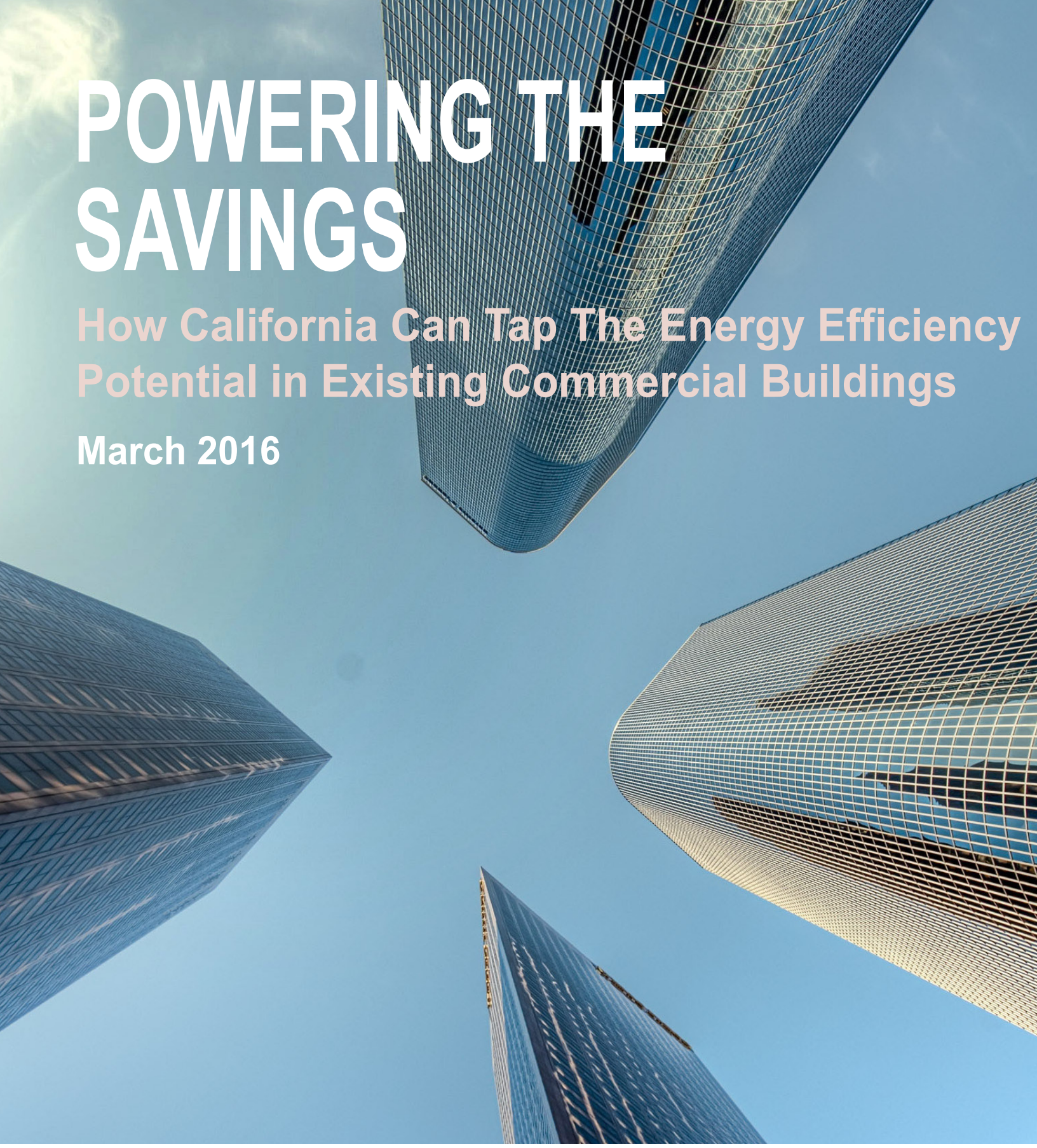

POWERING THE SAVINGS

How California Can Tap The Energy Efficiency Potential in Existing Commercial Buildings

March 2016

Bank of America

BerkeleyLaw
UNIVERSITY OF CALIFORNIA
Center for Law, Energy & the Environment

THE EMMETT INSTITUTE
ON CLIMATE CHANGE AND THE ENVIRONMENT
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About this Report
This policy paper is the seventeenth in a series of reports on how climate change will create opportunities for specific sectors of the business community and how policy-makers can facilitate those opportunities. Each paper results from one-day workshop convenings that include representatives from key business, academic, and policy sectors of the targeted industries. The convenings and resulting policy papers are sponsored by Bank of America and produced by a partnership of the UC Berkeley School of Law's Center for Law, Energy & the Environment and UCLA School of Law's Emmett Institute on Climate Change and the Environment.

Authorship
The author of this policy paper is Ethan N. Elkind, Director of the Climate Change and Business Research Initiative at the UC Berkeley School of Law's Center for Law, Energy & the Environment (CLEE) and UCLA School of Law's Emmett Institute on Climate Change and the Environment. Additional contributions to the report were made by Jordan Diamond of the UC Berkeley School of Law and Sean Hecht and Cara Horowitz of the UCLA School of Law.

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Glossary of Terms

American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE): a global society focusing on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry.

Assembly Bill 802: 2015 California law that directs the California Public Utilities Commission to incorporate measured energy efficiency into its planning, among other provisions.

California Air Resources Board (CARB): An organization within the California Environmental Protection Agency responsible for providing and maintaining clean air, including enforcement of the state's greenhouse gas reduction law (AB 32).

California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA): a state agency that focuses on financing solutions for California's industries, assisting in reducing the state's greenhouse gas emissions, conserving energy, and promoting economic development and jobs.

California Energy Commission (CEC): The state's primary energy policy and planning agency, which includes supporting energy research, developing renewable energy resources, and advancing alternative and renewable transportation fuels and technologies.

California Energy Efficiency Industry Council (CEEIC): a nonprofit that supports energy efficiency and demand response policies and programs for all Californians.

California Global Warming Solutions Act of 2006 (AB 32): California state law which sets out the greenhouse gas emissions reduction goal to be achieved by 2020.

California Independent Systems Operator (CAISO): An independent, non-profit grid operator responsible for maintaining the reliability and accessibility of California's power grid.

California Public Utilities Commission (CPUC): California's agency in charge of regulating investor-owned utilities.

Distributed Energy Resources (DER): smaller power sources that can be aggregated to provide power necessary to meet regular demand, such as storage and advanced renewable technologies.

Energy Service Companies (ESCO): A commercial or non-profit business providing a broad range of energy solutions, including design and implementation of energy savings projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management.

Energy Services Agreement (ESA): An energy savings performance contract in which an ESCO guarantees savings as part of the terms with the building owner.

U.S. Department of Energy's Federal Energy Management Program (FEMP): a program that gathers expertise from all levels of project and policy implementation to enable federal agencies to meet energy-related goals and provide energy leadership to the country.

Heating, Ventilation and Air Conditioning (HVAC): Technology for indoor environmental comfort.

High Opportunity Projects or Programs (HOPPS): AB 802-required energy efficiency efforts, which must use normalized metered energy consumption, with at least a portion of the incentive based on performance, that the Public Utilities Commission must authorize utilities to implement by September 2016.

International Performance Measurement & Verification Protocol (IPMVP): Standard terms and best practices developed by a coalition of international organizations (led by the United States Department of Energy) for quantifying the results of energy efficiency investments and increased investment in energy and water efficiency, demand management and renewable energy projects.

Investor-Owned Utilities (IOU): A privately owned electric company that in California is regulated by the CPUC.

Managed Energy Services Agreement (MESA): An agreement between a third-party contractor who invests in energy retrofits and then assumes responsibility for the building owner's energy bill and relationship with the utility, and a building owner who then pays the contractor a schedule of fixed monthly payments based on historical energy bills (what the owner would have paid if not for the retrofits), which could be corrected for weather, occupancy changes and other factors.

Megawatts (MW): A unit of power that is equivalent to one million watts, generally considered as able to provide sufficient power in any given moment to serve approximately 750 households.

Metered Energy Efficiency Transaction Structure (MEETS): A long term power purchase agreement with a utility for energy not consumed at a building due to efficiency improvements, as measured by a meter that tracks energy saved based on a dynamic baseline, with the building owner paying the bill as if the improvements did not happen and a third party energy efficiency investor paying the owner fixed payments based on a share of the power purchase agreement (i.e. shared savings).

Municipal Utility: A political entity, such as a city or county government, that provides utility-related services such as electricity, water, and sewage.

National Renewable Energy Laboratory (NREL): Federal laboratory dedicated to research, development, commercialization, and deployment of renewable energy and energy efficiency technologies.

Northwest Energy Efficiency Alliance (NEEA): an alliance of more than 140 Northwest utilities and energy efficiency organizations dedicated to accelerating both electric and gas energy efficiency.

On-Bill Financing/Repayment (OBF/OBR): Loan programs that utilize the customer's utility bill as the repayment mechanism for efficiency improvements, with on-bill financing involving an investor-owned utility originating the loan (from ratepayer funds), while on-bill repayment involves a loan from a third-party lender that the customer repays via the utility bill.

Open Energy Efficiency (EE) Meter: A standard "weights and measures" for energy efficiency that calculates the same level of savings for a given set of building efficiency projects, providing near real-time access to metered gross savings, realization rates, and other performance metrics.

Pacific Coast Collaborative (PCC): A forum for leadership and information sharing via formal agreement among Alaska, British Columbia, California, Oregon and Washington.

Property Assessed Clean Energy (PACE): A means of financing energy efficiency upgrades or renewable energy installations for buildings via an assessment on their property tax bills.

Renewable Portfolio Standards (RPS): Legal requirements that a specific percentage of retail electrical power for California comes from eligible renewable energy resources.

Senate Bill 350: 2015 California law requiring a doubling of the efficiency of buildings by 2030.

Western HVAC Performance Alliance (WHPA): A fusion of HVAC, energy efficiency, facility, and property management organizations, as well as researchers, educators, utilities, and regulatory agencies focused on curbing energy waste.

Introduction and Summary: An Urgent Need to Boost Commercial Building Energy Retrofits

Reducing the energy demand from existing buildings, such as through efficient lighting and heating and cooling systems, represents one of the most cost-effective ways to reduce pollution and increase economic savings. It is also crucial for meeting California's long-term climate goals, given that electricity use alone in existing buildings generates almost 21 percent of the state's total greenhouse gas emissions.

The state has relied on a number of policies and programs to achieve greater efficiency for existing buildings, which includes 75 percent of the existing housing stock and 5.25 billion square feet of commercial space. They primarily involve voluntary, consumer-financed measures. Rebate and incentive programs, with utility budgets of approximately $1 billion per year total, have encouraged rather than required the adoption of energy efficient equipment and monitoring.

California will need to look beyond the consumer-financed energy efficiency models currently in place in order to meet the state's climate and energy goals.

Despite these efforts, California's efficiency gains are not keeping pace with electricity load growth, even though a 2015 Navigant Consulting, Inc. study indicated that there is two to three times greater economic efficiency potential in existing buildings than what is achievable via current utility efficiency programs. In addition, program administrator non-incentive costs have grown to represent about half of program expenditures, meaning every dollar of efficiency investment entails an additional dollar in administrative costs.

