CLIMATE POLICY INITIATIVE

Raising the Stakes for Energy Efficiency: California's Risk/Reward Incentive Mechanism

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Executive Summary

In 2007, the California Public Utilities Commission (CPUC) implemented the Risk/Reward Incentive Mechanism (RRIM) — a system of financial rewards and penalties designed to motivate California's investor-owned utilities to expand their energy efficiency programs and meet ambitious energy savings targets.

During the time the RRIM was in place, utility-run energy efficiency programs achieved a large volume of cost-effective energy savings. Still, the policy has been controversial. Utilities, regulators, and other stakeholders disagree about the quantity of energy savings attained and what role the RRIM played in achieving them. The resulting conflict not only consumed resources but also led CPUC to pause halfway through implementation and overhaul the incentive.

California has long been a leader in energy efficiency policy among U.S. states, and the RRIM represents a large-scale policy experiment that holds lessons for other jurisdictions dealing with energy efficiency policy design, especially those considering shareholder incentives. Our evaluation of the RRIM contributes to the debate on the effectiveness of shareholder incentives, providing insights on how program design choices and institutional dynamics contribute to policy outcomes.

Our assessment of the RRIM's success at meeting its objectives is as follows:

Box 1: How the RRIM worked

The RRIM was a "shared savings" incentive, under which the total amount of money saved through energy efficiency programs was shared between ratepayers and utility shareholders. Payments followed a tiered system of rewards and penalties based on utilities' progress toward their energy savings targets.

A key component of the RRIM was that incentive earnings were calculated based on estimates of energy savings calculated after programs were completed. Utilities received interim incentive payments while their energy efficiency programs were underway. After the programs were completed, CPUC led evaluations to estimate the programs' true impact on energy savings. Incentive payments were then adjusted retroactively based on the evaluations. This component of the RRIM proved to be especially controversial, and it was modified after implementation.

	GOAL	ASSESSMENT	EXPLANATION
1	Accelerate progress toward California's energy efficiency goals	UNCLEAR	While it is difficult to isolate the RRIM's impact on energy savings, its design did drive toward the specific energy efficiency objectives that were important to CPUC — in particular, maximizing net economic benefits from energy efficiency. However, utilities had limited ability to respond to the policy, because of implementation delays.
2	Elevate energy efficiency within the utilities' decision-making	SOMEWHAT SUCCESSFUL	The RRIM elevated the status of energy efficiency within the utilities in an incremental, though not transformative, way. However, the impact of the policy is limited by the perception among utilities and investors that incentive earnings are uncertain and non-repeatable.
3	Protect ratepayers by ensuring that the utilities bear risks related to the performance of their efficiency programs	MOSTLY UNSUCCESSFUL	In the end, CPUC did not follow through with the primary ratepayer-protection component of the RRIM — adjusting utility earnings based on retrospective evaluations — because of conflict generated by the evaluation findings and the sensitivity of the RRIM's earnings function.

Policy Implications and Recommendations

What does California's experience imply for other jurisdictions? We address this question in three parts: which elements of the RRIM's design worked well, and which didn't (Incentive Design); which institutional factors contributed to the successes and shortcomings of the RRIM's implementation (Institutional Factors); and which institutional problems were caused, at least in part, by elements of the RRIM's design (Design for Implementation).

Incentive Design

Recommendation: Avoid sharp payment distinctions that do not reflect meaningful differences in program performance.

- Because the RRIM was meant to incentivize high performance in energy efficiency, it set ambitious targets for utilities and structured incentives so that a small change in estimated energy savings could make the difference between reward and penalty. However, this design did not reflect the reality of the energy savings estimation process, which involves some inherent uncertainty. The earnings calculation was too sensitive to small changes in energy savings estimates, and as a result, large differences in incentive payouts to utilities did not necessarily reflect meaningful differences in performance.
- Similarly, the RRIM required utilities to meet multiple energy savings targets in order to achieve any incentive earnings. This further raised the stakes for energy savings estimates and contributed to the disconnect between overall performance and earnings.

Institutional Factors

Recommendation: Consider the full suite of policies that affect returns on energy efficiency, as well as returns on investments in new energy supply, when designing a shareholder incentive. Don't expect an incentive to single-handedly right the balance between investment in new electricity generation and investment in programs to reduce energy consumption.

- In California, the RRIM was implemented in the context of many other aspects of utility planning and regulation — including the energy efficiency portfolio planning process, ratemaking and cost recovery, and system planning — that also affected utilities' treatment of energy efficiency. The RRIM encouraged utilities to prioritize energy efficiency programs more than they would otherwise, but their decisions depended on many factors beyond the size of the earnings opportunity.

Recommendation: Expect that incentives will put pressure on evaluation processes and engender new disputes. Implement a high-stakes incentive like the RRIM — especially one that includes retroactive adjustments to earnings — only if there are institutional arrangements for energy savings measurement and dispute resolution processes that are accepted by all parties.

- Measurement of energy savings has some inherent uncertainties. Incentives tied to energy efficiency will tend to increase the amount of regulatory negotiation and conflict around that measurement. California had recently changed its measurement and evaluation processes when the RRIM was implemented, and the utilities were not comfortable with the new process. This conflict over measurement and evaluation made it more difficult for CPUC to resolve the RRIM debate.
- Basing incentive payments on evaluated energy savings was a core principle of the RRIM and could have had a positive impact on ratepayer protection and utility performance. However, that provision put too much pressure on the evaluation process and amplified the conflict among parties, to such a degree that CPUC removed the true-up for the 2006-08 period. Whether such a provision would work elsewhere depends on whether utility-regulator relationships and evaluation processes can withstand that pressure.

Design for Implementation

Recommendation: Put incentives in place before utility energy efficiency programs are designed and implemented.

- Delays in the policy development and implementation process meant that the RRIM would apply to utility energy efficiency programs that were already more than halfway through their three-year program cycle. This delay limited the impact of the incentive. Utilities could only

change their programs at the margins; they could not design programs from the start with the RRIM in mind.

Recommendation: Design incentives to be as predictable and repeatable as possible. Condition incentives only on factors utilities can monitor and influence.

- Utilities and their shareholders value earnings streams that are predictable and repeatable. However, if an incentive like the RRIM is designed as an accountability tool, and if such an incentive becomes more ambitious over time as efficiency standards and markets change, it may not be repeatable enough to be valued by utilities and their shareholders. The retroactive adjustments to payments under the RRIM made the incentive less valuable in the eyes of California's utilities, because they could not present it to their shareholders as a dependable earnings stream.
- Balancing utilities' desire for predictable earnings with regulators' desire for accountability is not an easily solvable problem, but it may become easier going forward as utilities and program evaluators are able to make use of real-time energy usage data.

The RRIM was a new and ambitious policy, and its implementation did not go smoothly. However, it did bring more attention to energy efficiency among California's utilities, and it was a valuable policy experiment that holds useful lessons for California and other jurisdictions. CPUC has already made revisions to address some of the design and institutional issues that posed problems for the RRIM, including eliminating the sharp cutoff points for incentive earnings and developing a more collaborative process for reviewing evaluation results. With the modifications described here, the RRIM could provide a useful model for other states pursuing energy efficiency goals.

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Introduction

Shareholder incentives have received increased attention in recent years as a tool to drive energy savings in areas served by investor-owned utilities and, more broadly, to implement "pay for performance" principles in energy policy. In total, 21 states have adopted some form of shareholder incentive (Federal Energy Regulatory Commission 2011).

In 2007, California implemented a shareholder incentive intended to motivate its investor-owned utilities to meet ambitious energy savings targets. The Risk/Reward Incentive Mechanism (RRIM) was not the first shareholder incentive in California, but it introduced some novel elements in incentive design, including an attempt to pay for performance by basing incentive payments on program impacts evaluated after implementation.

The RRIM had three primary objectives, based on our interpretation of California Public Utilities Commission (CPUC) statements throughout the regulatory process:

1. Accelerate progress toward California's energy efficiency goals
2. Elevate energy efficiency within the utilities' decision-making
3. Protect ratepayers by ensuring that the utilities bear risks related to the performance of their energy efficiency programs

In this paper, we examine where the RRIM met these objectives and where it fell short. Our analysis is based on review of the record in the CPUC proceedings relating to the RRIM and other energy efficiency proceedings. We also conducted interviews with representatives from CPUC, the utilities, and other key stakeholders involved in the RRIM debate.

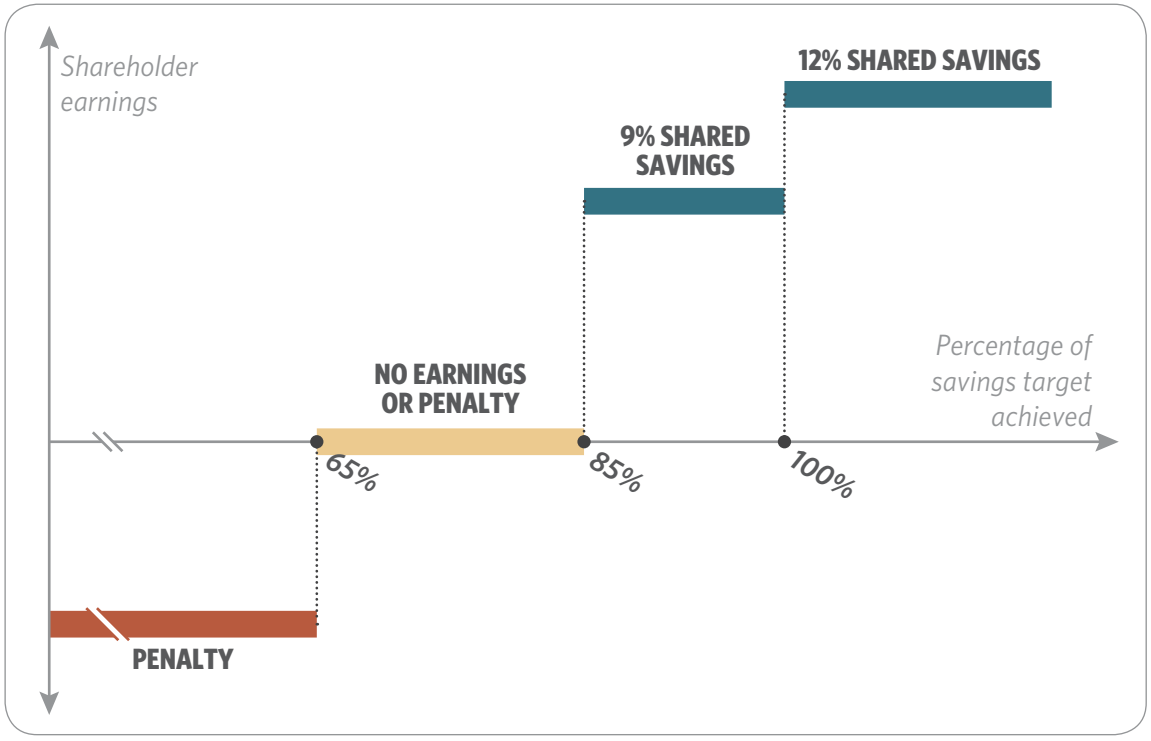
This report presents a single case study of California's experience implementing the RRIM between 2006 and 2012. While this is not a comprehensive picture of shareholder incentives in the United States, this episode was significant and holds important lessons for other jurisdictions. The RRIM was a larger and more complex incentive than the policies in many other states, and the public record is rich in information on its design and implementation process — including some flaws in its design that led to major roadblocks in implementation.

Overview of the Risk/Reward Incentive Mechanism

This section briefly describes the design and implementation of the RRIM. A full narrative of the RRIM's implementation is included in Appendix B.

