for a dishwasher, but half of the participating households were going to purchase the efficient dishwasher without the rebate, the benefit-cost calculations must be adjusted. However, it is difficult to determine with certainty how many people would have upgraded without the rebate. Understanding those details and getting accurate assessments can pose real challenges. CPUC field assessments attempt to understand the true program costs and benefits, but these assessments are sometimes the subject of debate.

VIII. How We're Doing

Evaluation results from the 2010 – 2012 energy efficiency portfolio are summarized below (the evaluations of 2013 – 2015 program activities are underway), and full results, and the detailed data sets, are available on the CPUC's website at www.cpuc.ca.gov/General.aspx?id=6391:

- 7,745 gigawatt-hours of electricity was saved, which is enough to power 800,000 homes for a year. California also saved 6,497 gigawatt-hours of electricity from 2006 to 2008.
- Energy efficiency savings offset nearly 1,300 megawatts of peak summertime energy usage.
- From 2010 to 2012, energy efficiency in California saved 170 million therms of natural gas.
- CO_2 emissions were reduced by 5.3 million tons, the equivalent of taking about 1 million cars off the road, compared to 2006 to 2008 with just over 4 million tons of CO_2 emission reductions.
- Every dollar invested in energy efficiency programs not related to building codes and appliance standards returned $1.04 in savings.
- Every dollar invested in building code and appliance standard advocacy returned $3.64 in savings.
- Energy efficiency created overall savings of $3.3 billion for California's ratepayers. Residential programs saved an average of $192 per household from 2010-2012.

- **Residential energy efficiency programs saved an average of $192 per household from 2010-2012.**

  Every dollar invested in energy efficiency programs not related to building codes and appliance standards returned $1.04 in savings.

- Utilities spent approximately $2.5 billion of an approved budget of $3.1 billion.

In addition, these impressive savings evaluations showed that the programs were cost effective and that the benefits exceeded the costs. These results are evidence that a smart investment in energy efficiency pays off.

Additional Resources

The energy efficiency section of the CPUC website has programmatic and policy information: www.cpuc.ca.gov/egyefficiency/

The energy efficiency statistics website has current evaluation data filed by the utilities, broken down by utility or by program, as well as regulatory and evaluation information: http://eestats.cpuc.ca.gov/

California Measurement Advisory Council has full evaluation reports of energy efficiency programs: www.calmac.org/

For more information, contact:
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Appendix: Frequently Asked Questions

This section clarifies important questions regarding the most common misinformation related to CPUC oversight of the energy efficiency portfolio.

What is the ex-ante review process and why is it so important?
The CPUC uses a process called an "ex-ante review" to assist the IOUs in developing accurate estimates of energy efficiency savings before the efficiency program or measure is put into place. This process is intended to help ensure that the IOUs' savings claims and the CPUC's evaluated savings are relatively close after the efficiency program or measure has been implemented and evaluated. Ex-ante review can create a longer regulatory process, but it helps California avoid disagreements between the IOUs and the CPUC over energy efficiency savings after the programs are implemented, when it is too late to do anything about savings estimate discrepancies.

How does the CPUC's ex-ante review process work and does it have any downside?
Before IOUs can implement an energy efficiency program, they must submit a proposal to the CPUC that includes their plan and their energy savings estimates. For proposals that are complicated or new (about one in every four proposals), a small team of CPUC staff and consultants will perform an ex-ante review to assess the proposed savings estimates. Most often, the review looks at the energy efficiency program's proposed technologies to determine whether a typical customer will actually realize the energy savings the IOUs predict will occur.

One downside of the ex-ante review process is that it creates a longer regulatory review process to approve a new energy efficiency program. Sometimes there are delays in this process from the IOU or the CPUC. This is a relatively new and evolving process and CPUC and IOU staff are working together to improve it.

Evaluation, Measurement, and Verification (EM&V) seems challenging and expensive. How much ratepayer money is spent on EM&V?
EM&V, which also includes strategic planning and policy research, makes up four percent of the entire statewide energy efficiency budget. Impact evaluation is about half of the EM&V budget, or two percent of the overall budget. The other half is spent on identifying energy efficiency potential, understanding market conditions, and improving current program delivery methods The CPUC manages 72.5 percent of the evaluation portfolio and the investor owned utilities manage 27.5 percent. The joint EM&V plan outlines all the studies planned by sector and cross cutting support (our evaluation research plan is posted at www.cpuc.ca.gov/General.aspx?id=4373).

Impact evaluation, while only using two percent of the overall statewide budget, allows the CPUC to do field research by installing measurement equipment and talking to Californians about their energy efficiency savings. Most importantly, it allows the CPUC to assess the effectiveness of and make improvements to a $1 billion per year program.