As a result, California will need to look beyond the consumer-financed models currently in place in order to meet the state's climate and energy goals. Programs will need to harness energy efficiency's potential as a source of revenue and take advantage of new efficiency measurement technologies and structures to simplify current incentives. Changes in state policy and new financing and transaction opportunities will be required to move the state's efficiency efforts in a more cost-effective and scalable direction.

Recognizing this need and economic potential, the state legislature enacted Senate Bill 350 (De Leon, 2015) to require a doubling of the efficiency of buildings by 2030. SB 350 and Assembly Bill 802 (Williams, 2015), which directs the California Public Utilities Commission to incorporate measured energy efficiency into its planning, for the first time contemplate the sanctioning of methods and technologies that explicitly meter energy savings (as opposed to just energy consumption). These technologies can "normalize"

What is normalized metering?

Normalized metered energy data, such as through "dynamic" baseline meters, can track a building's energy and load requirements over time, in order to determine what energy use would have occurred *but for* the energy efficiency improvements. Normalized meters can use a series of algorithms to discover and track a building's energy and load requirements in ways that can be dynamically calibrated to changes in structure, function, equipment, operations, occupancy, and weather. The calibration means the algorithms allow recognition that buildings are dynamic and that the baseline will vary depending on how the occupants use the building. The meters feature ongoing calibration of the baselines and comparison to metered load.

What is pay-for-performance?

Pay-for-performance programs set an energy-savings baseline for a building and then provide incentive payments for energy savings achieved beyond that baseline. The baseline can be dynamic, as with normalized metering technologies. These programs can therefore encourage building owners and their retrofit investors to deploy more substantial efficiency measures than they otherwise might have under traditional rebate or fixed incentive structures.

the energy savings data by creating a baseline that adjusts for such factors as weather, building use, and occupancy. They could potentially enable easier third-party financing via payments based on the performance data (known as "pay-for-performance").

To develop a vision and policies for encouraging deep energy efficiency retrofits, a group of energy retrofit company representatives, finance experts, public officials, utility leaders, and other energy experts gathered at the University of California, Berkeley School of Law in September 2015 for a discussion sponsored by the law school and the University of California, Los Angeles School of Law. They focused primarily on the commercial building sector in California due to its large efficiency potential and relatively fewer market barriers.

The participants envisioned California transitioning away from the complex, consumer-financed energy efficiency retrofit model and toward simpler approaches that rely on emerging technologies that meter energy savings. Transaction structures based on performance data could spur a thriving market for energy efficiency retrofit providers, harnessing robust capital-market financing. The state would then achieve verification of energy savings and the scalability needed to meet long-term energy goals, while building owners would benefit economically with simple, no-upfront-cost transaction structures. Ultimately, with the right technologies and business models, the state could recast energy efficiency as an energy resource in order to stimulate widespread market participation.

Top Four Barriers to Achieving Deep Energy Retrofits in Commercial Buildings

1) **Lack of standard measurement and verification of energy efficiency savings** to provide a basis for pay-for-performance financing and investment at a large scale;
2) **Lack of regulatory certainty to encourage innovative efficiency finance methods** that allow more robust third-party and utility investments in energy retrofits;
3) **Lack of standardized energy data to make energy efficiency performance measurement easier** and to reduce program costs, while encouraging innovation and large-scale capital market investment; and
4) **Lack of a robust energy efficiency private sector to execute and market retrofit projects** once measurement technologies and financing programs achieve the promise of scale.

Solutions to Overcome the Barriers

- **New regulations to encourage utilities to procure energy efficiency** using a building portfolio-based method for pay-for-performance;
- **Utility pilot projects based on emerging normalized metering technologies** to inform real-time estimates of savings and serve as the basis for pay-for-performance financing, with replicable data on current savings;
- **Rate design or tariffs that encourage utility-focused energy efficiency pilot projects with improved financing mechanisms**, such as projects that bundle energy efficiency with other distributed resources; and
- **A roadmap on ways to improve the energy efficiency industry workforce based on a change to pay-for-performance contracting**, which could lay out the projected workforce needs and the specific training that contractors will likely require to implement new program requirements.

The following section summarizes these and other recommendations that are discussed in greater detail in this report, which also contains an overview of current policies related to energy efficiency retrofits and the status of in-state progress to date.

California Public Utilities Commission could:

Encourage utilities to engage in pilots that utilize emerging normalized metering technologies to independently validate these technologies and to identify any needed legislation and regulation, with the end goal of enabling utilities to procure energy efficiency.

Build on existing work on the accuracy and cost effectiveness of normalized metering technology to support field deployment of meters based on the collection and publication of this work and to accelerate their deployment.

Develop and expedite clear and definitive rules to support standardized measurement and verification technologies, particularly for normalized metering, to encourage investment in pay-for-performance programs and projects.

Consider standardizing the reporting of efficiency measure performance for regulated parties seeking incentives to make the current reporting process less cumbersome and to streamline pay-for-performance to make it more efficiently administered.

Consider unifying measurement and verification rules and technologies with other states to facilitate a multistate energy efficiency market, such as by collaborating with entities like the Pacific Coast Collaborative or a coalition of states.

Encourage energy efficiency retrofit pilot projects that utilize pay-for-performance to inform new regulations, starting with a functioning path for rapid approval of innovative pilot projects supported by a specific sponsor and host utility.

Consider requiring a certain percentage of energy efficiency programs to be based on pay-for-performance by a certain date in order to overcome California's low commercial customer realization rates based on rebate programs.

Encourage utility-focused energy efficiency pilot projects that spur improved financing mechanisms for cost-effective energy efficiency retrofits through projects that combine energy efficiency and demand response or that involve utility "preferred resource" combinations of demand-side programs, awarding contracts on a pay-for-performance basis.

Ensure completion of rules that would allow cheaper financing of energy efficiency retrofits by third parties through state-backed credit guarantees such as with the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) rules to offer state credit enhancement benefits for third parties that finance and execute energy efficiency improvements.

Develop a roadmap on ways to improve the energy efficiency industry workforce based on a change to pay-for-performance contracting, which could lay out the projected workforce needs and the specific training that contractors may require based on likely new program requirements.

California Energy Commission could:

Collect and publicize existing work into the accuracy and cost effectiveness of normalized metered efficiency to jumpstart field deployment of meters.

Fund test deployment and standards development that could reduce the cost of dynamic baseline modeling and support technology deployment.

"Over time, 20 to 30 years out, we can reduce building loads by 25 to 40 percent by creating long-term investment opportunities, when efficiency is viewed as a persistent and measureable resource."

- *Cynthia Mitchell*
  Energy Economist
  and TURN consultant

California Legislators could:

Consider developing new legislation based on the results of pilot projects that utilize emerging normalized metering technologies, with the end goal of enabling utilities to procure energy efficiency at utility scale, aggregating multiple sites into a persistent, reliable resource.

Consider legislation that would support research and deployment of normalized metering technologies, in order to reduce the cost of more accurate retrofit metering.

Consider legislation to expedite standardized rules for measurement and verification technologies by accelerating existing proceedings through more ambitious timelines to meet these objectives.

Consider legislation, if necessary, that would help California unify measurement and verification rules and technologies with other states to facilitate a multistate energy efficiency market, such as by collaborating with entities like the Pacific Coast Collaborative or a coalition of states.

Industry Leaders and Advocates could:

Convene experts for follow-up discussions and working groups to assess the progress of various pilot projects and regulatory efforts and to track the progress, identify ongoing challenges, and recommend next steps and solutions for policy makers and the industry to implement.

Develop a roadmap on ways to improve the energy efficiency industry workforce based on a change to pay-for-performance contracting, which could lay out the projected workforce needs and the specific training that contractors will likely require based on new program requirements.

Coordinate and support contractor training efforts through existing networks and programs, in order to educate them on new pay-for-performance programs and rollout timing.

California is Committed to Improving Energy Efficiency in Order to Achieve Environmental and Economic Goals

Energy Efficiency and Climate Goals Rely on Retrofitting Existing Buildings

Reducing the energy demand from existing buildings represents one of the most cost-effective ways to reduce pollution and increase economic savings. The energy savings are also crucial for California to meet its long-term greenhouse gas reduction goals. Electricity use in existing buildings resulted in almost 21 percent of the state's total emissions (see Figure 1, combining imported and in-state electricity generation). Without reductions in this sector, the state will face difficulty meeting its goals under the California Global Warming Solutions Act of 2006 (Assembly Bill [AB] 32) to roll back greenhouse gas emissions to 1990 levels by the year 2020, equivalent to a 15 percent cutback from the business-as-usual scenario projected for 2020.[1] Former California Governor Arnold Schwarzenegger's Executive Order S-3-05 additionally calls for an eighty percent reduction from 1990 levels by 2050,[2] which California reaffirmed in Senate Bill (SB) 391

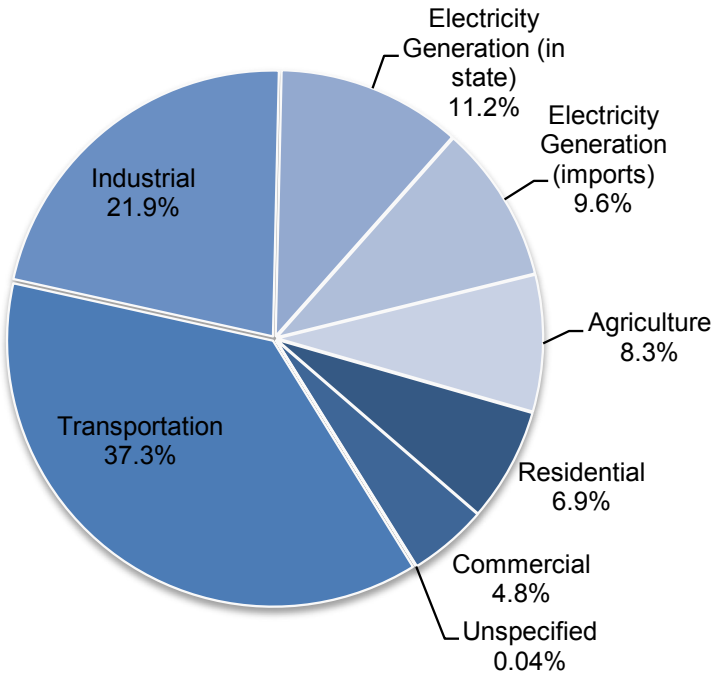
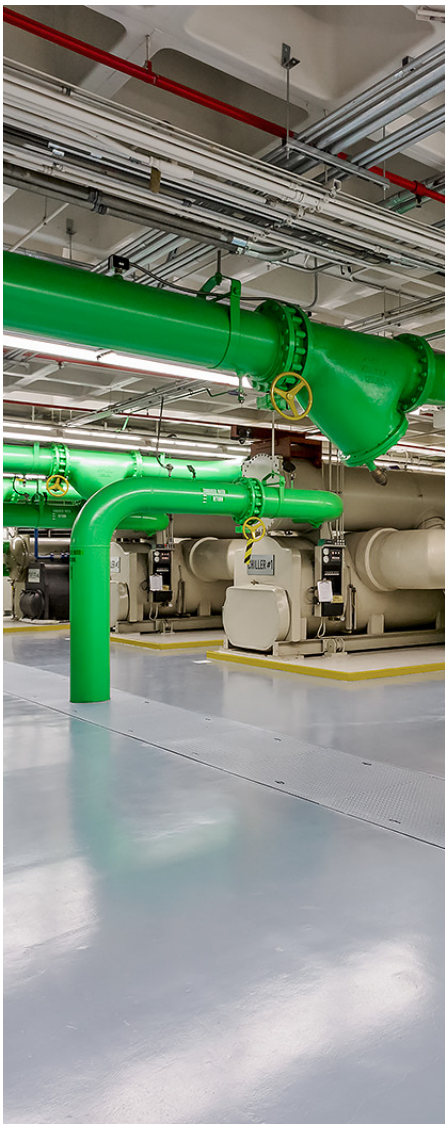


Figure 1. California's Greenhouse Gas Emissions by Sector (2012)
Source: California Air Resources Board



(Lowenthal, 2009), SB 350 (de Leon, 2015) and in the AB 32 Scoping Plan first update.[3] Meanwhile, Executive Order B-30-15 calls for 40 percent reductions by 2030.[4] California also set specific goals for energy efficiency in recent legislation. Among other goals, SB 350 codified the energy efficiency target of doubling energy efficiency in buildings by 2030. It also added mechanisms for enforcement.[5] As a result, California will need significant improvements in the efficiency of its existing buildings to meet this ambitious target.