The RRIM was a "shared savings" incentive, under which the total amount of money saved through energy efficiency programs was shared between ratepayers and utility shareholders.[1] Under the RRIM, the incentive payment for each utility was based on two primary performance measures: the net economic benefits produced by the utility's energy efficiency programs, and the total amount of energy savings.

Figure 1: Schedule of earnings and penalties in the 2006-08 RRIM



The RRIM included a tiered system of rewards and penalties based on utilities' progress toward their energy savings targets, represented in Figure 1. Annual savings targets were set for each utility for electricity, peak demand, and gas savings (in terms of kilowatt-hours (kWh), kilowatts (kW), and therms respectively). Under the RRIM, earnings were based on the percentage achieved of each of the three individual savings targets, as well as the average percentage achieved for all targets.

In order to earn an incentive payment, the utilities had to meet multiple savings targets simultaneously. Utilities received a 9% shared savings rate if they achieved an average of at least 85% of their energy savings targets and at least 80% of each individual savings target. If they exceeded 100% of their targets on average and at least 95% of each target, the shared savings rate increased to 12%. If utilities fell below 65% of any savings target, they were penalized for underperformance, with a per-unit penalty applied for each unit (kWh, kW, therms) below the savings goal. If they achieved at least 65% of each target but did not meet the requirement for the 9% shared savings rate, no rewards or penalties applied. This range was referred to as a "deadband."

Total earnings and penalties, for the four utilities combined, were each capped at $450 million over the three-year program cycle.

A key component of the RRIM as originally designed was that incentive earnings would be calculated based on ex post (post-implementation) estimates of energy savings. Utilities received interim payments for the first two years of the three-year program cycle based on ex ante (pre-implementation) estimates of energy savings and CPUC's interim evaluations of program implementation progress.

1 In the United States, most electric and gas utilities are for-profit companies owned by private investors and regulated by states; others are publicly owned. Because shareholder incentives are only relevant for investor-owned utilities, "utilities" in this paper refers to investor-owned utilities, unless otherwise specified.

At the end of the program cycle, CPUC and its contractors would complete a final program evaluation, and CPUC would update some of the values used to calculate net benefits with ex post estimates based on the final evaluation findings. Final payments to the utilities would be calculated so that the total award paid over the three-year cycle corresponded to the amount calculated based on ex post evaluation. This process was referred to as a "true-up."

The RRIM was adopted in 2007 and remained in place largely as designed until 2010, when conflict over incentive earnings for the 2006-08 period led CPUC to overhaul the incentive.

In 2010, CPUC staff released its final evaluation report estimating energy savings from the energy efficiency programs implemented in 2006-08. Based on the ex post updates to energy savings estimates, the report showed results that were dramatically different from the utilities' claimed energy savings levels. CPUC staff's evaluation indicated that the final true-up would have swung the utilities from the large reward calculated based on ex ante estimates to either a small reward (for SCE, SDG&E, and SoCalGas) or a penalty (for PG&E). PG&E had the largest swing: from $180 million in earnings based on ex ante estimates to a $75 million penalty based on ex post estimates for energy savings parameters.

The variables driving the difference between CPUC's evaluation report and the utilities' claimed energy savings included free ridership levels (program participants who would have taken action even without the program's support), the expected useful life of energy-efficient equipment, and adjustments associated with the impact of more efficient lighting on indoor air temperatures (for more detail, see Appendix C: Evaluation Issues).

After extended debate over the evaluation findings, CPUC decided by a 3-2 vote in December 2010 to abandon the true-up for the 2006-08 period. CPUC awarded final payments based on ex ante assumptions about energy savings parameters and ex post verification of program implementation, and lowered the shared savings rates to a flat 7% of net economic benefits, replacing the 9% and 12% tiers.

Figure 2 illustrates where the utilities fell on the RRIM earnings curve under the three scenarios — the utilities' own reports on their performance, using ex ante assumptions about energy savings parameters; the CPUC staff-led evaluation of the utilities' performance; and the values actually used in the final payment.

Figure 3 shows the utilities' 2006-08 performance and associated incentive earnings under these three scenarios.

Debate over the design of the incentive mechanism for programs between 2010 and 2012 continued throughout the program cycle, with CPUC approving a simplified incentive in December 2012. The 2010-12 incentive is primarily based on a percentage of approved program spending, not on energy savings. A smaller part of the incentive is based on utility conformance with CPUC's procedures for developing ex ante estimates of program impact; CPUC frames this incentive payment as an effort to incentivize the utilities to contribute accurate information during the ex ante review process.

In September 2013, CPUC adopted a new incentive mechanism, the Efficiency Savings and Performance Incentive, to reward 2013-14 energy efficiency programs. The core of the new incentive is based on ex post energy savings estimates, with no penalty provision and no sharp cutoffs in earnings (CPUC 2013). The new incentive rewards utilities based on the amount of energy saved through their efficiency programs, rather than the programs' net economic benefits. It also includes an incentive for utility compliance with CPUC's process for reviewing ex ante savings estimates, as well as a bonus payment as a percentage of spending for programs without quantified energy savings estimates.

Figure 2: Utility energy efficiency program performance during 2006-08 according to utility reports, CPUC staff-led evaluation, and final decision

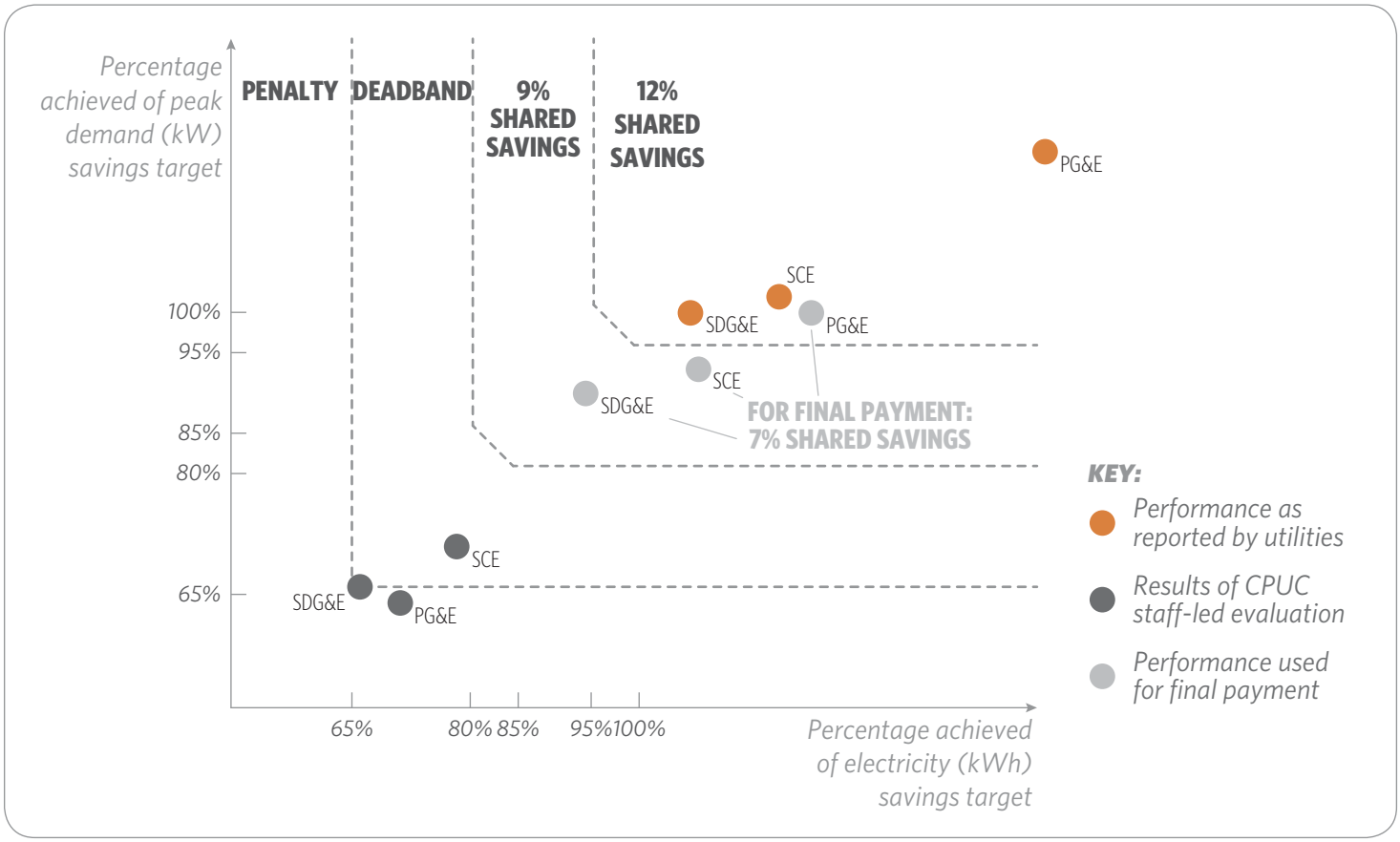
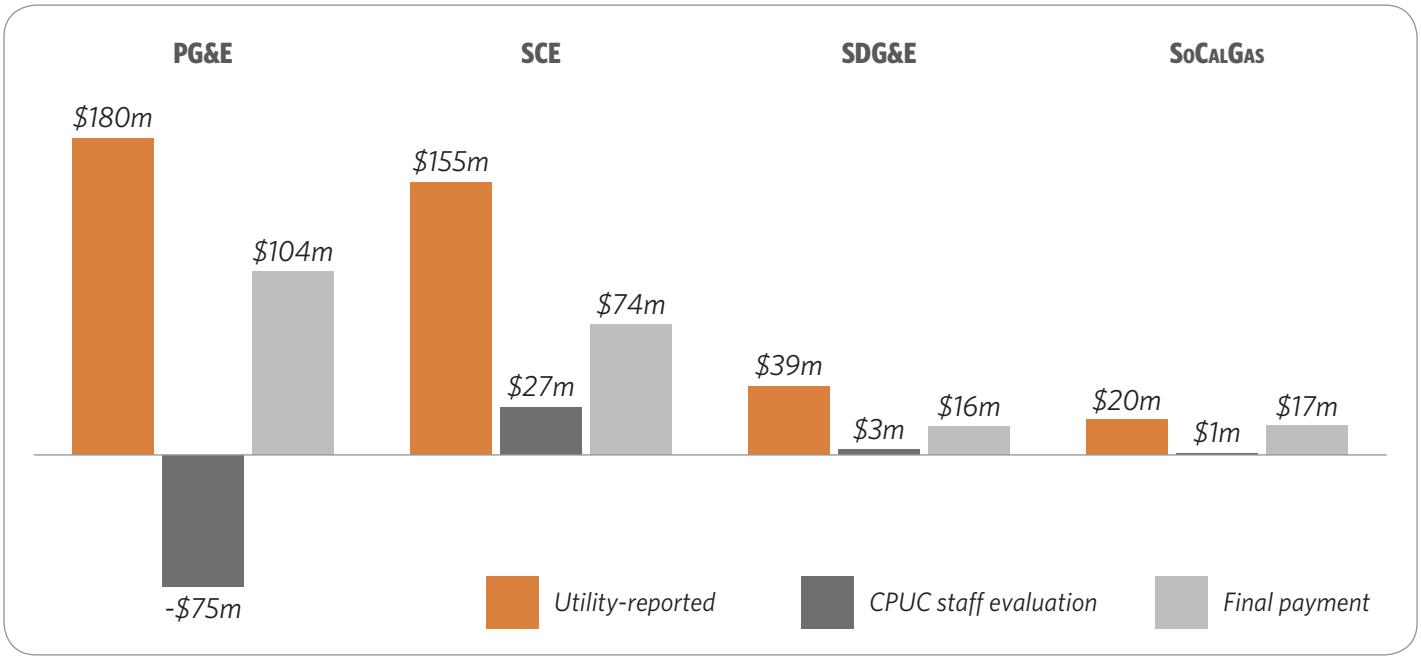


Figure 3: Utility incentive earnings under three alternate earnings scenarios (Dollar figures in millions)



Assessment of the RRIM's Effectiveness

In this section, we evaluate the RRIM's successes and shortcomings in meeting its three primary objectives:

1. Accelerate progress toward California's energy efficiency goals
2. Elevate energy efficiency within the utilities' decision-making
3. Protect ratepayers by ensuring that the utilities bear risks related to the performance of their energy efficiency programs

Goal 1: Accelerate progress toward California's energy efficiency goals

> **Assessment:** Utilities had limited ability to respond to the incentive because of delays in its implementation. But the RRIM's design did drive toward the specific energy efficiency objectives that were important to CPUC — in particular, maximizing net economic benefits from energy efficiency.