The CPUC evaluations are transparent, solicit public input on methods and draft results, and are contracted through a competitive bid process that complies with current state contracting requirements.

EM&V results are significantly less contentious than they have been in the past, due in part to the open processes adopted by the CPUC in 2010.

A natural level of contention is to be expected. The purpose of impact evaluations is to verify savings after an intervention has happened in the field. They offer new information to consider in estimating savings in addition to verifying calculations. Results are intended to update estimates, some of which are in the control of the implementer and some which are not, but they all are intended to represent the best available information of the resource available from the intervention now and over time. Some of the most vocal critics of the CPUC's evaluation work are individuals representing firms whose programs' savings were reduced based on the ex-ante review process or had poor results in impact evaluations. Thus it is important that the CPUC conduct its own EM&V review, and is why the CPUC took on this role in 2005. Overestimating energy savings can have negative consequences for ratepayers and for California's climate change goals and energy security.

While some stakeholders believe the CPUC's evaluation work is overly detailed, others criticize the CPUC for not being sufficiently rigorous. This may be the result of trade-offs needed to deliver the results in a timely and comprehensive manner or the fact that most programs are offered to all customers, which eliminates the opportunity to create a "control group." Overall, the wide range of challenges associated with measuring how much a program caused something *not to happen* (the challenge we call the counterfactual) is the core discussion for evaluation practitioners, stakeholders, and policy-makers. The balance of priorities and new methods to manage rigor, timing, and cost is an ongoing public debate at the CPUC.

Are California's standards for evaluations higher than other places?
Determining energy savings is part art and part science. The current state of impact evaluation represents decades of development and adjustment of evaluation techniques and practices. There is nothing particularly unique or exceptional about California's protocols. In fact, the methods from the CPUC's adopted evaluation framework and protocols, which were published in 2006, have served as the foundation for evaluation protocols used in other jurisdictions, including the Department of Energy's Uniform Methods (http://energy.gov/eere/about-us/ump-home).

Why does it take so long to complete evaluations?
Three key drivers stand behind the long timeframe that EM&V reporting requires:

1. Projects need to be finished before they can be assessed. Effective EM&V requires multiple site visits and many data points, so the evaluation process cannot begin until multiple participants complete their projects, and the savings claims have been

submitted to the CPUC. Once the information is submitted the sample design and site visit planning can begin.

2. In order to find statistically significant results, the CPUC needs to collect a large enough sample of reliable data. Samples are targeted and prioritized around expected savings and high uncertainties. Ideally, EM&V will look at a representative number of completed applications, which means many site visits and much data collection. Additionally, evaluations need to assess results over a representative amount of time. Seasonal variation and operations mean that field measurement and tracking needs to capture that information to accurately review the projected savings. While this means increasing the time EM&V takes, it also means better, more reliable information.
3. Outside forces can also play a role in slowing down the EM&V process. This could include the stakeholder comment and engagement process, an integral part of CPUC's transparency for review of methods and results, IOUs not meeting deadlines to provide requested data, and project participants and implementers not cooperating or responding slowly when the CPUC requests to conduct site visits.

What is the CPUC doing to improve EM&V timeliness?

The CPUC is working on a number of ways to improve the timeliness of its evaluations. One way is to embed measurement and verification into program design. Improving evaluation readiness can ensure data collection is focuses on key information gathered from customers at the time of implementation. The CPUC has delivered important interim results to IOUs and other program implementers so they can anticipate changes that may be needed based on final studies. The CPUC has also implemented a new Energy Saving Performance Incentive schedule, which requires ex-post evaluation values approximately a year and a half after program implementation.

Lastly, the CPUC is considering a new regulatory model called the Rolling Portfolio Cycle that, if adopted, will target the spring of every year for publishing results, and the fall for planning the next round of research. Lastly, the CPUC is working to streamline data requirements and embed real-time data collection into program designs. All these initiatives should help make evaluations more timely and effective.

How does the CPUC balance energy savings goals with its mandate to protect ratepayer dollars?

As noted in the body of this document, it is difficult to get people to spend money on efficiency measures whose benefits are received over the life of the measure and can be masked by other factors that result in utility bill changes. On the other hand, people who are already predisposed to purchase efficiency measures are by and large perfectly willing to accept a rebate that reduces the cost of the product they were already planning on purchasing. Consequently, an important challenge of efficiency programs design and implementation is to tip program participation towards customers who wouldn't otherwise

adopt the programs' efficiency measures and, when feasible, away from customers who already intend to purchase the measure.