California's Commercial Energy Efficiency Efforts Have Largely Involved New Building and Appliance Standards and Voluntary Retrofit Measures

Achieving these ambitious energy efficiency goals will require modernizing the state's existing energy efficiency policies. These efficiency measures have been a part of state policy since the 1970s, when California was one of the first states to take the lead on energy efficiency measures. The state adopted mandatory appliance and building efficiency standards in the late 1970s, including Title 24 in 1978, which created mandatory energy efficiency standards for new buildings, both residential and commercial.[6] Then in response to the market manipulations that caused statewide electricity shortages in 2000 and 2001, the legislature and agencies responsible for developing and implementing California's energy plans made energy efficiency the first option that utilities must pursue to acquire new sources of energy, before building new power plants.[7]

Because 75 percent of the existing housing stock and 5.25 billion square feet of commercial space was built before the Title 24 standards, these buildings represent a greater portion of the demand. For example, the energy requirements for space heating, cooling, and water heating in residential buildings constructed during the 1970s (pre-Title 24 and other efficiency standards) are over twice the energy requirements for comparable systems in houses built in 2005.[8] As a result, this older stock of buildings represents a critical and largely untapped market for energy efficiency improvements to meet state goals.

To improve the energy performance of these existing buildings, the state's effort to date have relied on the voluntary consumer market. California policies have boosted rebate and incentive programs, which encourage rather than require the adoption of energy efficient equipment, behavior, and monitoring. They also rely primarily on the consumer bearing most of the upgrade cost. Financial backing for these incentive pools began in 1996 from a "Public Goods Charge" on utility bills,[9] but since 2013 have been provided through energy procurement funds (see Figure 2).[10] These funds come from the rates established at the same time as California's decoupling policies, which separated investor-owned utility profits from the amount of energy consumed.[11] This scheme eliminated some of the utilities' disincentive to encourage lower consumption based on energy efficiency, as utility revenue is no longer dependent on usage. Furthermore, utilities must use those ratepayer funds to implement only cost-effective energy efficiency measures in order to stay in compliance with California law.[12]

California's older stock of buildings represents a critical and largely untapped market for energy efficiency improvements to meet state goals.

Once collected, the California Public Utilities Commission oversees expenditures, which include energy efficiency programs, research, and renewable energy technology.[13] Utilities are ultimately responsible for creating programs and portfolio budgets, but they must be approved and overseen by the California Public Utilities Commission. The commission has also been in charge of evaluating the results of such programs since 2005.[14]

Commercial Buildings Are a Key Opportunity for California's Efficiency Programs

The commercial sector remains a key market for potential energy efficiency growth, and investor-owned utilities have targeted them via rebates and incentives. A 2013 study commissioned by the California Public Utilities Commission found that the commercial sector had the greatest potential for growth and the lowest market barriers.[16]

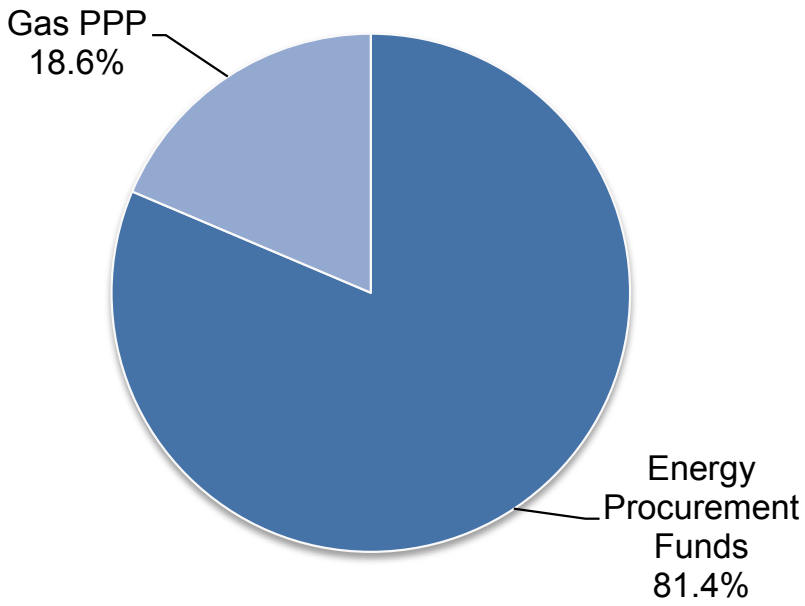


Figure 2. California's Annual Energy Efficiency Budget, 2013-2014[15]
Source: California Public Utilities Commission

California's investor-owned utilities have both incentive and rebate programs targeted at commercial customers. Typical incentive programs provide commercial ratepayers cash payments based on the energy saved from installing efficient equipment that exceeds code.[17] Pacific Gas & Electric's commercial incentive program, for example, pays customers based on the peak demand and annual energy saved due to the installation of equipment such as lighting, boilers, and chillers.[18] Unlike incentives, rebates are not paid depending on energy savings after installation of new equipment but instead are paid up front to help offset the incremental cost of higher efficiency equipment. All three major investor-owned utilities have extensive rebate lists, with qualifying products ranging from water pumps to LED fixtures to commercial fryers.[19]

In 2013, California allocated almost $1.8 billion, with annual budgets of approximately $1 billion, to support energy efficiency programs across all sectors.[20] During that year, the total budget for commercial programs was over $510 million. The largest pieces of funding came from investor-owned utilities; though their individual program budgets ranged from $18 million (SoCalGas) to $171 million (SoCalEdison), they contributed nearly $380 million altogether, with an additional $135 million from outside sources. Within that larger budget, $164 million was allocated to commercial incentive programs, of which $140 million funded statewide programs.[21]

California's Efficiency Efforts Have Been Insufficient to Meet New Energy Goals

With the large amount of funding these various programs receive and the market opportunities, California's commercial sector saved 1,112 gigawatt hours of electricity in the first year of utility reporting in 2013, with a utility program budget of $510 million. Meanwhile, overall energy savings that year totaled 3,704 gigawatt hours, with a total program budget of $1.969 billion.[22] Compared to the state's average annual electricity usage of 265,000 gigawatt hours, with increases of over 1% per year on average,[23]

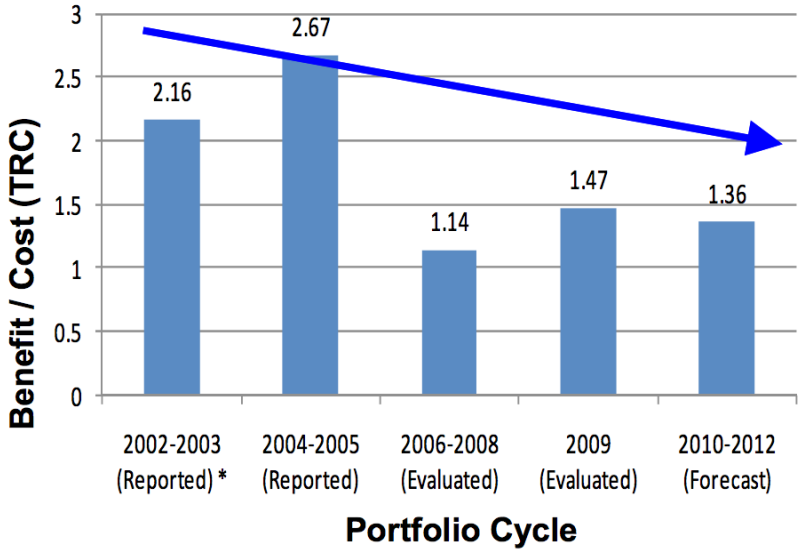


Figure 3. California's Declining Cost-Effectiveness for Energy Efficiency Spending [28]

Source: California Public Utilities Commission

Program administrator non-incentive costs have grown to represent about half of energy efficiency program expenditures.

those savings are not keeping pace with electricity load growth.[24] Projected future savings to be gained through the same means were also set to decline, due to a forecasted shrinking supply of easy efficiency upgrades (see Figure 3).[25] Program administrator non-incentive costs have meanwhile grown to represent about half of program expenditures.[26]

California efficiency efforts have overall been insufficient to encourage the full potential of cost-effective efficiency measures in existing buildings. A 2015 study by Navigant indicated that the economic efficiency potential in existing buildings was two to three times greater than what would be achievable via current voluntary incentives and policies (dubbed "market achievable" in the study). For example, although these figures are projected to narrow over time, the study found the 2016 economic potential of efficiency measures to be approximately 33,700 gigawatt hours, compared to 8,620 gigawatt hours in market potential (see Figure 4).[27]

Based on these results, California will need to look beyond ratepayer-financed programs in order to meet the state's long-term goals. Programs will need to capitalize on energy efficiency's potential and take advantage of new efficiency measurement technologies and structures to simplify current incentives. Changes in legislation, California Public Utilities Commission regulations, and financing and transaction opportunities will be required to move the state's efficiency efforts in a more cost-effective and scalable direction.