Findings

1.1 The RRIM was implemented retroactively, meaning it could not have its maximum potential impact on energy savings. Because programs had already been designed and were already underway, the newly implemented incentive could only have an impact through driving mid-stream changes to already-existing programs. The same is true of the 2010-12 and 2013-14 incentives.

An incentive would have maximum impact on outcomes if it were implemented before the energy efficiency portfolio development process. Utilities would then take the incentive into account when putting together their energy efficiency portfolios for that program cycle, and have additional motivation to design and suggest programs that the mechanism rewards.

Due in part to the CPUC's complex institutional environment and rulemaking process, the RRIM has not yet been implemented under these circumstances — many important policy decisions have been made retroactively, lessening their potential impact. The utilities and CPUC finalized portfolios in 2006; while an incentive mechanism was in development at that point, the design of the incentive was not finalized until the RRIM was adopted in late 2007.

For programs implemented in 2010-12, the incentive was not created until the end of the program cycle, meaning it could have had very limited impact on program design and implementation. The 2013-14 incentive was adopted nine months into a two-year program cycle, again preventing the incentive from exerting its full influence on program selection and design.

In these circumstances, utilities can still respond to the presence of the incentive by shifting effort to different programs within their portfolios, but they cannot entirely redesign their portfolios in response to the incentive. A RRIM-like incentive would undoubtedly have greater impact when established at a time that allows for a fuller response on the part of the utilities.

1.2 Parties agree that ratepayer-funded programs achieved substantial savings of electricity, peak demand, and natural gas during the period when the RRIM was in place, although these savings cannot be directly attributed to the RRIM.

CPUC estimates that gross energy savings associated with programs implemented during 2006-08 totaled 6,497 GWh of electricity (3.2% of sales), 1,175 MW of peak demand, and 84 million therms of natural gas (1% of sales) (CPUC 2010c: ii). The utilities claim the true numbers are higher. Even the lower numbers put California among the leading states in energy savings: In terms of savings as a percentage of energy sales, California ranked between second and seventh nationally during that time period (Eldridge et al. 2008; Eldridge et al. 2009; Molina et al. 2010).

While the RRIM was a departure from previous policy, there were also changes in markets, programs, and evaluation practices at the same time, meaning that simply comparing the 2006-2012 period to prior years does not adequately capture the RRIM's impact. Attributing actual energy savings and net benefits to the RRIM is therefore

a speculative exercise that we do not undertake here. Nonetheless, these savings represent significant progress toward California's energy efficiency targets.

1.3 The RRIM's design supported CPUC's original set of policy objectives — achieving net economic benefits from efficiency measures.

The 2006-08 RRIM was designed to maximize net economic benefits and achieve the most cost-effective energy savings, and accordingly, it offered an incentive tied to net economic benefits and achievement of energy savings targets. In the 2007 decision establishing the RRIM, CPUC also emphasized producing quantified energy savings (in both the short and long term), as well as displacing more expensive supply-side resources, as overarching goals of the mechanism (CPUC 2007a: 2–4).

The RRIM's shared-savings design reflected that priority, since efficiency measures with high net economic benefits generated greater rewards for shareholders.

1.4 California's energy efficiency goals changed with the adoption of the Long Term Energy Efficiency Strategic Plan in 2008. The RRIM did not effectively drive toward the new set of goals; with its adoption of a new incentive in 2013, CPUC has made some changes to better align the incentive with policy objectives.

The design of the RRIM, which was originally intended to run from 2006-2011, soon fell out of step with California's energy savings goals, which were revised and expanded in 2008. In 2008, the Long Term Energy Efficiency Strategic Plan articulated the goal of rebalancing utility energy efficiency portfolios to include more comprehensive, long-term savings (CPUC 2008a: 4). Reflecting these developments, in 2008 CPUC replaced its earlier, narrower set of energy-saving goals with market-wide goals focusing on the larger, longer-term project of market transformation. (For more on the evolution of California's energy efficiency goals, see Appendix A: Policy Background.)

The RRIM did not provide a strong incentive for programs believed to produce longer-lived, more comprehensive savings — indeed, in some cases it penalized utilities for pursuing these programs. Because the RRIM awarded utilities a percentage of net economic benefits, it provided the greatest reward for those programs currently deemed to be the most cost-effective, such as lighting programs. More comprehensive measures, like whole-home retrofits, fare poorly on cost-effectiveness tests as they are currently implemented (see Appendix C: Evaluation Issues). Under the RRIM, these programs would lower a utility's earnings by lowering the net economic benefits of the energy efficiency portfolio, and thereby the basis for the shared savings calculation.

CPUC sought to fix the mismatch between incentive and policy objectives in the new incentive mechanism for 2013-14 programs. The decision adopting the 2013-14 incentive reads:

> *In accordance with the Strategic Plan, our adopted ESPI mechanism differs from the prior approach by placing greater emphasis on capturing deeper, more comprehensive, and longer lasting energy savings. This objective reflects a shift from the previous priority to maximize net economic benefits. Maximizing net economic benefits yields higher current economic benefits, but reduces energy savings and lessens support for longer-term policy objectives. This policy guides away from any measure or program that is not cost-effective (even if it may be in the future). The choice is between maximizing energy savings while keeping a positive portfolio benefit-cost ratio, versus maximizing net economic benefits. (CPUC 2013: 35)*

In order to meet the policy priorities of capturing long-lived, more comprehensive energy savings, the new incentive is based on the lifetime energy savings of efficiency measures installed due to utility programs. The new incentive no longer offers a greater reward for the most cost-effective measures, nor does it penalize less cost-effective measures.

Box 2: What is needed to focus utility attention on energy efficiency?

The concept of "supply-side equivalence" — equalizing the utility's return on investment in supply-side and demand-side resources — was the starting point for California's first shareholder incentive, implemented in the 1990s, and was one driver of the initial design of the RRIM. The Energy Action Plan proposed to "provide utilities with demand response and energy efficiency investment rewards comparable to the return on investment in new power and transmission projects" (California Consumer Power and Conservation Financing Authority, California Energy Commission, and California Public Utilities Commission 2003: 5).

However, interpretations of the "supply-side equivalence" concept have shifted over time. During the proceeding to revise the RRIM in 2010-12, CPUC asked the utilities to calculate a supply-side equivalent earnings rate — the level of shared savings that would equalize the return on energy efficiency and supply-side investment. The results of these calculations ranged from 24% to 77% shared savings — far higher than the actual incentive levels offered by the RRIM (Pacific Gas and Electric Company 2012; San Diego Gas & Electric Company and Southern California Gas Company 2012; Southern California Edison Company 2012).

In practice, coming up with a supply-side equivalent earnings rate is not a simple task. There are some fundamental differences between investments in energy efficiency and in supply-side resources, so the challenge of putting the two on a level playing field goes beyond changing the shared-savings rate. Utilities acknowledged this in the comments accompanying their 2010-12 supply-side equivalence calculations; none argued for CPUC to use the higher shared-savings rates.

What are the key points of divergence between investments in efficiency and in supply-side resources? First, energy efficiency programs are funded upfront by ratepayers. As ratepayer advocates have consistently pointed out, this means utilities are not putting their own capital at risk when they invest in energy efficiency, as they do when they invest in supply-side resources. The rationale for rewarding efficiency is not the same as the rationale for allowing utilities a rate of return on supply-side investment. In addition, the earnings rate that would achieve the goal of supply-side equivalence depends on a number of factors that vary in different areas and at different points in time. At some points, efficiency programs are offsetting the need for construction of new power plants or transmission and distribution infrastructure. At other times, efficiency programs are reducing demand for power from existing power plants. Utilities face a range of different risks and financial rewards across different investments and activities. The role of efficiency in this landscape is complex; it is not a binary choice between investing a dollar in efficiency or in energy supply.

The broader challenge facing regulators is to make efficiency a core part of utilities' business practices, so that they give energy efficiency a central role in resource planning. California policymakers' language has changed to reflect this more fundamental goal. In the 2005 update to the Energy Action Plan, the state's energy agencies framed the concept of supply-side equivalence in terms of utilities putting the two activities on equal footing in their own resource planning — tying the concept of supply-side equivalence to the utilities' own management decisions, rather than to a specified return on investment (California Public Utilities Commission and California Energy Commission 2005: 5).

Goal 2: Elevate energy efficiency within the utilities' decision-making

Assessment: The RRIM did elevate the status of energy efficiency within the utilities, in an incremental if not transformative way. However, the impact of the incentive is limited by the perception among utilities and investors that incentive earnings are uncertain and non-repeatable.

Findings

2.1 Utilities designed their energy efficiency portfolios to emphasize the most heavily rewarded activities (particularly lighting programs). The RRIM was a factor in this decision, though not the only one.

Given the design of the RRIM, we should expect the incentive to induce utilities to shift their spending towards programs that they expected to deliver large net benefits. The composition of utilities' energy efficiency portfolios for the 2006-08 period suggests that this did occur to some extent.

The most notable case is the expansion of programs that subsidized compact fluorescent light bulbs (CFLs). Indoor lighting measures, composed largely of CFLs, accounted for more than half the total evaluated savings in California between 2006 and 2008 (CPUC 2010c). The move toward CFLs was so substantial that it prompted a response from the CPUC:

> *One of the "unintended consequences" of this proceeding is that utilities were encouraged to place greater emphasis on measures with high annual savings levels even if their design lives were relatively short, with the result that the majority of 2006-2009 portfolio savings (and a significant portion of projected 2010-2012 program savings) derived from one measure — basic Compact Fluorescent Lamps. (CPUC 2012a: 348)*

Whether or not this was the intention of the CPUC, we take this as evidence that the mechanism did meaningfully drive utility behavior. Utility stakeholders also affirmed in interviews that the large reward potential associated with lighting programs was one reason for the emphasis on lighting in program portfolios.

2.2 While the RRIM was in place, utility senior management took a more active interest in energy efficiency and tracked progress toward earnings goals.

In interviews, utility representatives said that the RRIM led to increased visibility for energy efficiency within their utilities, and that senior management at their companies pay more attention to energy efficiency if it is seen as a potential source of profit than if it is purely for compliance with regulatory requirements. Interviewees stated that senior utility management requested frequent updates from efficiency staff on utilities' progress toward the RRIM's performance targets, after expressing little interest in efficiency prior to the RRIM. While the RRIM was in place, utilities also reported on incentive earnings projections in their annual reports and presentations to investors (PG&E Corporation 2009; Southern California Edison Company).

Our findings are consistent with ACEEE's survey of shareholder incentives (Hayes et al. 2011); in interviews with utility representatives in multiple states, ACEEE also found that the presence of an incentive helped to "legitimize" efficiency in the eyes of senior management, or to raise the profile of efficiency within the utility. Hopper et al. (2009) also cite statements by utility managers in California and Nevada that shareholder incentives can be an important way to focus management attention on efficiency.