Consequently, current CPUC policy encourages utilities to reduce "free ridership," but it also recognizes that utility marketing and education programs may be contributing to free ridership by creating a more informed customer base. To acknowledge this tension, the energy efficiency goals that the CPUC currently sets for the utilities are **gross** savings goals. Free ridership comes into play in two other areas – in determining portfolio cost effectiveness and for calculating the IOUs' shareholder incentives.

The reason net savings (those savings that occurred solely because of an energy efficiency program, and that wouldn't have happened on their own) are important for the cost-effectiveness test is best understood in the extreme (i.e., nearly 100 percent free ridership) – if the IOU energy efficiency programs were providing rebates almost entirely to customers who would have taken the measure anyway, then a gross-based (the total savings) cost effectiveness test would indicate a highly cost-effective portfolio that, in reality, was really just transferring rebate dollars from non-participants to participants and wasting all of the associated portfolio administration costs. For the utility shareholder incentive, since the net to gross ratio is a measure of utility program impact, it seems entirely appropriate to reward utility shareholders based on the ability of their energy efficiency programs to induce more savings than would have occurred without the programs.

It's important that our evaluations measure what energy savings happened because of a specific energy efficiency program. Specifically, our evaluations are designed to parse out the savings that would have happened without the program. For instance, if an old motor that needed replacing because it's not performing well is replaced with a new, efficient one that receives a rebate for being incentivized, our evaluations are designed to make that distinction.

- Less than 25 percent of the impact evaluation budget is spent on determining attribution – which means that less than 0.5 percent of the total portfolio budget is used to determine the net impacts programs are having on total savings.
- It is hard to reconcile the limited ways in which attribution impacts the portfolios and the minimal amount of resources devoted to its study with the high level of focus it receives from critics of the EM&V process. Notably, the 2010-2012 impact evaluations resulted in about a 6 percent net savings adjustment compared with the net savings the utilities reported using the portfolio default net-to-gross ratios. The rest of the difference between evaluated and reported was in the IOU claims based on default values.

Should measures that meet building or appliance codes receive incentives?
Many stakeholders worry that the combination of the CEC's increasingly stringent code requirements and the CPUC policy of estimating efficiency savings using a "code baseline,"

rather than a "current consumption baseline," is resulting in a lot of old, inefficient equipment not being replaced. This is also known as stranded savings. Addressing these stranded savings was the intention of Assembly Bill (AB) 802, which will be enacted into law in 2016.

As a result of AB 802, the CPUC and CEC are currently reconsidering their policies on energy efficiency baselines. Here are some of the important factors being considered in the implementation of AB 802:

- Current policy already allows for the use of a current consumption baseline for some or all of an efficiency measures savings under appropriate circumstances. In fact, the CPUC estimates that as much as 40 percent or more of the measures in the current energy efficiency portfolio are credited in the existing conditions baseline.
- An across-the-board current consumption baseline policy will be simpler to implement and much easier for everyone to understand than the current policy. On the other hand, it comes with a serious risk as an across-the-board policy change is adopted, then IOUs are likely to focus on customers and equipment that will probably adopt energy efficiency with or without the programs. That is because, by definition, those customers are the easiest to target – they'll almost certainly say "yes" to an upgrade. This means that those stranded savings would still not be captured and energy efficiency savings claims would be significantly less accurate in terms of measuring program effectiveness.
- As "big data" from new technologies like Smart Meters become more common and easier to use, the need to simplify energy efficiency measurement rules may lessen. It should become easier for program administrators, customers, and the CPUC to utilize data to create an effective, efficient, and easy to understand system for modeling and calculating energy efficiency savings.
- The CPUC could use this opportunity to determine where current policy is creating a "stranded savings" problem and apply a "current consumption baseline" policy to those targeted efficiency projects.

Are the IOUs delivering energy savings?
Yes! Despite disputes over the exact amount of savings, energy efficiency programs are unquestionably creating real and significant energy savings for California. This is backed up by IOU evaluations and CPUC evaluations.

How is energy efficiency considered in energy demand forecasting?
Periodically, the staff experts of the CPUC, the CEC, CAISO, and others convene the Demand Analysis Working Group (DAWG). The members of DAWG bring their expertise in the following areas:

- Inputs to and development of demand forecasts

- Modeling assumptions and techniques used to produce the forecasts
- Approaches for ensuring transparency
- Uses for demand forecast results

Of particular importance to the DAWG are methods and approaches for accounting for energy efficiency savings in projections made to decide what power plants and transmission lines will be needed in the future. These include 1) energy efficiency and demand response — the first resources in the state's energy procurement loading order — and 2) customer-side distributed generation.

The findings and the work of DAWG members heavily influence the energy efficiency forecasts that are published in the CEC's Integrated Energy Policy Report, which in turn informs the CPUC's Long Term Procurement Plan where we authorize new power plants.