Partly in response to the lack of progress on efficiency to date, the California legislature and energy regulatory agencies have devised a suite of policies to improve performance. On the legislative front, Governor Schwarzenegger signed AB 758 (Skinner) in 2009 to require the California Energy Commission to develop a comprehensive program to achieve greater energy savings in the state's existing residential and nonresidential buildings, focusing attention on the problem.[29] More recently, SB 350 included provisions that push for standardized energy efficiency measures and "programs that link incentives directly to measured energy savings."[30] And most promising of all, AB 802 directed the California Public Utilities Commission to incorporate measured energy efficiency into its goals, portfolios, and budgets. Though AB 802 was primarily aimed at implementing a statewide benchmarking program, it also included provisions helping commercial and multifamily building owners to

Figure 4. Statewide Technical, Economic and Cumulative Electric Potential

Source: Navigant Consulting

access whole-building data so long as they are above a minimum tenant threshold. As a result, they can track and measure energy usage more easily. AB 802 also authorized utility incentives and rebates for customers to increase the energy efficiency of their buildings based on all estimated energy savings, rather than only savings that start at the code baseline.[31]

The California Public Utilities Commission is Currently Evaluating Enhanced Programs to Improve Energy Efficiency

California's primary energy utility regulatory agency is also developing regulations and approving utility procurements that could have a significant impact on energy efficiency uptake in the state's commercial building sector. First, the agency is attempting to improve how energy produced by distributed resources can be better utilized. These distributed energy resources (DERs) mean energy-producing resources on the consumer side of the grid, such as energy efficiency, electric vehicles, rooftop solar, and demand response.[32] State policy makers are focusing on ways to integrate these resources into the grid, with efficiency-related measures as part of the mix.[33] In addition to grid integration, the state is finding ways to bring distributed energy resources into the California Independent System Operator (CAISO), which could potentially include energy efficiency as a resource.[34]

In 2013, the California Public Utilities Commission instituted a rulemaking regarding energy efficiency portfolios and programs in the state, which outlined the part that "rolling portfolios" would play and made clear that, despite an eye toward the long-term, adjustments would be made as needed. Currently in its second of three phases, each rulemaking within the proceeding will address slightly different issues within the policy itself, as well as any other issues that arise, such as scope changes to bring the proceeding in line with the standards imposed by the passage of SB 350 and AB 802.[35]

On the procurement side, in September of 2013, Southern California Edison requested offers to meet local capacity requirements in both the West Los Angeles Basin and Moorpark Sub-Areas and was authorized to procure 1400-1800 and 215-290 megawatts for each area, respectively. The utility purchased some energy efficiency and demand response products, among procurement totals of 1891.8 and 328.5 megawatts for each location.[36] Due to the retirement of the San Onofre Nuclear Generation Station, San Diego Gas & Electric was similarly authorized to accept offers to help meet its local capacity requirements, including energy efficiency. San Diego Gas & Electric is seeking to procure as many as 775 megawatts from renewable facilities (with a maximum of 800), with final agreements to be submitted to the California Public Utilities Commission in early 2016.[37] These regulatory proceedings and procurement experiences, with continued policy direction, could shape the future of energy efficiency uptake in California.

"Today we are expecting consumers to finance energy efficiency retrofits as if they will be around for a 20-30 year payback. And they won't do it."

- *Workshop Participant*

New Financial and Transactional Opportunities Are Emerging for Efficiency Improvements

With current state policies, coupled with federal action to encourage energy efficiency retrofits, three general types of business models and transaction structures have emerged:

1. Credit-Enhancement and Debt Financing

These models involve consumer-financed retrofits with low-cost financing. The prominent models include on-bill financing/repayment and Property Assessed Clean Energy (PACE).

On-Bill Financing/Repayment. On-bill financing (OBF) and on-bill repayment (OBR) are loan programs that utilize the customer's utility bill as the repayment mechanism. On-bill financing involves investor-owned utility originating the loan (from ratepayer funds), while on-bill repayment involves a loan from a third-party lender that the customer repays via the utility bill.

"On-bill financing at PG&E has been successful, with year-over-year loan volume growth of about 80% through 2014. One hurdle for customers is, 'even if this is a zero interest loan I have to repay, what happens if the energy savings don't materialize – will my contractor be around over the life of the loan?'"

- *Al Gaspari, Jr.*
  Pacific Gas & Electric

In California, on-bill financing provides commercial property owners with zero-percent interest loans to finance energy efficiency improvements on their property. Loans range in amount from $5,000 to $100,000 and are repaid over a period typically 3 to 5 years long.[38] Payments are made directly through the recipient's utility bill.[39] Loans are extended either by the utility itself using ratepayer funds or a program administrator, such as a government agency, and that same organization bears the risk of non-repayment. This financing structure carries several benefits. First, customers can achieve bill neutrality, with the monthly repayment amount being less than or equal to the energy savings a customer will enjoy by making the improvement. Second, commercial property owners have the opportunity to obtain financing that does not require a traditional credit review or guarantee/security interest. Third, the customer risks utility service disconnection if they fail to make timely payments.[40] Based on these advantages, average default rates are low, with the State & Local Energy Efficiency Action Network finding the average default rates for seven non-residential programs were between only 0.57% and 2.90%.[41] However, these programs may be limited by their reliance on ratepayer capital in terms of scalability and potential to finance large energy retrofits.

Presently, the major California investor-owned utilities (San Diego Gas & Electric, SoCalGas, SoCal Edison, and Pacific Gas & Electric) all provide similar on-bill financing programs for their commercial customers.[42] As of May 2014, over $43 million in funding had been provided to over 1,300 California projects.[43] On a nationwide scale, over 25 states were preparing to implement or had already begun on-bill financing programs as of January 2014.[44]

PACE. Property Assessed Clean Energy (PACE) programs assist owners in financing renewable or energy efficiency projects via a private-public funding partnership. PACE financing providers cover 100 percent of the project's upfront cost, eliminating the burden of paying out of pocket. Project cost is recovered via an assessed property tax over the

course of up to 20 years. For that reason, PACE financing is available only in counties or districts where local governments have authorized the tax collection recovery program. This tax repayment method is further eligible for other benefits (e.g., interest might be deductible, payments might be amortized, the loan might be transferable along with the property, etc.).[45] The long-term repayment structure, however, allows property owners to take advantage of cash-flow positive projects, paying less each month than they save in energy or water costs.[46] As with on-bill financing, commercial property owners also benefit from the fact that PACE providers do not require a credit score.[47] However, the program requires some equity in the building and approval by the existing commercial mortgage holder.

PACE financing for commercial projects is on the rise both in California and nationwide, as more states pass the required legislation. In the second quarter of 2015, 33 commercial PACE projects were funded across the US, totaling $22.8 million. During that same period, one California PACE provider, Figtree Financing, funded $4.5 million worth of small commercial energy efficiency projects, while provider CaliforniaFirst financed the largest PACE project to date for $2.5 million. Presently, commercial PACE funding across the US totals approximately $147 million. Based on the initial success of the program, analysts project both residential and commercial PACE programs to see continued growth.[48]

"There is lots of low-hanging fruit out there with the smaller-size customer, which allows us to create a customer class. You may start out with retrofitting lights, but then you have four years to sell the customer the next level of technology."

- *Arjun Saroya*
  Lime Energy

2. Contractual Performance-Based Financing

This model involves third parties paying for the retrofits and then sharing in the "profits" (energy savings) with the building owners or tenants. The third parties, typically contractors, guarantee the savings. Prominent examples include ESCOs, ESA and MESA.

Energy Service Companies (ESCOs) / Efficiency Services Agreement (ESA): ESCOs are typically third-party energy retrofit project developers that lead the project's design, financing, installation and operation. The ESCOs guarantee the energy savings as part of the terms of their energy savings performance contract with the building owner. This contract, referred to as the Efficiency Services Agreement (ESA), creates pay-for-performance energy efficiency financing, in which payments are made based on metered efficiency savings compared to an adjusted baseline, with no upfront cost to the building owner. Through the ESA, a third-party investor covers the full cost of the retrofit development and construction. The building owner then pays a portion of the energy savings to the investor. ESA service payments may be either based on the actual energy units saved, such as avoided kilowatt hours of electricity or avoided therms of natural gas, or pre-agreed in a deemed savings payment.[49]

"It's about buying something from the building, not selling a project to a building owner. Efficiency is energy, but we usually require it to be net metered."

- *Bill Campbell*
  Equilibrium Capital

Managed Energy Services Agreement (MESA): With MESA, a third-party contractor invests in the energy retrofits and then assumes responsibility for the building owner's energy bill and relationship with the utility. The building owner then pays the contractor a schedule of fixed monthly payments based on historical energy bills (what the owner would have paid if not for the retrofits), which could be corrected for weather, occupancy changes and other factors. The building owner receives a monthly invoice from the contractor, reflecting a reduced rate or fixed, guaranteed savings, from the baseline usage for a fixed period of time. The contractor typically receives any utility incentives available for the retrofits to reduce the amount of the capital investment to be recovered from the customer payments.

3. Metered/Regulatory Performance-Based Financing:

The prime example of this model is the metered energy efficiency transaction structure, or MEETS, which creates a revenue stream from energy non-use. The initial pilot project was pioneered by Portland-based EnergyRM with the utility Seattle City Light and the Bullitt Center (see photo), which became operational in April 2015.[50]

Metered Energy Efficiency Transaction Structure (MEETS): A MEETS transaction begins with the installation of a software system that collects and normalizes the building's energy consumption, providing an adjustable, normalized baseline against which energy

Bullitt Center in Seattle

efficiency can be calculated. The software uses a calibrated building model within a building, also known as a "dynamic baseline" meter such as EnergyRM's "DeltaMeter." A project developer, such as an affiliate of the building or a third party backed by appropriate investors, signs a lease to become an "energy tenant" of the building. The energy tenant sells this energy savings to a utility according to the dynamic baseline meter readings, at a power purchase agreement rate that over its term may increase less than projected increases in the utility tariff rate.

The building owner benefits by receiving a share of the savings through "rent" payable under the energy tenant's lease, which is a percentage of the revenue generated from selling savings to the utility. As a result, the building owner gains as savings increase. At the same time, the building owner agrees to pay a utility bill consisting of actual energy usage, *plus* the calculated savings during the lease term that is based on what the utility bill is estimated to have been without the tenant improvements. The building owner's bill therefore does not change, as the total normalized energy consumption, as billed by the utility, remains what it would have been had the building not been improved. The monetary gain that the owner receives is from the aforementioned "rent" payments. Meanwhile, the utility receives its expected cash flow from the property, while the building's load is substantially reduced. The sale contract (power purchase agreement) with the utility provides a steady cash flow that can attract investors, ideally in the same way that investors are attracted to wind farms or rooftop solar arrays. As mentioned, the first MEETS project was implemented in 2013 between Seattle City Light (the utility) and the Bullitt Center building.[51]

Though still in the pilot stage, the MEETS structure has the potential to address multiple parties' interests: building owners receive increased revenue and a better building with no cash outlay; tenants get a better performing building with no increase in costs; ratepayers get better assurance of actual efficiency gains while potentially forestalling increased costs from conventional efficiency structures that may reduce utility revenue and therefore increase costs for remaining units; and utilities face diminished risk of lost revenue and can become investors themselves in MEETS projects. In addition, the long-term power purchase agreement structure of MEETS (up to 20 years) can enable deep energy retrofits without the use of utility ratepayer incentive dollars.

Transaction Structures and Typical Barriers to Retrofit Adoption

Each of these transaction structures have the potential to address various barriers identified by convening participants. The following matrix (Figure 5) lists these barriers and indicates which structure may address them. A more in-depth discussion of the priority barriers, along with recommendations to address them, follows.

Which transaction structures address the following barriers?