2.3 Predictability and reliability of earnings over the long term are very important in making an earnings stream valuable to a utility. After the RRIM true-up process revealed that RRIM earnings were subject to fluctuation and could conceivably flip from earnings to penalties, utility management's view of energy efficiency became substantially less positive.

Utilities' maximum potential earnings opportunity and potential penalty under the RRIM totaled 2.6% of their pre-tax profits during the 2006-08 period ($450 million). Utility representatives emphasized in interviews that the non-repeatability of incentive earnings and the uncertain regulatory environment significantly limited the value of the RRIM to utilities and their shareholders. Recurring earnings are important to investors; the expected flow of future earnings is part of the company's current value and factors into its stock price. Unpredictable or one-time earnings that cannot be counted on to recur in the future do not factor into the company's valuation in the same

way. Utility staff made this point in interviews, noting that the perceived unpredictability of the RRIM meant that it did not increase the company's value to its shareholders.

Some interviewees stated that management attention dropped off after the extended debate over the true-up process for 2006-08 incentive earnings, or refocused around avoiding a penalty rather than valuing the earnings potential.

In interviews conducted after the conclusion of the RRIM debate, interviewees stated that for the most part, utility management views energy efficiency programs as a compliance requirement with bonus payment potential, more than a high-level strategic initiative.

2.4 There are many factors that influence a utility's propensity to devote effort and resources to energy efficiency — not just the possibility of a financial reward. This includes some factors that favor efficiency, and some that work against it.

Many factors in a utility's business and regulatory environment have an impact on the potential profitability of energy efficiency and its attractiveness as a strategy. Utilities may invest in efficiency because of a financial incentive, a regulatory requirement, or a host of other factors. Incentive mechanisms for energy efficiency exist in coordination with many other aspects of utility planning and regulation, including the energy efficiency portfolio planning process, ratemaking and cost recovery, and system planning.

Some of these factors create positive incentives for efficiency — for example, efficiency may be a good way to relieve grid congestion in areas where building a new transmission line would be too difficult. California invested heavily in efficiency during the 2001 energy crisis, including a major expansion of utility programs, in order to avoid blackouts (Bachrach, Ardema, and Leupp 2003). Utilities also invest in efficiency as a customer service function — indeed, energy efficiency falls within the customer service division for all four of California's investor-owned utilities.

Other factors weigh against efficiency, including the long lifespan, predictability, and ease of measurement of returns for utility investment in supply-side resources. The specifics — and the relative importance of a shareholder incentive — will likely vary from state to state, and even from utility to utility. As with efficiency, supply-side investments are based in part on regulatory requirements and other factors, and are not only motivated by an earnings opportunity.

Goal 3: Protect ratepayers by ensuring that the utilities bear risks related to the performance of their efficiency programs

Assessment: The RRIM was mostly unsuccessful at meeting this objective. In the end, CPUC did not follow through with the primary ratepayer-protection component of the RRIM — the ex post true-up — because of conflict generated by the evaluation findings and the sensitivity of the RRIM's earnings function.

Findings

3.1 The ex post true-up conflicted with the utilities' interest in predictable earnings and created a flashpoint for conflict, since it gave utilities a financial stake in fighting the measurement process.

CPUC and its contractors did complete interim reports on the progress of 2006-08 efficiency programs, but their final evaluation was completed after the conclusion of the programs. At that point, the utilities could no longer change their programs to improve their evaluated performance; the only way to increase their incentive earnings was to contest the evaluation. This is not to say that the utilities' objections were not sincere — only that the incentive existed for them to dispute the evaluation findings regardless.

CPUC had intended the ex post true-up to serve as an incentive for the utilities to respond more dynamically to changes in the market while implementing efficiency programs (CPUC 2010d). In some cases, utilities did receive early signs that energy savings parameters were likely to change. But in the 2010 decision altering the RRIM, CPUC stated that overall, the goal of achieving rapid updating of programs had not proven to be achievable, given the time it took to implement programs, complete evaluations, and make updated information public.

3.2 The RRIM's penalty provision was not enforced in practice. Beyond California, most shareholder incentives do not include penalties, and it does not appear that any state has ever actually levied a penalty on a utility for not meeting energy efficiency targets.

In discussions about RRIM reform, utilities have indicated that they are highly averse to penalties. Utility energy efficiency staff have stated that the presence of a penalty focuses management attention on avoiding the penalty rather than maximizing the reward — and thereby undermines the ability of the incentive to drive toward ambitious goals.

A penalty can help ensure that risks and potential rewards are appropriately shared between utilities and ratepayers, and it can be a powerful tool for discouraging outcomes regulators specifically do not want. The National Action Plan for Energy Efficiency (2007) also notes that penalties can be important to align utility incentives with regulators' objectives. However, penalties may not be a good fit in all circumstances — for example, they may be better suited to guard against a bad outcome (e.g., a system failure) than to drive toward greater levels of a good outcome (e.g., efficiency).

In the initial design of the RRIM, the penalty was one component of CPUC's attempt to shift the risk of underperformance from ratepayers onto the utilities. But in the eventual resolution of the RRIM, the utilities were able to negotiate a resolution that pushed some of the risk back to ratepayers. The changes to the RRIM in the 2010 true-up decision made it significantly less likely that a utility would face penalties under the RRIM.

CPUC's decision may have been informed by the broader need to preserve a harmonious relationship with the utilities, and the sense that following through with the true-up and penalty would have jeopardized that relationship. It is noteworthy that there are very few examples of other jurisdictions adjusting shareholder incentive payments based on ex post evaluation of energy savings (Hayes et al. 2011). However, the adopted 2013-14 incentive preserves the ex post true-up, signaling that CPUC has not given up on this policy tool.

Most other shareholder incentives for energy efficiency do not include penalties. Moreover, in states whose mechanisms do include a penalty, ACEEE found no instances where one has actually been imposed (Hayes et al. 2011). Given the regulator's need to preserve an ongoing working relationship with the utilities, as well as the utilities' aversion to penalties, penalties may not always be enforceable. They may have value as a negotiating tool, but at the risk of tying up resources in regulatory disputes.

3.3 The RRIM as designed was too sensitive to unavoidable fluctuations in energy savings parameters, resulting in earnings calculations that were not meaningfully tied to performance.

Uncertainty in measured energy savings is a fundamental problem for shareholder incentives to contend with. As we do not observe the energy use that would have occurred absent the programs, actual savings can only be estimated. Even state-of-the-art evaluations can produce highly uncertain estimates (see Appendix C: Evaluation Issues), and even high-quality evaluations will inevitably have to contend with incomplete data or other imperfections in execution. For example, in evaluations of the 2006-08 lighting programs, estimates of free ridership for CFL purchases (the proportion of purchases that would have occurred absent the program's intervention) ranged from 19% to 89% for the same store type, using different methods (KEMA, Inc. 2010: 49–54) In addition, evaluators examining the market impact of the Upstream Lighting Program did not have sufficient baseline data on market penetration of CFLs before programs were implemented. The missing data made it much more difficult to measure the program's impact (The Cadmus Group 2010: vii–ix).

The tiered structure of the RRIM created points where a small change in estimated energy savings could push a utility to a different shared savings rate or into the deadband or penalty range (see Figure 1). This structure assumes that regulators know with confidence that a utility achieved 85%, rather than 84%, of a savings metric. In fact, this is not likely to be the case, even in high-quality evaluation of efficiency programs. Analysis undertaken by CPUC's Energy Division to inform the true-up calculation demonstrates how different judgments about energy savings parameters could have a dramatic impact on savings estimates. Based on a range of assumptions about parameters, total RRIM earnings in the different scenarios varied from earnings of nearly $400 million to a penalty of over $100 million (CPUC 2010a: 36, 57).

Making a single reward contingent on meeting multiple targets exacerbated this problem. Because the RRIM's earnings structure required utilities to meet multiple targets simultaneously, small fluctuations in one metric had an outsize effect on the incentive payment: If one target was not met, the utilities received no reward for meeting other targets. This provision led to differences in incentive earnings that did not reflect meaningful differences in performance. The CPUC staff-led evaluation of savings found similar average performance across the utilities — the evaluation found that the utilities had met an average of 66% to 74% of their savings targets. However, PG&E fell just short of 65% of its demand savings target in that evaluation, even though it achieved over 70% of its other energy savings targets. This meant that PG&E would have received a $75 million penalty according to that evaluation, while the other utilities would retain a limited amount of earnings (see Figure 3).

In the 2013-14 incentive, CPUC has addressed this problem by eliminating the earnings "cliffs." CPUC has also introduced an incentive payment for utility compliance with the process for ex ante review of energy savings parameters, as an attempt to improve ex ante estimates and narrow the gap between ex ante and ex post estimates. Evaluation findings factor into the resource planning and forecasting process in addition to incentive payments, and greater resources devoted to energy savings estimation at both the ex ante and ex post stages reflects CPUC's commitment to improving the quality and certainty of savings estimates.

Policy Recommendations

The RRIM was a novel and ambitious policy that successfully drew greater utility management attention to energy efficiency, and both its successes and shortcomings hold useful lessons for other jurisdictions. Our analysis of the RRIM experience suggests the following recommendations for policymakers implementing utility incentives for energy efficiency:

Put incentives in place before programs are designed and implemented. The RRIM's impact was limited because it applied to programs that were already underway. Utilities could only change programs at the margins, thus blunting the influence of the incentive on the nature of those programs. Moreover, this timing issue was one reason CPUC reversed some of the RRIM's accountability provisions: CPUC concluded that the utilities did not have enough time to change their programs in response to evaluation results that informed the incentive payment.

Avoid sharp cutoffs in earnings that do not reflect meaningful differences in program performance. The RRIM created several high-stakes inflection points where a small change in estimated savings could make the difference between reward and penalty, and exacerbated this problem by conditioning rewards on meeting multiple targets simultaneously. This design led to differences in incentive earnings across the utilities that did not reflect meaningful differences in performance. This outcome undermined the incentive's goal of tying rewards and penalties to utility performance. Earnings "cliffs" do not reflect the reality of the evaluation, measurement, and verification (EM&V) process, which involves some inherent uncertainty. Incentives should be designed so that similar estimates of energy savings produce substantially similar rewards.

Design incentives to be as predictable and repeatable as possible. Investors factor repeated earnings into a company's valuation, but they do not do the same with one-time or unpredictable earnings. Utilities indicated that the RRIM was not valued by their shareholders — and therefore received less management attention and, presumably, less weight in program decisions — because it was perceived as unpredictable. Making an incentive simultaneously performance-based and predictable involves tradeoffs and perhaps requires innovation in incentive design, but this should be a point of focus for utility regulators. Repeatability faces challenges as well,

as increasingly stringent codes and standards consume some of efficiency programs' advances over time. Finally, the incentive design itself should be seen as stable and predictable – something that has not characterized California's experience. After the extended dispute over 2006-08 incentive earnings, utility management and investors were left with the perception that the utilities could not control or predict their future incentive earnings, meaning the incentive could not factor meaningfully into the companies' value.

Relatedly, condition incentives only on factors utilities can monitor and influence. Ex post rewards and/or penalties should relate to utility actions (e.g., the number of measures installed), not to factors the utility cannot control (e.g., a change in the expected useful life of a piece of equipment, or an engineering estimate of the additional heating load induced by switching to more efficient lighting). There is no hard line between these categories, and part of the virtue of a pay-for-performance incentive is to encourage the utilities to monitor and constantly improve their programs. But making them responsible for variables they cannot control only serves to make rewards more uncertain, thereby lowering their relevance to utility shareholders. In the final resolution of the RRIM, CPUC chose not to follow through with the accountability provisions it had designed. One of the primary reasons it gave for this decision was that the RRIM penalized utilities for downward adjustments in savings estimates, regardless of whether those adjustments were due to factors the utilities could control (or were even aware of).