* Y = Yes they address the barrier

COMMON RETROFIT BARRIERS	Credit Enhancement/ Debt	Contractual Performance	Regulatory Performance/ MEETS
Lack of standard measurement/verification			Y
Too much focus on evaluation, measurement & verification			Y
No market for energy savings as a grid asset			Y
Lack of utility training/finance expertise			
Regulatory uncertainty or limits	Y	Y	
Insufficient contractor training/workforce			
Split incentive between owner/tenant			Y
Tenant exposure to performance risk/tenant incentives lacking			Y
Lack of property owner access to building	Y		Y
Utility disincentive			Y
Difficulty accounting for behavior changes	Y	Y	Y
Unclear role of utility	Y	Y	Y
Rate design does not incentivize savings			Y
Lack of standardized data and utility programs			Y
Need for bounded risk	Y	Y	Y
No funding for continuous commissioning and operation & maintenance savings		Y	Y
Difficult customer process/"doorstep conversation"	Y		Y
Marketing solution challenge			Y
Difficulty tracking changing use impact on contract	Y	Y	Y
Lack of information about customers			
Risk of changing evaluation later based on utility measurement	Y	Y	Y
Risk placed on contractors or building owners			Y
Lack of credit enhancement	Y	Y	Y

Figure 5: Transaction Structures and Common Energy Retrofit Barriers
Source: UC Berkeley / UCLA School of Law convening

Barrier #1: Lack of Standard Measurement and Verification of Energy Efficiency Savings

Financing energy efficiency measures based on performance is only feasible if building owners, utilities and policy makers can accurately measure the energy saved by the retrofit. The current practice of standard measurement and verification of efficiency is essentially an estimation of savings based on statistics integrated across thousands of discrete and dispersed efficiency measures. As a result, efficiency is an estimation of savings, not a measurement of metered load reductions. Efficiency savings therefore do not always equate to real reductions in load and energy usage at the customer meter.

A number of entities have developed evaluation, measurement and verification technologies and protocols, but California regulators have not officially sanctioned any particular set of technologies or methodologies for energy efficiency. As a result, utilities and third parties may be reluctant to rely on these technologies or standards in the absence of more regulatory certainty. Without a standard, transparent, and agreed-upon method and technologies to measure energy savings, the state cannot achieve a pay-for-performance platform or encourage the market to innovate and invest in energy efficiency retrofits.

"Standard measurement of energy savings would serve as the basis to secure investment-grade performance insurance, which in turn provides assurance to attract more significant capital and more attractive terms."

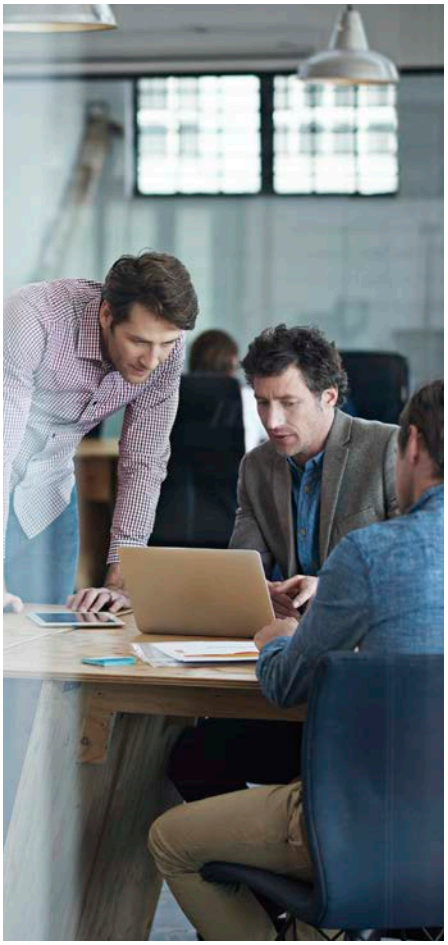
-- Dennis Quinn
Joule Assets, Inc.

SOLUTION: Pilot Projects With Measurement Technologies That Track Normalized Metered Energy Usage Can Inform New Regulations

Performance measures based on normalized metered energy data, such as through "dynamic" baseline meters, can track a building's energy and load requirements over time, in order to determine what energy use would have occurred *but for* the energy efficiency improvements. Some participants advocated expanded deployment of these normalized meters that use a series of algorithms to discover and track a building's energy and load requirements in ways that can be dynamically calibrated to changes in structure, function, equipment, operations, occupancy, and weather. The calibration means the algorithms allow recognition that buildings are dynamic and that the baseline will vary depending on how the occupants use the building. The meters feature ongoing calibration of the baselines and comparison to metered load. Ultimately, the state should move toward automation of energy savings measurement and verification, which would be a key technology enabler for third-party, performance-based contracting models.

California Public Utilities Commission leaders should encourage utilities to engage in pilots that utilize emerging normalized metering technologies. The Commission could direct utilities and other energy efficiency program administrators to develop a pilot project to independently validate the scope of meter technologies, such as EnergyRM's "DeltaMeter" or equivalent normalized meter, provided the technologies match the California Energy Commission and Public Utilities Commission's accepted basis for incremental load change. The Commission may want to encourage a range of projects that use both individual buildings and a portfolio-based (multiple buildings) statistical approach to measurement and

verification, in order to give utilities greater energy efficiency opportunities, provided they maintain transparency. AB 802 provides this opportunity by requiring the Public Utilities Commission to authorize utilities to engage in high opportunity projects or programs (HOPPs), which can be open-ended in terms of program and project type and design and must use normalized metered energy consumption, with at least a portion of the incentive based on performance. By law, these programs must be fully implemented by September 2016, providing an opportunity for immediate pilot projects using the metering technologies and for the California Public Utilities Commission to move to implement AB 802 on an aggressive and expedited timetable, as well as encourage programs that let the market innovate more freely.



Participants wanted the agreed-upon method and technology to inform real-time estimates of savings and provide replicable data on current savings. They agreed that whatever the methodology and technology used in the pilot projects, utilities will need clear direction on how to measure the energy baseline, without any technology or measurement issues that might be open to interpretation or challenge. Utilities will also need short-term successes with customers to make the broader case for wholesale changes as to how energy efficiency is financed. These pilot projects should therefore inform new legislation and regulation, with the end goal of enabling utilities to procure energy efficiency using a portfolio-based method. The commission should therefore encourage transparent and standards-based approaches to measurement.

The California Public Utilities Commission or Energy Commission should build on existing work to improve the accuracy and cost effectiveness of normalized metered efficiency. Much work on the accuracy, reliability, and cost effectiveness of normalized meter technologies and methodologies has been done by research entities such as National Renewable Energy Laboratory in Boulder, Colorado and in the Pacific Northwest by Northwest Energy Efficiency Alliance (NEEA, a non-profit organization that accelerates energy efficiency in the Pacific Northwest through the adoption of energy-efficient products, services and practices), Cadmus, Idaho Design Labs, Seattle City Light, Portland State University, and others. California could benefit from reviewing this work to bolster the state's development of calibration protocols under all-source procurements, leading to a potential jumpstart in field deployment of the meters. The appropriate state agency should collect this work, build on it, and publish it on their websites.

The California Legislature, Energy Commission and Public Utilities Commission should accelerate deployment of normalized metering technologies. Technology purveyors of normalized metering technologies would benefit from additional support to verify existing technologies, improve and tailor them to California's specific requirements, and encourage the development of additional purveyors. Concurrent with efforts to develop pilot projects using various evaluation, measurement and verification technologies, policy makers could dedicate research and development funding that might reduce the cost of more accurate retrofit metering that leverages new technologies.

Industry leaders and advocates could convene experts for follow-up discussions and working groups to assess the progress of various pilot projects and regulatory efforts. As the pilot projects deploy, industry leaders and other stakeholders may want to formalize expert working groups to track the progress, identify ongoing challenges, and recommend next steps and solutions for policy makers and the industry to implement.

California Public Utilities Commission leaders should develop and expedite clear and definitive rules to support standardized measurement and verification technologies, particularly for normalized metered efficiency. Without regulatory approval of these technologies, industry actors may be reluctant to

invest in pay-for-performance programs and projects. Convening participants noted that dozens of reputable measurement and verification methodologies already exist, such as the International Performance Measurement & Verification Protocol (IPMVP), American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), and U.S. Department of Energy's Federal Energy Management Program (FEMP) standards. These methodological standards, particularly IPMVP, have already been adopted in many jurisdictions and form the basis for some California energy policy.

The California Public Utilities Commission should consider standardizing the reporting of energy conservation measure performance by parties seeking pay-for-performance incentives. Many convening participants felt that the current reporting process is cumbersome and could be streamlined to make pay-for-performance incentives more efficiently administered. The commission could use methodologies related to pay-for-performance, as described above, with incentives paid quarterly within a specified number of days of receipt of reports demonstrating performance. Performance reports could provide normalized meter data from the participating site. Third-party servicers could potentially provide these reports or metering service, instead of the utilities, as occurs with Energy Trust of Oregon, with baselines that evaluate the isolated effect of particular retrofits.[52]

"Establish a standard with broad acceptance, demonstrate compliance with the standard, and then you will get traction with utilities. Not until."

- *David Jacot Los Angeles Department of Water & Power*

State leaders should consider unifying measurement and verification rules and technologies with other states to facilitate a multistate energy efficiency market. California Public Utilities Commission leaders, following the finalization of California rules, could collaborate with entities like the Pacific Coast Collaborative (PCC), which works to harmonize environmental policies across California, Oregon and Washington. This broader effort could also include the Energy Trust of Oregon, Northwest Energy Efficiency Alliance, NREL, and the Regional Technical Forum (an energy efficiency standard-setting body in the Bonneville Power Administration area). A coalition of states could collectively address advanced metering solutions with the aim of creating a standardized market. Ultimately, a multi-state market for energy efficiency, using standardized measurement and verification technologies, could encourage more investment and innovation by the energy efficiency industry and its financial backers.

The California Legislature should consider legislation to expedite standardized rules for measurement and verification technologies. Pursuant to SB 350, the California Public Utilities Commission will assess and adopt policies that promote pay-for-performance efficiency programs. Given the urgency of meeting the 2030 goals, state legislation could allow the commission to expedite the process for adopting measurement and verification rules in its upcoming proceeding pursuant to SB 350. Considerable work has been done in the private sector to standardize functional specifications for both static baseline meters (those accommodating weather changes but not other changes in buildings) and "dynamic" baseline meters (those incorporating all basic elements of the IPMVP methodology.) California should consider piggybacking on these functional specifications to expedite standard rules for such technologies and procuring standard engines and methodologies for dynamic baseline metering. The agency could also expedite the third phase of its ongoing energy efficiency proceeding to meet these objectives. Legislation could therefore strengthen and accelerate these existing proceedings to set more ambitious timelines.

Barrier #2: Lack of Regulatory Certainty and Rate Design to Encourage Innovative Efficiency Programs

Participants at the convening noted that current regulations may stifle pay-for-performance finance programs or incentives. Many participants believed energy efficiency should be considered as a capacity resource that utilities could procure along with resources like generation, demand response and energy storage. Regulators should ensure that current rate design and regulations are not unintentionally inhibiting utilities from procuring energy efficiency in this manner, while utilities and market actors need certainty regarding rules and regulatory support for these initiatives.

SOLUTION: Regulatory And Rate Design Pilot Projects That Could Encourage Pay-For-Performance Business Models And Inform New Policy

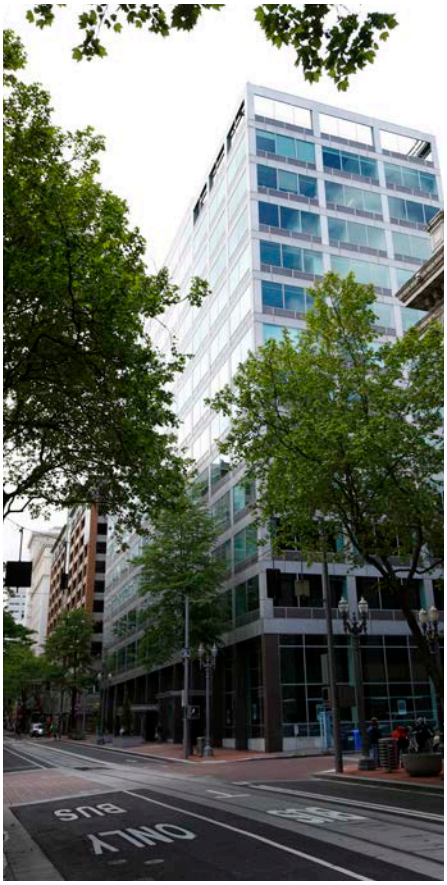
With the passage of SB 350, California is now committed to pay-for-performance models for energy efficiency retrofits. The state may need tariffs to encourage utilities and market actors to design programs that can meet these objectives, (although new regulation may not be necessary, as Seattle City Light's MEETS pilot did not require a new tariff or rate system in that jurisdiction). Pilot projects can inform policy makers about the best way to encourage the development of this market, while utilities would benefit from short-term successes with customers to make the broader case for wholesale changes in how energy efficiency is financed.

California Public Utilities Commission leaders should encourage energy efficiency retrofit pilot projects that utilize pay-for-performance. These pilot projects could inform new regulations to launch more pay-for-performance mechanisms for energy efficiency. The commission could introduce a functioning path for rapid approval of innovative pilot projects supported by a specific sponsor and host utility. As a possible framework, the commission could authorize execution of long-term projects (up to twenty years) that address the substantial aggregation barriers that limit energy efficiency uptake in California. These projects need sufficient time for implementation and outcome measurement, as well as capital formation necessary to demonstrate the benefits.

California Public Utilities Commission leaders could encourage utility-focused energy efficiency pilot projects via rate designs or tariffs that spur improved financing mechanisms for retrofits. Commission leaders could develop two types of pilots that could inform the development of new utility standard offers or tariffs. First, the agency could encourage more sustained utility commitment to soliciting projects that combine both energy efficiency and demand response into a single transaction and to pay a front-end price for expected performance. This model could also involve a bonus or premium for after-the-fact verified performance on energy savings. The pilot could be implemented without the commission or utility developing any new finance structures.

"Pay-for-performance couldn't be simpler to the customer. The market will find customers if there is a business model."

- Sam Walker
Energy Trust of Oregon



Second, utilities could use "preferred resource" combinations of demand-side programs, such as combining energy efficiency improvements with demand response, to award contracts on a pay-for-performance basis. As a potential model, Southern California Edison received offers for a past all-source solicitation with these combinations but ultimately did not select them, possibly due to perceived regulatory risk. Work done in that procurement may serve as the basis for future policy, should the utility agree to share it. Policy makers and industry actors should determine what additional tools or assurances utilities might need to evaluate the terms and prices offered for demand-side solutions, other than energy storage (which was selected by Southern California Edison in the solicitation). In addition, the commission could encourage utilities to engage in pilots that utilize innovative financing programs like MEETS, with the risk not bounded by the length of contract but by the number of participating buildings.

State leaders should incorporate lessons from the pilot projects into rate design and tariffs to encourage pay-for-performance energy efficiency programs. Based on the results of the pilot projects discussed above, regulators should consider adopting rates and tariffs that promote energy efficiency bids bundled with other services such as demand response.

State legislators and regulators could ensure completion of rules that would allow cheaper financing of energy efficiency retrofits by third parties through state-backed credit guarantees. Currently, the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) is finalizing rules to create state credit enhancement benefits for third parties that finance and execute energy efficiency improvements, either through loans to customers, energy service agreements, or energy efficiency leases. These credit enhancements could also cover on-bill repayment and a loss reserve pool. Ultimately, they could allow customers who participate in energy efficiency financing programs to receive reduced borrowing costs.

Barrier #3: Lack of Standardized Energy Data to Measure Energy Efficiency Performance

Commercial customers and their third-party designees, such as energy efficiency contractors, often lack sufficient access to their energy data in order to analyze usage patterns and determine optimal retrofit measures. Many have difficulty sharing data or opting into data disclosure programs. Currently, commercial ratepayers that would like to share detailed data on their historical energy usage and tariffs have no easy option for compiling and disclosing the data in an easily accessible, readily transmissible format. The lack of standardized data makes it difficult to measure energy savings from new improvements going forward.

SOLUTION: Improved Standardized And Streamlined Energy Data Access For Customers And Their Designated Representatives

Commercial customers and their energy efficiency contractors need improved access to standardized energy data in machine-readable formats at hourly or 15-minute intervals, as residential customers currently have with Green Button and Connect My Data tool.[53] They may also need historical data dating back more than the typical 13 months provided by utilities, such as for the previous three to four years.

The California Public Utilities Commission should ensure that commercial meter data isstreamlined and made available by utilities to designated energy efficiency providers, as required by AB 802. The data are critical to assisting building owners with energy efficiency improvements, and they should be made available within a specified number of days after submission of the request for access. This transparent and immediate access could help remove any bias in the timing and results of the data. Designated third parties, with customer approval, should be able to secure the data via a fee payment, which utilities could increase in exchange for faster processing. The third party could be a standardized "Meter Data Servicer" entity, as covered in the regulations. Of note, more progress has been made for residential customers on the data-sharing options, offering a potential model for commercial customer data sharing.[54]

"You can get meter data, but with a lot of difficulty. Otherwise, we can argue about the energy savings until the cows come home."

- *Michael Murray Mission:data*

The California Public Utilities Commission should consider requiring a certain percentage of energy efficiency programs to be based on pay-for-performance by a certain date. Policy makers approved the current commercial customer rebate program for contracting based on discrete efficiency measures and *ex ante* estimates, with payments based in part on *ex post* performance. Perhaps as a result, California's commercial customer rebate program has had low realization rates of about 50 percent. The programs also rely on consumer finance, investment, and debt, which discourage participation. The commission should therefore transition energy conservation programs to pay-for-performance, such as MEETS or Energy Trust of Oregon's pay-for-performance business model. California's commercial customer rebate program could also pay customers on a cents-per-kilowatt-hour calculation that is revenue neutral. As an example, the Oregon pilot works with Energy Star buildings to achieve 15 percent savings, largely from retro-commissioning (improving existing equipment and systems), without a California-style contracting process based on discrete efficiency measures and *ex ante* estimates. Note that on the residential side, ratepayer advocates, an environmental organization, and Pacific Gas and Electric supported a pilot for pay-for-performance using the Open EE Meter system, which could serve as a potential model for commercial customers.[55]

Barrier #4: Lack of An Energy Efficiency Workforce to Execute and Market Retrofit Projects

Convening participants noted that the workforce lacks sufficiently trained and skilled workers who can both market and execute energy efficiency projects to a consistent degree. While policy makers, academics and other experts can study the problem to suggest solutions, many industry participants believed that the industry itself needs to enhance its training efforts. Some also suggested that a more competitive and lucrative market for energy efficiency contracting, spurred by regulatory reform and utility procurement practices, could encourage more privately held training programs for contractors. As a result, this barrier could be symptomatic of the larger inability to develop a thriving energy efficiency market.

"We have a lack of customer information, and we don't get to the customers fast enough. We struggle to know what are their needs, who are they, and what works for them."

- *Janisse Martinez San Diego Gas & Electric*

SOLUTION: Identify Workforce Needs And Support Training Programs That Address Them

Industry leaders and policy makers should assess the current workforce status, identify key needs, and formulate solutions, leveraging existing programs and resources that could support the effort.

State leaders in government, academia, industry and nonprofit organizations could develop a roadmap on ways to improve the energy efficiency industry workforce based on a change to pay-for-performance contracting. Such a roadmap, based on research and consultation with industry experts, could lay out the projected workforce needs and the specific training that contractors may require based on new program requirements. State agencies or other research entities could convene stakeholders to develop the workforce training program and priorities. The conversations could include would-be entrepreneurs, such as those with the California Energy Efficiency Industry Council (CEEIC), and trade associations for building systems such as heating, ventilation and air conditioning (HVAC) and lighting, to determine how to organize competent contractors to test new transaction structures. Key topics could include measurement and verification, financing, performance contracting, controls, cloud-based management and user interface systems, and reporting, among others. The initial training could focus on discrete areas of improvement, such as the gateway efficiency resources of space cooling and lighting. The training could also include sales and financing structures for contractors and utility representatives, training on performance contracting for the contractor network, examples of materials documenting customer benefits, and sales training for the contractor network.

State and utility leaders should coordinate and support contractor training efforts through existing networks and programs. These leaders could develop the training programs using utility contractor alliance networks and statewide contractor

organizations, such as the Western HVAC Performance Alliance (WHPA), in order to educate them on new pay-for-performance programs and rollout timing. The California Public Utilities Commission could use its existing Workforce, Education, and Training Program to assist, along with pay-for-performance demonstration projects. State leaders could also provide more marketing and training funds for the contractor networks. The agency could issue a "request for proposal" (RFP) for packaged, topic-based training programs for a first-year training initiative and subsequent follow-on training. The commission could require utilities to develop on-line videos and fact sheets to explain these services, as marketing support for expanding energy efficiency in commercial buildings. The agency could also require utilities to present these videos and fact sheets via their business communication channels, or let entrepreneurs use the materials to explain the concepts. In addition, utilities should train their account representatives and similarly-placed employees on pay-for-performance energy efficiency programs, financing options, and solutions sales, in order to ensure these programs are utilized and well-staffed.

Conclusion: The Necessity of Widespread, Scalable Retrofits

California has made progress developing innovative policies and programs to spur energy efficiency retrofits. From stringent building and appliance standards to PACE, the state has led in helping building owners achieve cost-effective energy savings, benefiting the economy and the environment in the process. But given the scale of the emissions reductions needed to achieve the state's climate and energy goals, coupled with the significant economic potential left untapped in retrofits that have not yet materialized, the state needs to do more. Moving to widespread, pay-for-performance, metered energy efficiency can unlock capital market investment and simplify the retrofit process to make it financially attractive and easy for building owners. With its history of innovation, California should act now to achieve the cost-effective efficiency gains at the scale required by the economic and environmental need.

Moving to widespread, pay-for-performance, metered energy efficiency can unlock capital market investment and simplify the retrofit process.

Participant Bios

Dan Adler
Energy Foundation

Dan Adler is Vice President of Power Strategies at the Energy Foundation, a nonprofit, philanthropic organization that promotes the transition to a sustainable energy future by advancing energy efficiency and renewable energy. Mr. Adler was formerly the Managing Director of the California Clean Energy Fund (CalCEF), a nonprofit, evergreen venture capital fund created to accelerate investment in California's clean energy economy. Prior to joining CalCEF, he was a senior analyst in the Division of Strategic Planning at the California Public Utilities Commission, where he was responsible for the design and implementation of California's Renewables Portfolio Standard and was senior staff for climate change policy. In addition to energy issues, Mr. Adler has professional experience in international trade policy and socially responsible investment. He has a B.A. in Political Science from the University of California at Berkeley and an M.A. in Public Policy from Harvard University.