Expect that incentives will put pressure on evaluation processes and engender new disputes. Consider implementing a high-stakes incentive only if there is an institutional arrangement for savings estimation and dispute resolution that is accepted by all parties. Incentives tied to efficiency will increase the amount of regulatory negotiation and conflict around the measurement of energy savings, particularly given the inherent uncertainty in that measurement process. This additional negotiation has real costs in terms of resources and time on the part of utilities, regulators, and other stakeholders. These resource costs should be accounted for as part of the cost of an incentive.

In California, the protracted debate over the 2006-08 incentive payment consumed a great deal of time and staff resources for all parties, including CPUC, the utilities, and other organizations involved in the proceeding. The debate prevented the timely implementation of a new round of efficiency programs, which was scheduled to begin in 2009 but was delayed to 2010. The debate over evaluation results was heightened because California's institutional system for evaluation was also changing at the time the RRIM was implemented, and utilities were not comfortable with the new process. In subsequent years, the conflict has lessened in part because the evaluation process has been revised to allow more opportunity for input and review, allowing parties to build trust in the process.

Finally, don't expect shareholder incentives to single-handedly right the balance between supply-side and demand-side utility investments. Incentives can encourage utilities to prioritize efficiency programs more, but their impact on utility decision-making depends on many factors beyond the size of the earnings opportunity. Incentive mechanisms for energy efficiency exist in coordination with many other aspects of utility planning and regulation, including the energy efficiency portfolio planning process, ratemaking and cost recovery, and system planning. Some of these factors make efficiency more attractive to the utility; others have the opposite effect. The power of a shareholder incentive depends in part on these other factors. Regulators should not expect an incentive on its own to transform efficiency into a core part of the utility business model; that transformation will require deeper changes to the structure of utilities.

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Appendix A: Policy Background

In this appendix, we review the argument for shareholder incentives and the existing evidence on their effectiveness. We then describe the specific policy landscape within which California's shareholder incentive was implemented.

Why shareholder incentives?

In most U.S. states, energy efficiency programs are primarily delivered by utilities (Sedano 2011). There are some advantages in assigning responsibility for energy efficiency to utilities, namely their scale and central role in the energy market. Utilities have a direct relationship with energy users, and since they procure energy to meet their customers' demand, they are in theory well-placed to deploy efficiency to meet that demand at lower cost.

However, investor-owned utilities do not generally have a financial incentive to invest in efficiency. In general, utilities earn profits by providing energy services and building energy infrastructure. Most states allow utilities to recover the cost of energy efficiency programs through rates charged to their customers (ratepayers), but do not generally allow them to earn positive returns on these programs. Utilities therefore will not tend to pursue efficiency, even if efficiency is a less expensive way to meet demand. This financial disincentive on the part of utilities has been identified as a major barrier to energy efficiency investment (Kushler, York, and Witte 2006; National Action Plan for Energy Efficiency 2007; e.g., Hayes et al. 2011).

In order to remove the disincentive to save energy, many states now "decouple" utility revenue from sales — by ensuring utilities recover their authorized fixed costs, no more and no less, regardless of whether actual energy sales are higher or lower than forecasted (Kushler, York, and Witte 2006).

Cost recovery and decoupling remove the financial penalty for pursuing energy efficiency, but they do not offer utilities the opportunity to profit from energy efficiency as they do from supply-side investment. As a next step to level the playing field, a growing number of states are offering utilities shareholder incentives for delivering energy savings (Hayes et al. 2011). The principle of "supply-side equivalence" — that utility shareholders should be able to profit on energy efficiency investments just as they do on supply-side investments — has been an important driver of shareholder incentives, in California and elsewhere.

Existing evidence on shareholder incentive effectiveness

There is relatively little empirical evidence on the impact of shareholder incentives for energy efficiency. The most comprehensive survey of existing shareholder incentives was undertaken by the American Council for an Energy-Efficient Economy (ACEEE) (Hayes et al. 2011). That survey notes that states with shareholder incentives in place tend to have more extensive energy efficiency programs that achieve more energy savings, although it is not possible to draw a clear causal link between the incentive and energy savings.

Hopper et al. (2009) review the degree to which utilities in the western United States are incorporating energy efficiency into their resource planning (long-term planning for meeting energy demand in their service territories). They find that California's investor-owned utilities incorporated more energy efficiency into their resource plans than most other utilities in the region. Based on statements by utilities, they note that shareholder incentives were important in helping California's utilities make a business case for large-scale investment in efficiency. However, since there are many policy levers in California directed at increasing energy efficiency investment, the analysis does not specify how much of the difference may be due to the presence of shareholder incentives.

Blumstein (2010) points to the "principal-agent problem" posed by shareholder incentives: Through an incentive, regulators are attempting to motivate utilities to achieve outcomes that the regulators want (energy savings, cost savings, or other goals). But utilities are complex organizations with institutional interests that do not perfectly correspond to the interests of policymakers, even with a shareholder incentive in place.

The question of how to measure and verify performance is a critical component of incentive design. Kaufman and Palmer (2012) argue that utilities are likely to overstate the performance of their energy efficiency programs in the presence of a shareholder incentive, and that independent evaluation of program performance provides an

important role in preventing overpayments. Blumstein (2010) argues that incentives can only function well if their goals are concrete, measurable, and limited.

National expert groups have also considered shareholder incentives. The National Action Plan on Energy Efficiency, a coalition of policymaker and industry stakeholders convened by the U.S. government, explored the use of shareholder incentives for energy efficiency in a 2007 report (National Action Plan for Energy Efficiency 2007). Among its recommendations for doubling U.S. energy productivity by 2030, the Alliance to Save Energy's Commission on National Energy Efficiency Policy — representing a coalition of high-level policymakers and stakeholders — recommended offering utilities financial incentives for energy efficiency (Alliance Commission on National Energy Efficiency Policy 2013).

Shareholder incentives in the United States

Including California, the Federal Energy Regulatory Commission counts 21 states with a shareholder incentive in place (Federal Energy Regulatory Commission 2011). In its survey of shareholder incentives in 18 of those states, ACEEE notes that across the states with shareholder incentives, utilities have almost always succeeded in earning the full incentive available to them (Hayes et al. 2011). This could mean that the incentives are effective at motivating energy savings, that the thresholds for earning incentives are not generally very ambitious, that utilities are adept at negotiating the highest incentives, or all three.

Shareholder incentives take different forms across states; Hayes et al. (2011) detail the design of incentives in 18 states. The most common type of incentive is a "shared savings" arrangement, which offer utility shareholders a portion of the cost savings due to their efficiency programs. (California's shared savings mechanism is described in more detail in Section 3.) Some states instead offer utility shareholders a financial reward for meeting quantified energy savings goals, or allow utilities to earn a regulated rate of return on energy efficiency spending. Several states also employ hybrid models, offering incentives for a range of energy savings goals and/or program activities. Two states other than California include a penalty if utilities fail to meet their targets.

YEAR	POLICY	DESCRIPTION
2003	State of California Energy Action Plan	Gave a central role to energy efficiency and renewable energy in accomplishing the state's broad goals of ensuring reliable, affordable, and environmentally sound energy provision Established the principle that energy efficiency and conservation should be "first in the loading order," meaning that efficiency is the preferred resource to meet the state's energy needs
2005-2006	Senate Bill 1037 (Kehoe, Chapter 366, Statutes of 2005) Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006)	Required California's utilities to identify and procure all cost-effective energy efficiency measures
2006	Assembly Bill 32, the Global Warming Solutions Act (AB32)	Established mandatory greenhouse gas (GHG) mitigation targets The California Air Resources Board, the agency implementing AB32, expects to achieve 15% of the planned 2020 GHG emissions reductions — 26.3 million metric tons CO_2 equivalent of the projected 169 million metric tons total — through energy efficiency (California Air Resources Board 2008: 17)
2008	California Long Term Energy Efficiency Strategic Plan	Stated that the unifying goal for future energy efficiency programs will be **market transformation**, defined as "long-lasting sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where further publicly-funded intervention is no longer appropriate in that specific market"(CPUC 2008a: 4-5) Refocused energy efficiency efforts to include more measures that produce long-term energy savings, target innovative technologies, or overcome barriers to efficiency

Setting the stage: The policy landscape in California

California's shareholder incentive interacted closely with other components of the state's energy efficiency policy structure. California has long been a leader in energy efficiency among U.S. states. It consistently ranks at or near the top of ACEEE's state energy efficiency scorecard (Eldridge et al. 2007; Foster et al. 2012). California spends more on energy efficiency programs than any other state, and it ranks in the top 10 states in per-capita spending on these programs (Foster et al. 2012).

Energy efficiency policy framework

In California, efficiency programs are primarily delivered by the state's four investor-owned utilities: Pacific Gas and Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), and Southern California Gas (SoCalGas). Their territory covers most of the state — 77% of the state's electricity customers and 98% of gas customers — although the large markets of Los Angeles and Sacramento, and many smaller markets, are served by municipal utilities (California Energy Commission 2012; Energy Information Administration 2012).

The utilities manage a wide range of efficiency programs, including (though not limited to) customer rebates for residential and commercial appliances, upstream subsidies to manufacturers of efficient products, whole-home retrofits, custom retrofits for industrial customers, and education, marketing, and outreach programs. These programs are amassed into portfolios implemented in multi-year "program cycles." Efficiency programs are funded by utility ratepayers.[2] California also has a large low-income energy efficiency program that is funded separately from other efficiency programs and was not covered by the RRIM.

The California Public Utilities Commission (CPUC) is the regulator of California's investor-owned utilities and plays a major role in guiding energy efficiency policy. CPUC sets broad energy efficiency policy goals and sets specific energy savings targets for the utilities. It also oversees the development and implementation of ratepayer-funded efficiency programs. Before the start of a new program cycle, CPUC issues guidelines to the utilities to direct their development of energy efficiency program portfolios, based on CPUC's policy priorities. The utilities submit their proposed portfolios and budgets to CPUC, and CPUC approves them before program activities commence.

CPUC is led by five commissioners, with an extensive support staff of administrative law judges, advisors, and analysts. CPUC's structure means that there are a range of actors involved in any policy decision. CPUC decisions are made by majority vote of the five commissioners, who are appointed by the governor to six-year terms. Within CPUC, administrative law judges facilitate settlements and propose decisions for CPUC consideration, based on publicly developed records. When we refer to CPUC in this paper, we generally mean decisions made by one or all of the five commissioners.

CPUC's Energy Division, part of the commission's professional staff, conducts analysis that informs CPUC decisions. Although the Energy Division reports to the commissioners, they do not always adopt its findings and recommendations, since other parties often present conflicting positions and the commissioners' weighing of public policy and political factors may differ from the CPUC staff's.

Program evaluation is an important component of the energy efficiency policy framework. In California, energy efficiency evaluation is under the purview of the CPUC's Energy Division, not the utilities. (The institutional responsibility for evaluation has shifted over the years; that shift is discussed further in Section 4.) During and after implementation of efficiency programs, CPUC's Energy Division oversees evaluation processes to estimate the impact of the programs, including their impact on energy savings and their cost-effectiveness. The evaluations are usually carried out by third-party consultants under contract to CPUC.

CPUC's Division of Ratepayer Advocates is a ratepayer advocacy organization housed within CPUC but separated from CPUC's regulatory decision making. The Division of Ratepayer Advocates participates in CPUC proceedings with the mission of "obtain[ing] the lowest possible rate for service consistent with reliable and safe service levels" (CPUC 2012b).