Obadiah Bartholomy
Sacramento Municipal Utility District

Obadiah Bartholomy is a Manager of Distributed Energy Resources at SMUD. He group is responsible for developing enterprise strategy and pilot programs associated with Energy Efficiency, Demand Response, Electric Vehicles, Distributed Solar, and Distributed Storage at SMUD. This work involves developing new valuation methodologies for the distributed resources within the utility planning processes and improving the forecasting approaches for evaluating adoption of these resources spatially as well as through time. Obadiah has worked at SMUD for 13 years, previously managing their Climate Change, Emerging Technologies, and Distributed Solar R&D programs. He has an MS in Transportation Technology & Policy from UC Davis, and a BS in Mechanical Engineering from Cal Poly, and is a registered Professional Engineer in the state of California.

Bill Campbell
Equilibrium Capital Group

Bill Campbell is CFO and a co-founder of Equilibrium Capital Group. Equilibrium is a Benefit Company. It builds operating portfolios of sustainability-driven real assets for institutional investors. Equilibrium is built on values of "we", sustainability at the core, innovation, excellence in execution, community, and doing the right thing. Its principles of sustainability prioritize long-term productivity, resilience, integrated solutions, scale - and a healthy dose of humility. Bill has been responsible to apply those values and principles to the field of energy efficiency. To this he brings experience in the field dating to 1979. Equilibrium's community in this effort includes the Bullitt Center, the Northwest Energy Efficiency Alliance, Seattle City Light, EnergyRM, Idaho Design Labs, QuEST, Cadmus, McKinstry, TURN and particularly Cynthia Mitchell's work, the New Building Institute, and feedback, interchange, and insight from commissioners and staff of the CPUC and the CEC as well as California and Northwest utilities. That collective work has delivered the Metered Energy Efficiency Transaction Structure, now in commercial operation for Seattle City Light at the Bullitt Center.

Michael Campbell
California Public Utilities Commission

Since October 2012, Mike has been the Program Manager of the Electricity Pricing and Customer Programs branch at the Office of Ratepayer Advocates (ORA) in the California Public Utilities Commission (CPUC). Mike's branch is responsible for advocating on the behalf of California's small consumers at the CPUC's public proceedings on matters related to electric rate design and customer programs. From 2008 through 2012, he was the Director of San Francisco's Community Choice Aggregation (CCA) Program, which is designed to offer San Franciscans the choice of a 100% renewable energy product. From 2005 to 2008, he worked at Pacific Gas & Electric. From 2000 through 2005, Mike worked in a variety of roles at the CPUC, including energy efficiency, resource adequacy, transmission siting, and generation to general rate cases. He also spent two years as Energy Advisor to Commissioner Lynch. A graduate of U.C. Davis in Economics, Mike earned his Master's of Public Administration at Syracuse University with a focus on energy policy.

Jeanne Clinton
California Public Utilities Commission/Governor's Office

Jeanne Clinton is California's Special Advisor for Efficiency, based at the California Public Utilities Commission and advising the Governor's Office. Her current focus is leading state and utility policies to drive scaled markets for efficiency, with considerable attention to investment capital structures and finance. She previously served as Governor Schwarzenegger's Clean Energy Advisor at the PUC (Calif. Solar Initiative and Energy Efficiency Strategic Plan) and consultant for his 2004 Green Building policy initiative. Jeanne has extensive state/local government and US and international consulting experience, regularly tackling the nexus of policy and market engagement for clean energy issues, sustainable development, and climate mitigation. She has degrees from Dartmouth College and UC Berkeley.

Brad Copithorne
Renewable Funding

Brad Copithorne is Vice President of Commercial PACE Programs at Renewable Funding. Prior to joining Renewable Funding, Brad spent four years at Environmental Defense Fund, an environmental advocacy organization. At EDF, Brad worked with states to implement clean energy finance programs including PACE an On-Bill Repayment. Brad was one of the primary architects of the open-source OBR model that is being implemented by Hawaii. Brad has over 20 years experience in the financial services industry. He started his career at Salomon Brothers/Citi where he worked on fixed income origination and new product development. More recently, Brad worked for Morgan Stanley's Technology Investment Banking team in Silicon Valley where he covered the enterprise hardware, contract manufacturing and IT distribution industries. In 2008, Brad was a partner at a fixed income hedge fund. In 2009 Brad re-enrolled at Stanford University to study energy policy and graduated in 2010 with a Masters in Civil and Environmental Engineering.

Al Gaspari
Pacific Gas & Electric

Alfred Gaspari is the Manager, Transaction Services in PG&E's Energy Efficiency Programs. In his current role, he oversees PG&E's Customer Financing Programs, including the On Bill Financing program and the upcoming Energy Efficiency Financing pilot as well as overseeing the internal reporting and controls functions of the EE Portfolio. Prior to his role with PG&E, Al was the Finance Director with the Greater Cincinnati Energy Alliance, and prior to that he was a Senior Manager with KPMG LLP in the Audit and Assurance Practice.

Chris Giuliano
Banc of America Public Capital Corp

Chris Giuliano is the Managing Director for Banc of America Public Capital Corp (BAPCC). In this role, Giuliano is responsible for delivering nationwide taxable and tax-exempt financing solutions to issuers and borrowers from the government (states and municipalities), not-for profit institutions, healthcare, and general industry sectors, as well as energy equipment manufacturers, utilities, and energy services companies (ESCOs). BAPCC's industry coverage model includes Healthcare & Institutions, Municipal & Federal Government and Energy Services. Prior to re-joining Bank of America in May of 2009, Giuliano was a Director at Merrill Lynch Capital Corp, where he ran a team focused on institutional buy and sell side activities for the Equipment Finance Group, a team that was subsequently acquired by GE Capital in 2008. Giuliano is located in San Francisco, California and holds a B.A. from the University of Virginia with degrees in the both Economics and French.

Matt Golden
Environmental Defense Fund

Matt Golden is both an entrepreneur and policy advocate, committed to bringing energy efficiency in the built environment to scale as a demand side resource. Currently, Matt leads Environmental Defense Fund's Investor Confidence Project implementing a system to credential Investor Ready Energy Efficiency™ projects, designed to reduce transaction costs, and develop actuarial data to unlock capital markets. Previously, Matt founded Recurve Inc., which develops tablet based energy auditing software for the residential energy efficiency industry based on real world experience gained through thousands of energy efficiency audits and retrofits as a licensed CA energy efficiency contractor. Recurve was acquired by Tendril Networks in 2012. Matt is a national leader in the energy efficiency industry and was instrumental in forming Efficiency First (www.efficiencyfirst.org), the national trade association for the residential energy efficiency industry, representing over 1,300 contractors and manufacturers in all fifty US states. In addition to Efficiency First, Matt serves and has served on a number of national and state nonprofit boards, including the Building Performance Institute (BPI), National Home Performance Council, and the California Building Performance Contractors Association (CBPCA).

Rob Harmon
MEETS Accelerator Coalition

Rob Harmon is principal at Robert K. Harmon & Company LLC and director of the MEETS Accelerator Coalition. He has worked in the fields of energy productivity, renewable energy and water for 30 years. In 2014, as President and CEO of EnergyRM, Rob closed the first twenty-year Metered Energy Efficiency transaction in history. Rob served for 10 years as Chief Innovation Officer and Senior VP for the Bonneville Environmental Foundation (BEF), where he developed and launched the first carbon calculator on the Internet and closed the first retail REC transaction in history. In 2004, Rob was awarded the national Green Power Pioneer Award for his leadership in establishing a thriving and credible voluntary retail renewable energy certificate market. In 2009, Rob created and launched BEF's Water Restoration Certificate business line, which utilizes voluntary markets to restore critically de-watered ecosystems. This business is the subject of Rob's 2010 TED Talk. The approach is now credited with restoring more than 10 billion gallons of water to degraded rivers and streams.

Scott Henderson
ADN Capital Ventures

Scott is a Principal with ADN Capital Ventures, a boutique project finance advisory firm focused on the energy and infrastructure markets. He is also an Advisor to Metrus Energy, a pioneer in the commercialization of the efficiency services agreement, a PPA-like contract that it uses to develop, finance and own energy efficiency and power generation projects in commercial and industrial buildings. Scott previously served as Director of Finance at the Clinton Climate Initiative (CCI), where he provided project finance expertise and support to the organization's Energy Efficiency Building Retrofit, Municipal Lighting and Solid Waste Programs. While at CCI, Scott consulted with The White House, President Clinton, Department of Energy, Congress, state energy offices, utilities and city mayors on energy finance policy. Prior to CCI, Scott built up extensive finance experience advising on utility-scale clean energy projects while at ADN Capital Ventures, serving as VP Finance at biotechnology firm Diobex, and working as an investment banker at UBS Investment Bank, Dillon Read and Merrill Lynch. Scott holds a BA from Harvard.

Steve Hussey
Sierra Asset Management

Steve formed Sierra Asset Management with Barbara Kelly in 2005. Sierra Asset Management is a full service Commercial Property Management Company based out of the Sacramento Region. They manage Property all over the State for both large and small clients. Steve holds the Certified Property Manager (CPM) designation from the Institute of Real Estate Management (IREM), as well as being a licensed real estate brokers. In addition, Steve is a past President (2009) of the Sacramento Chapter of the Institute of Real Estate Management. Steve has over twenty five (25) years of commercial property management experience in the Sacramento region and continually strives to develop his knowledge by keeping up to date with the latest technology and ideas. Steve has been a part of many Lighting and HVAC energy savings projects at office buildings and understands the value these projects can bring to Building Owners with the right type of rebate and financing options.

David Jacot
Los Angeles Department of Water & Power

David Jacot, P.E., is the Director of Efficiency Solutions for the Los Angeles Department of Water & Power (LADWP). In this role, David oversees all aspects of LADWP's offerings and strategies designed to overcome market barriers to the comprehensive adoption of energy efficiency by LADWP's customers. David also oversees the implementation of LADWP's class-leading water conservation and efficiency programs, as well as the customer-facing integration of water and energy efficiency program delivery both within LADWP and also through a nation-leading joint program partnership with the natural gas utility serving Los Angeles, the Southern California Gas Company. David has a Bachelor's degree in Mechanical Engineering from the University of Oklahoma, and a Master's degree in Urban and Regional Planning from California State Polytechnic University - Pomona, as well as 15 years of experience designing high performance building systems, modeling building energy usage, and managing investment-grade energy efficiency programs.

Janisse Martinez
San Diego Gas & Electric

Janisse is the Energy Efficiency Technical Services Manager for San Diego Gas & Electric. She is responsible for the accurate energy efficiency and demand response measure identification, calculation and validation for the San Diego County region. She has over 15-yrs of experience in several technical and environmental roles, including 5-yrs as an Officer in the United States Coast Guard, where she was responsible for the Planning, Response and Incident Management for Puerto Rico and the Virgin Islands. Janisse holds a BS in Mechanical Engineering and a Masters in Business Administration with a concentration in Technology Management. She is a Licensed Professional Engineer and a Commissioned Officer in the US Coast Guard Reserves and an active board member for a local non-profit.

Cynthia Mitchell
TURN

Cynthia's past 40 years of experience as an energy economist and consumer advocate has been a passion for saving versus selling energy in order to help consumers conserve and use energy more efficiently while greening the planet (Amory Lovins' cold beer and warm showers). Her area of energy economics is the regulation of monopoly investor-owned utilities. She has worked throughout the country, with the last fifteen years near California exclusive for TURN – The Utility Reform Network. As a small-scale chicken farmer, she has taken notice of the simplicity of a chicken's life; her website www.chickenocomicsinc.com focuses on breaking down complex energy issues and making them chicken-simple in order to offer insight as to how less consumption / more efficiency can be attained.

Michael Murray
Mission:Data

Michael is co-founder and chief technology strategist of Mission:data, a coalition of 35+ technology companies advocating for better use of smart meters to drive efficiency and clean energy. Previously, Michael co-founded Lucid, an energy management software company serving commercial building owners. He has over ten years of experience with building automation, sub-metering and liberating data from utilities. Michael earned his B.A. in Environmental Studies with highest honors from Oberlin College.

Dennis Quinn
Joule Assets, Inc.

Mr. Quinn is COO and co-founder of Joule Assets, Inc. Mr. Quinn is responsible for establishment and operations of Joule's ERA Fund, development of Joule's contractor finance network and development of the Fund's performance-based financing models. Previously, Mr. Quinn was a founding member and CEO of Celerity Energy LLC, one of the first demand response companies in the US in 2000 where he built a western US portfolio comprised of university, commercial and industrial clients. Mr. Quinn was instrumental in developing early rules of participation for DR in California. His vision to create a fully dispatchable portfolio of resources under a 25 MW long term contract led to one of the first successful third-party-owned non-spin reserve DG/DR resources in the US. Mr. Quinn successfully sold Celerity Energy in 2006 to EnerNOC. Mr. Quinn's experience and success with energy efficiency and conservation stretches back over 30 years. As Vice President of PacifiCorp Development Company, he led development efforts for over $300m in domestic and international operating power projects.

Kimberly Rodriguez
Southern California Edison

Ms. Rodriguez currently manages the Market Segment Programs and Contracts group within the Customer Programs and Services organization at Southern California Edison (SCE). Her group manages a portfolio of 20+ segment specific programs including Healthcare, Data Centers, Oil Production, Commercial Office and Schools. During her 16 years at SCE she has held several positions in Human Resources, Audit Services, and Demand Side Management. Kim received her B.S degree in Business Administration and a Master's degree in Industrial/ Organizational Psychology from Cal State San Bernardino. She lives in the Pasadena area with her husband and two furry kids.

Arjun Saroya
Lime Energy

Arjun Saroya provides day-to-day leadership of Lime's strategic and forward looking initiatives and has been a major contributor to the development of Lime's Utility Programs business since its inception. He has been integral in evolving our award winning performance based program design and in incubating several of these programs under this model for our marquee clients. He was also responsible for overseeing the product development of our industry-leading technology platform, Direct Install, that now enables hundreds of thousands of small business customers to seamlessly participate in energy efficiency. Today, he continues the effort to bring innovation to energy efficiency in his role as head of Product and Corporate Development. Prior to becoming a founding member of the utility programs business unit, and the first energy advisor on the team, Arjun served the company in several roles from energy engineer to project manager with varied experience in retro-commissioning, monitoring and verification, lighting, hvac , controls, and solar. He has a B.S. in Mechanical Engineering from the University of California Los Angeles and is a Certified Energy Manager.

Chris Smith

Chris is a Professional Engineer, Certified Energy Manager, Certified Building Commissioning Agent, and Certified Demand Side Manager with 15 years of experience in the energy efficiency field. Chris has published a number of papers on energy efficiency, and was awarded AEE's Energy Innovator of the Year Award in 2008. Chris has conducted hundreds of energy audits, managed hundreds of efficiency projects, as well as designed, managed, and evaluated energy efficiency programs. Chris received his Bachelor of Science in Mechanical Engineering from the University at Buffalo.

Greg Thomas
Performance Systems Development

Greg Thomas is CEO and founder of Performance Systems Development. He developed and implemented the first utility low income multifamily energy performance contract in 1989, a $12M retrofit of over 7000 apartments, and designed and managed the first Home Performance program in the country in 1995. He is past chair of the Efficiency First trade association, has served on the RESNET board and is past chair of Affordable Comfort Inc. (now the Home Performance Coalition). Greg's and PSD's current work focuses on combining prediction with measurement in the delivery of commercial and residential performance based whole building programs, including current work with NYSERDA, NREL, LBNL, Duke Energy, First Energy, and Xcel Energy. Recent US DOE funded projects include contracts to support utility commercial whole building programs using DOE tools (OpenEfficiency Initiative), EPA Portfolio Manager to SEED integration and Automated M&V testing with LBNL, OpenStudio training and software development with NREL, Home Energy Score research, and research on residential and commercial code compliance with PNNL.

Sam Walker
Energy Trust of Oregon

Sam Walker, sr. commercial project manager, joined Energy Trust of Oregon in March of 2015. He holds a degree in mechanical engineering from Oregon State University and has 10 years of commercial & industrial energy efficiency experience, ranging from industrial energy audits, to public utility energy efficiency program management. He also worked as a consulting engineer, primarily in delivering strategic energy management services. In his role at Energy Trust of Oregon, Sam is developing and managing a Pay for Performance pilot, working with local Portland-area jurisdictions on the development of a Commercial Property Assessed Clean Energy (C-PACE) pilot, and collaborating with local utilities and the City of Portland to help impacted customers comply with the City's recent commercial energy benchmarking requirement. Sam also leads Energy Trust's commercial sector finance strategy. Sam lives in Portland, Ore., in a multigenerational household, on two-thirds of an acre within the city limits. Sam has earned his Portland merit badges in chicken-raising, gardening, bicycle commuting and craft beer indulging. Energy Trust of Oregon is an independent nonprofit organization dedicated to helping utility customers benefit from saving energy and generating renewable power.

Endnotes

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7 In 2003, the California Public Utilities Commission (CPUC, the agency responsible for regulating investor-owned utilities) and the California Energy Commission (CEC, the agency responsible for setting energy efficiency standards) adopted an "Energy Action Plan" that prioritized how the state should meet its future energy needs. The plan placed energy efficiency first in the "loading order," or highest priority. *See* State of California, Energy Action Plan, May 8, 2003. Available at: http://www.energy.ca.gov/energy_action_plan/2003-05-08_ACTION_PLAN.PDF (accessed January 11, 2016). The legislature then codified this goal in 2005 with SB 1037 (Kehoe), which required electric utilities to meet their resource needs first with energy efficiency. *See* California Senate Bill 1037, Statutes of 2005, Chapter 366. The legislation set targets for statewide annual energy demand reductions equivalent to enough power to supply more than five million homes and to avert construction of approximately ten new 500 megawatt power plants (one megawatt can power 750 homes for a year). *See* California Air Resources Board, *Climate Change Scoping Plan*, December 2008, p. 41. Additional legislation has furthered these energy efficiency efforts. In 2006, the governor signed AB 2021 (Levine), which requires the CEC, in consultation with the CPUC and publicly-owned utilities, to produce a statewide estimate of "all potentially achievable cost-effective electricity and natural gas efficiency savings and establish targets for statewide annual energy efficiency savings and demand reduction for the next 10-year period." *See* Assembly Bill 2021, Statutes of 2006, Chapter 734.

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13 California Public Utilities Commission, "CPUC's Role in Energy Efficiency Programs" website. Available at: http://www.cpuc.ca.gov/General.aspx?id=5393 (accessed January 11, 2016)

14 Carmen Best, "Energy Efficiency: A Brief History" presentation, California Public Utilities Commission, December 10, 2014. Available at: http://www.naruc.org/international/Documents/Energy%20Efficiency%20A%20Brief%20History_Best.pdf (accessed January 11, 2016). *See also* Simon Baker, "CPUC Energy Efficiency Policies and Investor-Owned Utility (IOU) Programs," at slide 17.

15 *See* Mark Ferron, "California's Energy Economy: A Regulatory Perspective" presentation, California Public Utilities

Commission, September 2012, slide 13. Available at: https://www.google.com/url?q=http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx%3Fid%3D4751&sa=U&ved=0ahUKEwjdn5ay7KLKAhUG1mMKHWRQDyAQFggHMAE&client=internal-uds-cse&usg=AFQjCNFd5U76PNmkVxw4INaETDkQciwDxA (accessed January 11, 2016).

16 "2013 California Energy Efficiency Potential and Goals Study: Revised Draft Report," Navigant Consulting Inc., prepared for the California Public Utilities Commission, November 26, 2013, p. 19. Available at: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=4024 (accessed January 13, 2016).

17 *See* "Customized Incentives for Energy Efficiency," Pacific Gas & Electric website. Available at: http://www.pge.com/en/mybusiness/save/rebates/ief/index.page (accessed January 11, 2016).

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19 "PG&E Business Rebate Application," Pacific Gas & Electric website. Available at: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/ee_business_rebate_app_final.pdf (accessed January 13, 2016).

20 U.S. Department of Energy, "Public Benefits Funds for Renewables and Efficiency" website.

21 "CPUC Energy Efficiency Primer" presentation, California Public Utilities Commission, at slides 21 & 22. Available at: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/EE_and_Energy_Savings_Assist/CPUCEEPrimer_.ppt (accessed January 13, 2016). These programs are implemented by utility providers and include the Energy Advisor, Calculated Incentive, Deemed Incentive, Direct Install, Continuous Energy Improvement, and Non-Residential HVAC programs. Each provides customers with a unique type of support. For instance, Energy Advisor works to educate customers about efficiency and the most appropriate ways they can participate, while Direct Install provides energy efficiency hardware retrofits to small businesses at low or no cost. "Fact Sheet: Statewide Commercial Program (2013-2014)," California Public Utilities Commission, April 2013, pp. 2-4. Available at: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5414 (accessed January 13, 2016). Additional programs are offered by third parties and typically address the needs of niche markets, such as healthcare, hospitality, and office facilities. Finally, utility companies often offer their own programs. For example, Pacific Gas & Electric has developed a commercial "Automated Demand Response" program which delivers both incentives and technical assistance to customers willing to automatically adjust their energy usage during periods of peak demand. "Automated Demand Response Program," Pacific Gas & Electric website. Available at: http://www.pge.com/en/mybusiness/save/energymanagement/adrp/index.page (accessed January 13, 2016). *See also* "Demand Response," Pacific Gas & Electric website. Available at: http://www.pge.com/en/mybusiness/save/energymanagement/index.page (accessed January 13, 2016).

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facilitate their integration into the grid, maximizing the benefits for ratepayers and the environment alike. By law, Pacific Gas & Electric, SoCal Edison, & San Diego Gas & Electric had to submit proposed plans on July 1, 2015. For more information on what the California Public Utilities Commission requires for the distribution resource plan, please see "Draft Order Instituting Rulemaking," Agenda ID #13206, California Public Utilities Commission, August 14, 2014. Available at: http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M102/K036/102036703.pdf (accessed January 14, 2016).

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