2 There is a surcharge on utility bills to pay for energy efficiency programs. However, without these programs, ratepayers would have had to bear the cost of additional supply. Evaluations of most programs show that ratepayer bills would have been higher absent the programs (see for example Arimura et al. 2012).

CPUC's decision-making process allows stakeholders extensive opportunities for input on policy issues, and CPUC decisions incorporate evidence and ideas submitted by parties in comments, as well as ideas originating within CPUC. In addition to the utilities, several local governments, private companies involved in energy efficiency, and non-governmental organizations are also parties to the RRIM proceeding. The Utility Reform Network (TURN), a non-governmental consumer advocacy organization, and the Natural Resources Defense Council (NRDC), an environmental advocacy organization, have been among the most active.

Energy efficiency goals

California's energy efficiency policies are framed by broad goals of saving energy, reducing greenhouse gas emissions, and driving lasting changes in the markets for energy-efficient products and services. The following table lists the major policies establishing California's big-picture efficiency goals immediately before and during the implementation of the RRIM.

The 2003 Energy Action Plan and the 2006 Global Warming Solutions Act established the goals of relying on energy efficiency as the preferred method to meet energy demand and using energy efficiency to meet emissions reduction targets. Both of these goals treat energy savings as a quantifiable resource. In this context, the value of energy efficiency programs depends on whether they produce quantifiable, reliable energy savings. The RRIM was developed and implemented in the context of these big-picture goals.

In 2008, the California Public Utilities Commission (CPUC) adopted the Long Term Energy Efficiency Strategic Plan, informed by the expansion of GHG mitigation and energy conservation goals in AB32 (CPUC 2008a). The strategic plan expanded and changed the focus of California's energy efficiency policy goals. The new goals go beyond the goal of acquiring energy savings as a resource to meet demand.

Market transformation had long been among the goals of energy efficiency programs (CPUC 2003). But CPUC stated in the strategic plan that previous efficiency programs — implemented to meet the overriding goal of acquiring energy efficiency as a low-cost resource — had not done enough to drive market transformation. Prior programs, CPUC stated, had emphasized measures that produce energy savings in the short term but do not alter the underlying markets for efficient products — for example, subsidizing the purchase of compact fluorescent light bulbs (CFLs) when they were already widely available (CPUC 2008a: 4–5).[3] CPUC instead wanted future programs to focus on more comprehensive, long-term measures such as whole-home retrofits, as well as on activities that induce market transformation. The revised incentive mechanism adopted in 2013 is an attempt to better align incentives with these new goals.

3 There is a debate over whether incentives for CFL purchases are still warranted in today's market, but no debate over the importance of policy in bringing the market to its current state. Past energy efficiency policies, both in California and elsewhere, have driven the transformation of the market for household CFLs. Early financial incentives for purchases of CFLs helped increase their market share and drive down prices. More recently, California and the federal government have both tightened minimum efficiency standards for light bulbs; the new standards confirm the status of CFLs as mainstream rather than specialty products (California Assembly Bill 1109 (2007); Energy Independence and Security Act of 2007, Title III, Subtitle B).

Appendix B: Design and Implementation of the RRIM

This section details the design of the Risk/Reward Incentive Mechanism (RRIM) and California's experience implementing it from 2006-2012.

California's history with shareholder incentives

The motivation for the RRIM grew out of other efforts at rewarding efficiency that began as early as the 1980s. Shareholder incentives were first proposed in California in 1989, and a number of incentives were implemented on an "experimental" basis in 1990. After an initial pilot period, CPUC concluded that these incentives were effective at driving needed growth in energy efficiency investment and decided to continue them on a statewide basis (CPUC 2003).

The incentive implemented in 1994 was intended to offer the utilities a financial reward for energy efficiency that approached the reward available for supply-side investments. It was a "shared-savings" incentive that allowed utilities to keep a share of the net cost savings produced by their efficiency programs, as long as they achieved a minimum level of total energy savings. Costs and benefits of the utilities' programs were calculated based on evaluations performed at the end of the programs; the utilities oversaw the evaluation process, with CPUC's Division of Ratepayer Advocates reviewing the results. This incentive was similar in structure to the RRIM, which CPUC adopted more than ten years later.

The 1990s incentive attracted utility management attention to efficiency as a potential profit source, according to stakeholders involved at the time. However, this early experiment was short-lived. As part of the broader restructuring of California's electricity markets, CPUC decided to limit ratepayer support for energy efficiency programs and shift responsibility for energy efficiency programs from the utilities to an independent administrative body. In 1997, CPUC altered the existing shareholder incentives and lowered utilities' potential earnings. Utilities' incentive earnings after 1997 were based on pre-implementation estimates of energy savings impact, rather than post-implementation evaluation (CPUC 2003). Utilities were also offered incentive payments for meeting "milestones" toward market transformation; there were numerous milestones capturing different aspects of program activity levels and impact.

When the transition to independent administration ran into administrative difficulties, CPUC continued to authorize limited shareholder incentives until 2001, when it eliminated them entirely. Between 2001 and the introduction of the RRIM in 2007, utilities were required to administer energy efficiency programs and were allowed to recover the costs of those programs from ratepayers, and rates were decoupled from sales volume, but no additional incentive for energy savings was offered.

Objectives

California policymakers expressed plans for a shareholder incentive for energy efficiency in the 2003 Energy Action Plan, with the goal of leveling the playing field between energy efficiency and supply-side investment. In the subsequent decision authorizing the RRIM, CPUC argues that the presence of an incentive is necessary to draw utility management attention to energy efficiency:

> *A comparable earnings benchmark recognizes that utilities as portfolio managers make day-to-day decisions on how to direct their resources and personnel that regulators cannot directly control or mandate. Without an energy efficiency incentive, given the focus of investors and utility management on increasing shareholder value, utilities will on balance be more inclined to devote scarce resources to procurements on which they will earn a return, and not on meeting or exceeding the Commission's energy efficiency goals, or maximizing ratepayer net benefits in the process. (CPUC 2007a: 67)*

The RRIM had two core objectives: to motivate utilities to focus more effort on energy efficiency, and to protect ratepayers by tying utility earnings to performance. In its decision, CPUC states:

> *Today's decision creates incentives of sufficient level to ensure that utility investors and managers view energy efficiency as a core part of the utility's regulated operations that can generate meaningful earnings for its shareholders. At the same time our adopted incentive mechanism protects ratepayers' financial investment, ensures that program savings are real and verified, and imposes penalties for substandard performance. (CPUC 2007a: 7)*

Design

Under the RRIM, the incentive payment for each utility was based on two primary performance measures: the net economic benefits produced by the utility's energy efficiency programs, and the total amount of energy savings.

As described in CPUC guidance, the net economic benefit of an efficiency program is the value of the avoided cost of energy (the costs that would have been necessary to deliver energy without the efficiency program) minus the costs of the program itself (CPUC 2001). The RRIM provided an incentive for utilities to deliver cost-effective energy efficiency programs by allowing utility shareholders to keep a share of the net economic benefits attributed to energy efficiency programs. This arrangement was referred to as a "shared savings" incentive, since the total amount of money saved through energy efficiency programs was shared between ratepayers and shareholders; without the incentive, it would all go to the ratepayers.

For each utility, the "shared savings rate," or the percentage of net economic benefits awarded to utility shareholders, depended on the utility's progress toward energy savings targets. These targets were established in 2004 and were intended to be ambitious (CPUC 2004). Annual savings targets were set for each utility for electricity, peak demand, and gas savings (in terms of kilowatt-hours (kWh), kilowatts (kW), and therms respectively). Under the RRIM, earnings were based on the percentage achieved of each of the three individual savings targets, as well as the average percentage achieved of all targets.

The RRIM included a tiered system of rewards and penalties based on utilities' progress toward these savings targets, represented in Figure 1.

CPUC's Energy Efficiency Policy Manual requires that the utilities' energy efficiency portfolios be cost-effective overall (CPUC 2008b). To underscore this requirement, in addition to the per-unit penalties for underperformance, a cost-effectiveness requirement also applied to energy efficiency portfolios as a whole: If utility portfolios were found not to be cost-effective when evaluated after implementation, the utilities would be penalized dollar-for-dollar for negative net benefits. Utilities would pay the larger of the two possible penalties (per-unit penalty or paying back negative net benefits). This dual penalty mechanism helped ensure that ratepayers could not be made worse off by inadequate utility energy efficiency efforts. Ratepayers were protected if they overpaid for ineffective efficiency programs, or if they had to pay for more expensive supply-side resources due to inadequate efficiency efforts.

The shared savings rate was applied to the net economic benefits of energy efficiency programs, as determined by program evaluations. Total earnings and penalties, for the four utilities combined, were each capped at $450 million over the three-year program cycle. The utilities would earn the maximum reward if they achieved 125% of their savings targets. Penalties would be triggered if utilities achieved below 65% of any savings target; if utilities achieved only 50% of their targets, penalties would be approximately $240 million (CPUC 2007a: 6).

A significant component of the RRIM as originally designed was that incentive earnings would be calculated based on ex post (post-implementation) estimates of energy savings. Utilities would receive interim payments during the first two years of the three-year program cycle based on ex ante (pre-implementation) estimates of energy savings and CPUC's interim evaluations of program implementation progress.

At the end of the program cycle, CPUC and its contractors would undertake a final evaluation, and CPUC would update some of the values used to calculate net benefits — including free ridership rates — with ex post estimates based on the final evaluation findings. CPUC would adjust the final payment to the utilities so that the total award paid over the three-year cycle corresponded to the amount calculated based on ex post evaluation; this process was referred to as a "true-up." If the final earnings calculation showed that some or all of the interim payments were not justified by program performance, the utilities would be obligated to return those payments.

The RRIM was designed to provide an incentive for energy efficiency programs implemented between 2006 and 2011. This period covered two energy efficiency program cycles, each three years long (2006-08 and 2009-11). CPUC planned to revisit the mechanism in 2011 (CPUC 2007a: 169–170).

Parties raised concerns with some of the RRIM's design elements at the time it was proposed. In particular, the Division of Ratepayer Advocates argued that sharp discontinuities in the earnings curve could produce perverse incentives for the utilities. While acknowledging these concerns, CPUC opted to move forward with the incentive

as designed, noting that it would reevaluate the tiered incentive structure during the planned 2011 review of the incentive's design (CPUC 2007a: 172–178).

Implementation

Figure 4 summarizes the timeline for the RRIM's implementation, as originally planned and as executed.

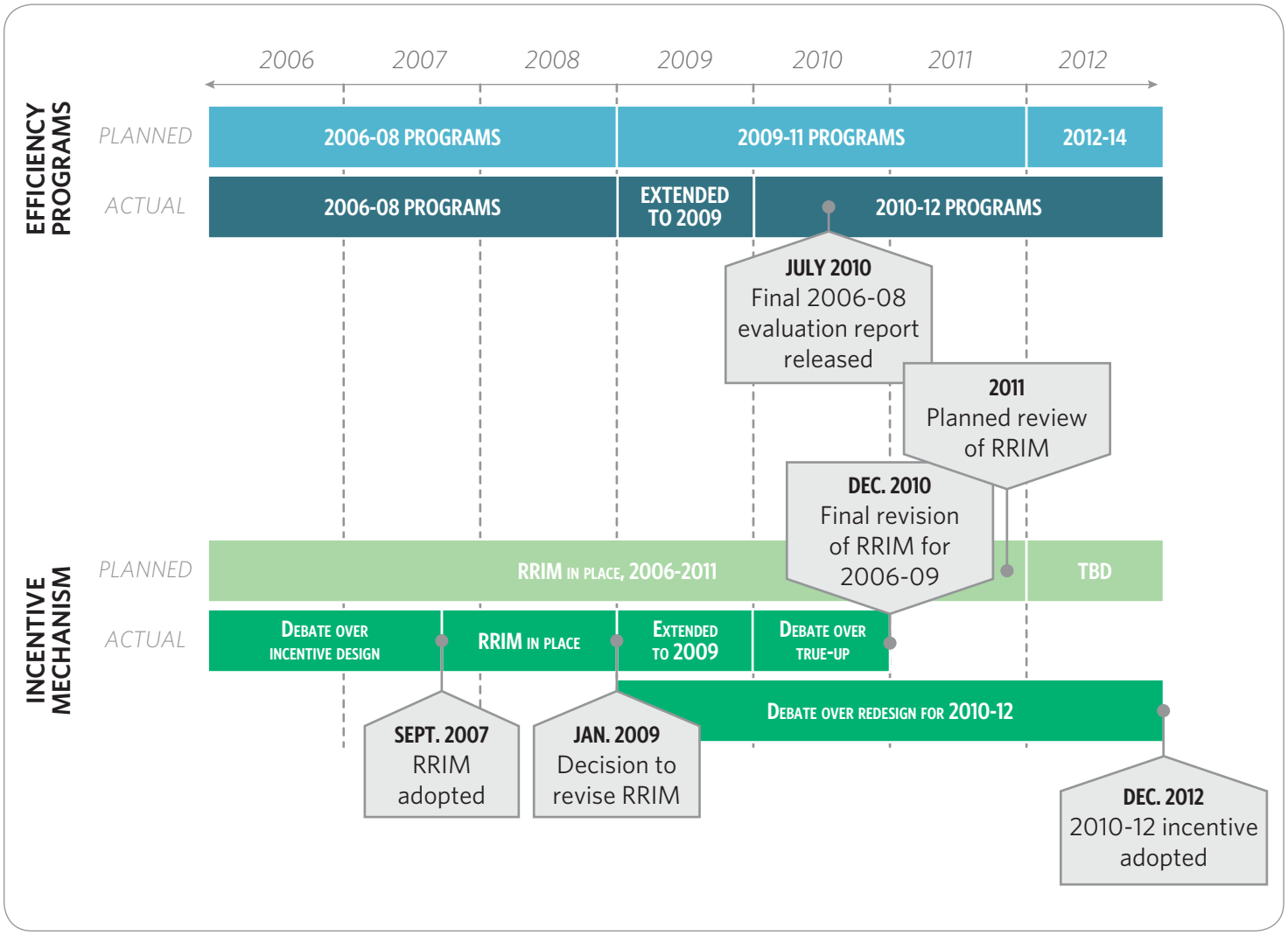
2006-2008: Initial implementation

The RRIM was implemented more than halfway through the 2006-08 program cycle. During the three-year period, the utilities implemented large-scale energy efficiency portfolios that had been designed and approved before the RRIM was finalized. As the program cycle went on, implementation of the 2006-08 RRIM was increasingly dominated by a dispute over evaluation methods.

CPUC approved the utilities' 2006-08 energy efficiency program portfolios in early 2006. The RRIM was finalized in September 2007, although an incentive was already being studied as of late 2005 (CPUC 2007a: 15). Utilities therefore did not design their 2006-08 energy efficiency portfolios with specific knowledge of the RRIM's design, although they did design those portfolios with the expectation that an incentive would eventually be put in place. Utilities were able to adjust their activities to some extent after the RRIM was implemented.

California's investor-owned utilities spent $2.1 billion of ratepayer funds on non-low-income energy efficiency programs during the 2006-08 program cycle. According to CPUC staff's estimates, these programs saved 6,000 GWh of electricity (3.2% of total electricity sales), 1,100 MW of peak demand, and 80 million therms of natural

Figure 4: RRIM implementation timeline



gas (1% of gas sales) (CPUC 2010c). Over half of electricity savings were from indoor lighting programs; the largest of these was the Upstream Lighting Program, under which tens of millions of discounted CFLs were sold to consumers. The utilities and NRDC argue that actual savings were considerably greater than CPUC staff's estimates (Miller 2011).

Disagreement over evaluation, measurement, and verification (EM&V) methods and processes was evident early on. While the utilities were developing their efficiency portfolios in 2005, CPUC staff and other parties expressed concern that the assumed net-to-gross ratios were too high for some measures, particularly lighting programs; more recent studies indicated the ratio might be lower. Utilities acknowledged this concern at the time, but in their own estimates, the utilities continued using the higher net-to-gross values (CPUC 2007b). In turn, when the RRIM was implemented, the utilities objected strongly to the possibility of CPUC forcing them to return interim payments based on the results of the ex post true-up, including an updated (and presumably lower) estimate of net-to-gross ratios (CPUC 2007a: 172–178).

2009-2010: Dispute over outcomes

As originally implemented, the RRIM would have remained in place until 2011, covering both the 2006-08 and 2009-11 program cycles. But with dispute over measurement of energy savings already hindering implementation, CPUC opened a rulemaking in early 2009 to revisit the RRIM's design for the post-2008 period (CPUC 2009a).

In the meantime, planning for utilities' 2009-11 energy efficiency programs began without an incentive mechanism in place. The utilities originally submitted portfolios for the 2009-11 program cycle in 2008, but when it became clear that there was not enough time for CPUC to complete its review and approval of the portfolios, CPUC instead extended existing programs into 2009 (CPUC 2008c).

Throughout 2009 and 2010, parties continued to debate about the outcomes and evaluation of the efficiency programs implemented in 2006-2008. The record of the CPUC proceeding includes hundreds of comments and reply comments filed by parties to the proceeding. Utilities, largely supported by NRDC, argued that CPUC staff's estimates understated the achievement of energy efficiency programs. Ratepayer advocacy organizations argued that the utilities had overstated their claims. Parties attempted to reach a settlement in 2009 but were unsuccessful.

In 2010, CPUC staff released its final evaluation report estimating energy savings from the energy efficiency programs implemented in 2006-08. These evaluation findings were intended to inform calculation of the final true-up payment for the 2006-08 program cycle. Based on the ex post updates to energy savings estimates, the report showed results that were dramatically different from the utilities' claimed savings levels.

The utilities disputed the methods used to estimate energy savings in CPUC staff's evaluation report, and the parties continued to debate over the evaluation methods. Some of the main points of debate related to the evaluation of lighting programs; stakeholders disagreed about the methods for determining net-to-gross ratios and the number of bulbs purchased that were installed right away rather than stored for later use. In addition, the utilities disagreed with the treatment of "interactive effects," an adjustment made to capture the fact that more efficient lighting can increase gas usage for home heating (because the more efficient bulb is losing less energy as heat).

Based on CPUC staff's evaluation, the final true-up would have swung the utilities from the large reward calculated based on ex ante estimates to either a small reward (for SCE, SDG&E, and SoCalGas) or a penalty (for PG&E). PG&E had the largest swing: from $180 million in earnings based on ex ante estimates to a $75 million penalty based on ex post estimates for energy savings parameters.

Figure 2 illustrates where the utilities fell on the RRIM earnings curve under the three scenarios — the utilities' own reports on their performance, using ex ante assumptions about energy savings parameters; the CPUC staff-led evaluation of the utilities' performance; and the values actually used in the final payment. Figure 3 shows the utilities' 2006-08 performance and associated incentive earnings under these three scenarios.

After vigorous and unresolved debate over the evaluation findings, CPUC decided by a 3-2 vote in December 2010 to abandon the true-up. CPUC awarded final payments based on ex ante assumptions about energy savings parameters and ex post verification of program

implementation, and lowered the shared savings rates to a flat 7% of net economic benefits, replacing the 9% and 12% tiers.

Abandoning the true-up represented a major change to the incentive mechanism: It essentially changed the RRIM from a risk/reward proposition to a bonus payment for implementation of energy efficiency programs. While in theory, utilities could still have been subject to a penalty under the revised incentive, this would only have happened if program activity had fallen far short of expectations or if costs had run significantly above expectations. They no longer faced a penalty in the circumstance that pre-implementation assumptions about energy savings were proven overly optimistic.

Commissioners disagreed on how to resolve the RRIM debate and voted 3-2 to abandon the true-up, with two commissioners dissenting (CPUC 2010b). A central point of disagreement was whether the utilities or ratepayers should bear the financial burden of programs that — due largely to changes in energy savings parameters — had not produced the results originally anticipated. Parties disagreed strongly about the accuracy of the CPUC staff-led evaluations and about whether utilities had enough time to adapt their programs, given delays in the evaluation process. Utilities had acknowledged at the start of the program cycle that some parameters were likely to change (see discussion on page 16-17). However, the changes in parameters were more dramatic than anticipated, and the utilities continued to object to some of the evaluation methods that produced the new numbers. Weighing these considerations, the majority of commissioners concluded that it was not reasonable to ask the utilities to bear the risk of program underperformance, since the utilities did not control the changes in energy savings parameters and did not have enough information and time to adapt their programs mid-cycle in response to evolving data. The decision reads:

> *We find that the incentive mechanism as implemented was/is unfair to the utilities, in that it bases its results on assumptions the utilities cannot be reasonably expected to anticipate; and further, when those changed assumptions come to light, cannot be reasonably expected to respond to in a way that enables them to substantially avoid the adverse impacts on the estimated performance of their programs. (CPUC 2010b: 41)*

This decision reallocated the risk from utilities to ratepayers, who were left to pay "shared savings" incentives for programs that had not fully achieved those savings. In a dissent to the decision, Commissioner Dian Grueneich wrote that an incentive based only on ex ante assumptions about energy savings parameters "undermines the basic structure of ratepayer-funded energy efficiency" by failing to hold utilities accountable for actual program performance (CPUC 2010d).

At the end of 2010, the status of utility energy efficiency programs and shareholder incentives was as follows:

- CPUC had concluded the debate over the incentive payment for efficiency programs implemented between 2006 and 2009, awarded the utilities a total of $212 million in incentive earnings for efficiency programs implemented between 2006 and 2008, and put in place the same incentive formula for efficiency programs implemented in 2009.
- With the incentive mechanism still unresolved beyond 2009, CPUC had approved utilities' efficiency programs for 2010-12, and these programs were already one year into implementation.
- CPUC had begun deliberations over what sort of incentive to put in place for efficiency programs implemented between 2010 and 2012, but had not yet reached a decision.

2010-2012: Contention and uncertainty

The energy efficiency program portfolios originally proposed for implementation in 2009-11 were eventually adopted for 2010-12, and utilities proceeded with implementation with no incentive mechanism yet in place (CPUC 2009b). There was considerable debate over the ex ante estimates of energy savings parameters, and ex ante estimates for the 2010-2012 program cycle were not finalized until mid-2011.

CPUC staff released a report on program progress in September 2012, covering program activities in 2010 and 2011. In that time period, the utilities spent approximately half of their combined $3.1 billion budgets for the 2010-12 program cycle. According to the utilities' own estimates of program impact, they exceeded CPUC's goals for electricity and peak demand savings in 2010 and 2011 but missed

the target for gas savings; the programs implemented were cost-effective, creating energy savings more than double the programs' costs (CPUC 2012c: 10).

Debate over the design of the incentive mechanism for programs between 2010 and 2012 continued through the end of the program cycle, with CPUC approving a simplified incentive in December 2012. The 2010-12 incentive is primarily based on a percentage of approved program spending; it is not based on energy savings. A smaller part of the incentive is based on utility conformance with CPUC's procedures for developing ex ante estimates of program impact; CPUC frames this incentive payment as an effort to incentivize the utilities to contribute accurate information during the ex ante review process.

2013: A revised approach

Utilities began implementing a new two-year portfolio of energy efficiency programs in 2013. In September 2013, CPUC unanimously adopted a new incentive mechanism, the Efficiency Savings and Performance Incentive, to reward energy efficiency programs implemented in 2013 and 2014. The new incentive includes a core component based on ex post energy savings calculations, with no penalty provision and no sharp cutoffs in earnings (CPUC 2013). The new incentive rewards utilities based on the amount of energy saved through their efficiency programs, rather than the programs' net economic benefits. The new incentive mechanism includes an incentive for utility compliance with CPUC's process for reviewing ex ante savings estimates, as was used in the 2010-12 incentive. It also includes a bonus payment as a percentage of spending for programs without quantified energy savings estimates, and a similar payment for utility involvement with the process of incorporating efficiency measures into building codes and standards.

Explaining the decision to stick with the ex post true-up, the CPUC decision notes that evaluation methods can spark disagreement whether they are reviewed ex ante or ex post. The decision also returns to the principle of sharing risk between ratepayers and utility shareholders:

> *An effective incentive mechanism doesn't eliminate all risk or uncertainty as to the magnitude of incentive earnings awards. Instead, an effective mechanism balances uncertainty against the benefits of robust ex post evaluation of savings. Any uncertainty as to ex post results affects not just shareholders, but also ratepayers. While shareholders experience some risk of earnings variations, ratepayers receive protections by funding incentive awards based on independently evaluated savings. (CPUC 2013: 55–56)*

Appendix C: Evaluation Issues

Evaluation methods in brief

Methods for evaluating the impact of efficiency programs are varied and often complex, but a very simplified explanation is helpful in understanding some of the issues surrounding the RRIM.

For a program based on installing energy-efficient products, estimates of energy savings would typically be based on the number of installations (e.g., the number of efficient fixtures installed through a lighting program) and a range of energy savings parameters associated with each installed product. Some examples of energy savings parameters are the typical hours of usage for the efficient product, the product's expected useful lifetime, and the net-to-gross ratio, or the percentage of efficient products purchased under the program that would not have been purchased without the program in place. In CPUC's process, these estimates are usually based on past program evaluations.

Translating a "gross" energy savings number to a "net" number typically requires making two adjustments. The evaluator must remove free riders, or those who participate in a program but would have installed the efficient measure anyway. In some jurisdictions, evaluators also make a positive adjustment to account for spillover effects, when the program indirectly induces energy savings beyond the direct program activity (for example, if a customer purchasing a rebated appliance also decides to make other efficiency improvements). California's definition of the net-to-gross ratio does not account for spillover, only free ridership (Kushler, Nowak, and Witte 2012: 58).

Evaluation issues in the RRIM's implementation

The problems with the RRIM's implementation largely stemmed from the design of the incentive mechanism itself. However, the incentive was highly dependent on the EM&V process, and its implementation pointed to some important issues relating to evaluation processes and systems. We briefly discuss those issues here.

Variability of estimates

If a program is large enough, small changes in assumptions about energy savings parameters can have a dramatic impact on savings estimates. This was illustrated in CPUC's analysis of RRIM earnings under different scenarios (CPUC 2010a). In particular, the Upstream Lighting Program was so large that making relatively small changes in engineering assumptions could result in large swings in savings estimates. For example, the estimated hours of use for newly purchased bulbs dropped by 20% between the pre-program and post-program estimates (KEMA, Inc. 2010: 76). This corresponded to a decline of approximately 331 GWh of net electricity savings and tens of millions of dollars in incentive earnings.

The CPUC-led evaluation of efficiency programs also demonstrated that current methods for estimating net-to-gross ratios do not produce tight point estimates — estimates can vary widely for the same program. For example, the consultants evaluating the Upstream Lighting Program used several different methods to estimate free ridership, including surveys of suppliers and store managers, in-store interviews with consumers, and econometric analysis of sales data. The methods produced very different estimates. For example, estimates of free ridership among CFL purchases at home improvement stores ranged from 48% to 80%; for purchases at discount stores, from 0 to 82%; for purchases at grocery stores, from 19% to 89% (KEMA, Inc. 2010: 49). Changes in the free ridership rate based on these estimates had a major impact on the reduced estimates of savings from the Upstream Lighting Program and were one of the primary reasons for the dramatic drop in calculated RRIM earnings.

Timing of evaluation

Energy efficiency programs intervene in markets that are constantly changing. Moreover, evaluation itself takes time. This means that if incentives are based on ex post evaluation, there may not be time for the evaluation findings to inform improvements to programs that can impact current incentive payments. Changes from ex ante to ex post energy savings estimates will reflect both successes/failures in program implementation (over which the utilities have greater control) and changes/corrections to energy savings parameters (over which they have limited control).

More frequent updates to estimates of energy savings parameters provide an updated look at market conditions and reduce the risk that estimates of utility performance are overestimated because of outdated data. Greater availability of data from smart meters could improve this situation in the future, by providing timely and accurate data on energy consumption, energy efficiency actions undertaken, and changes in energy usage that could be used in program evaluation.

Institutional dynamics

In the dispute over evaluation findings, there was deep mistrust between the utilities and CPUC. Based on statements in CPUC proceedings, as well as CPI's interviews with stakeholders, it is evident that CPUC and the utilities do not trust each other's energy savings estimates, methods, and reporting (e.g., CPUC 2010b: 24–30). During the RRIM debate, some within CPUC believed the utilities were gaming the system by overestimating savings; some within the utilities believed CPUC designed the evaluation to produce low incentive payments. Our impression as outside observers is that the details of the evaluation were not the core problem; changes to the evaluation methodology likely would not have solved the conflict, because the two sides did not trust each other to be producing good-faith estimates.

The conflict over evaluation methods stems in part from changes in the institutional arrangements for EM&V. Implementation of the RRIM followed a transition from utility-led oversight of EM&V to CPUC oversight. Prior to the restructuring of the state's energy markets in the early 2000s, evaluation was primarily led by utilities, which contracted out evaluation work to third-party consultants; CPUC's Division of Ratepayer Advocates reviewed evaluation findings. By 2006, CPUC staff had assumed responsibility for overseeing EM&V, although third-party consultants continue to perform most of the ground-level evaluation work.

The RRIM raised the stakes for evaluation and put significant pressure on the evaluation process. The expansion of energy efficiency programs during the 2006-08 program cycle, as well as the increased stakes associated with the RRIM, greatly increased the evaluation workload for CPUC staff and their contractors. During this period, release of some evaluation reports slipped from the planned schedule, and there was limited opportunity for ongoing review from utilities and stakeholders (Best and Rufo 2013). Some within the utilities felt they had been cut out of the process. The earnings calculation for the 2006-08 RRIM relied on information from this contentious EM&V process, raising the stakes of the existing disagreements over EM&V practices. The controversy over evaluation methods contributed to CPUC's decision to abandon the true-up (CPUC 2010b: 23–30). The RRIM controversy also resulted in evaluation being oriented more toward verifying earnings than improving future programs.

Since the 2006-08 experience, CPUC has modified its EM&V process to allow utilities and other stakeholders more regular opportunities to review and give input on the evaluation process. According to stakeholders, the changes to the evaluation process since 2008 — a more collaborative, multi-stakeholder approach, where utilities are informed throughout the process but CPUC still makes the final decision on evaluation methods — have improved relationships among the parties and lessened conflict over evaluation.

It is relatively unusual for primary EM&V responsibility to sit with the regulator; in most states, evaluation is either administered by utilities or by a collaborative or third-party entity (Kushler, Nowak, and Witte 2012). Within the 18 states with shareholder incentives, EM&V is administered by utilities in nine states, by public utility commissions in three states, by an external advisory council in one state, and jointly by utilities with the public utility commission, another state agency, or an advisory council in five states (Kushler, Nowak, and Witte 2012: 54–55). In the context of an incentive, giving utilities sole responsibility for EM&V could lead to misreporting, as discussed by Kaufman and Palmer (2012). Oversight by an entity other than the utilities is necessary to verify that incentives are paid based on accurate information. But it is possible that third-party or collaborative administration of EM&V, rather than sole administration by the regulator, could help shield the EM&V process from the negotiation over incentive payments.

Cost-effectiveness tests as a barrier

Programs with longer-lived, more comprehensive savings tend to fare poorly on the cost-effectiveness tests employed by CPUC. The benefits of these programs are difficult to measure accurately, and often they are simply more expensive than shorter-term savings measures (Neme and Kushler 2010; Dunsky, Boulanger, and Mathot 2012). At the same time, CPUC is pushing the utilities

to expand some of these programs, bringing goals and cost-effectiveness testing into account. The RRIM design focused and heightened this dilemma, essentially penalizing the utilities for conducting such programs since they lowered portfolio net benefits.

The cost-effectiveness tests currently used in California have come under criticism for taking an imbalanced view of program costs and benefits. For example, increasing the number of whole-home retrofits is a specific goal of CPUC's, but under the cost-effectiveness tests used by CPUC, the calculated costs of whole-home retrofit programs are greater than their benefits (CPUC 2012c). Whole-home retrofits are expensive, but there are also challenges in accurately capturing the costs and benefits of these programs. Homeowners often make efficiency upgrades as part of comprehensive home renovations, including components unrelated to energy. Moreover, energy savings measures, such as adding insulation, also produce non-energy benefits such as improving occupant comfort. As such, many measures installed under these programs may have been motivated by reasons unrelated to energy.

The full costs of these measures are captured under the cost-effectiveness tests currently used in California, but the non-energy benefits are not. California's cost-effectiveness tests do include a "carbon adder" to capture the climate mitigation benefits of energy efficiency, but they do not account for other non-energy benefits such as improved occupant comfort, reduced air pollution, and job creation.

Cost-effectiveness tests in California also discount the value of future energy savings relatively heavily. California's guidance specifies that future benefits are discounted by a measure of the utilities' cost of capital, approximately 8%. Many other states use lower discount rates (for example, the interest rate on long-term U.S. Treasury bills, or a "societal discount rate") in cost-benefit calculations for efficiency programs (Kushler, Nowak, and Witte 2012).

For more information on the cost-effectiveness tests used in California, see CPUC (2001).

Measuring market transformation

California policymakers have found it difficult to incentivize market transformation in the past. In the late 1990s, California implemented an incentive mechanism that tied utility payments to a set of "milestones" related to program activity or market outcomes. Parties do not consider this attempt a success: there were too many milestones, and they were not always sufficiently connected to meaningful market transformation outcomes (Nadel et al. 2000).

CPUC is currently working to develop a revised set of market transformation indicators (CPUC 2012a: 356). Further progress on this front, in California or elsewhere in the program evaluation community, could make incentives for market transformation more feasible. In the meantime, regulators may need to use simpler metrics — such as spending on particular programs, or market share of particular efficiency technologies — in order to provide incentives tied to market transformation outcomes.

Evaluation methods for market transformation are continuing to evolve, but one critical piece of understanding market transformation is taking regular macro-level snapshots of market penetration of efficiency programs and products. The Northwest Energy Efficiency Alliance, a not-for-profit administrator of energy efficiency programs, focuses its efforts on market transformation, and its evaluation efforts include regular tracking of market data such as sales of efficient and inefficient products, changes in technology costs, and levels of consumer awareness in the markets targeted by efficiency programs (Northwest Energy Efficiency Alliance 2013). These snapshots help guide development of more targeted and more effective efficiency programs, even if they are not used for accountability.

California is not the only state struggling to reconcile increasingly ambitious policy goals with the need to track measurable outcomes (Vine et al. 2012). Its experience during the RRIM period — particularly post-2008 — demonstrates that if goals change, the incentive should change as well, or should be coupled with other policy tools that can drive toward achievement of hard-to-measure goals.