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ISSUE BRIEF

PUTTING YOUR MONEY WHERE YOUR METER IS

THE OPPORTUNITY FOR PAY-FOR-PERFORMANCE EFFICIENCY PROGRAMS TO INCREASE ENERGY SAVINGS

Smarter use of energy in buildings, and the appliances and equipment within them, is critical to meeting climate targets and avoiding the construction of unnecessary power plants, in addition to saving customers money on their energy bills.[1] Most leading states have energy efficiency savings goals and offer a range of programs to meet those targets.[2] The need to further ramp up energy efficiency to avoid greenhouse gas emissions from energy generation, along with an interest in better use of energy meter data to encourage efficiency, has led policymakers in states like California and New York to consider expanding the use of pay-for-performance, or P4P, energy efficiency programs. P4P programs reward energy savings on an ongoing basis as the savings occur by examining data from a building's energy meters, rather than providing upfront payments to fund energy-saving measures. Efficiency programs in the United States spend almost $8 billion annually (and growing) to reduce energy waste, but few of these programs are P4P.[3] Pay for performance could be a way to increase energy savings and stimulate innovation in the efficiency programs that help deliver them.

HOW SMART IS YOUR METER?

There are varying degrees of "smarts" in energy meters today. Advanced metering infrastructure (AMI) enables two-way communication of hourly data between customers and utilities (through what is often called a "smart meter"). Automated meter reading (AMR) is less sophisticated but still transmits hourly meter data, usually just one-way to the utility. About two-thirds of large commercial and industrial customers have either AMR or AMI meters.[4] More recently, AMI deployment has spread to about half of the residential sector as well.[5] Most P4P programs have used simple monthly meter data, and this can work well for many program designs. But more easily available and more granular (hourly) data enable better analytics, which can improve measurement of energy savings, efficiency program targeting, and information to customers on energy usage patterns.

In contrast to P4P models, most energy efficiency (EE) programs today pay customers upfront for expected savings through rebates and incentives for things like efficient lightbulbs or insulation, estimating (or "deeming") future savings on the basis of detailed technical analyses and the results of efficiency evaluations. This approach has served efficiency programs well for years—and in many sectors will continue to play a vital role in the future. At the same time, developments in the availability and analysis of energy meter data in order to understand program impacts and more directly reward performance may enable some types of P4P programs to scale up and capture additional energy savings.

A new analysis conducted for the Natural Resources Defense Council (NRDC) and Vermont Energy Investment Corporation (VEIC), *Putting Your Money Where Your Meter Is*, provides an indepth examination of the structure of P4P programs and their role in EE portfolios nationwide,

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reviewing 22 case studies of past and current P4P approaches.[6] Based on lessons learned from these examples, the report provides recommendations for policymakers to guide program design. The analysis finds that P4P has the potential to encourage energy savings and should be explored further. However, there is still significant uncertainty about how P4P stacks up in terms of cost-effectiveness and level of savings compared with more common methods of estimating and paying for energy savings.

WHAT IS PAY FOR PERFORMANCE?

There is a diverse spectrum of programs that fall into the pay-for-performance category, but at the most basic level these programs track and reward energy savings as they occur, usually by examining data from a building's energy meters. Most P4P programs have used monthly meter data to estimate the savings that occur, but there is increasing access to hourly meter data transmitted automatically to the utility or program implementer. These advanced meters are deployed primarily for other reasons (including lower meter-reading costs, improved utility outage management, and implementation of more dynamic energy rates). However, in combination with advanced statistical techniques, they also can enable a more data-driven, real-time approach to energy efficiency.

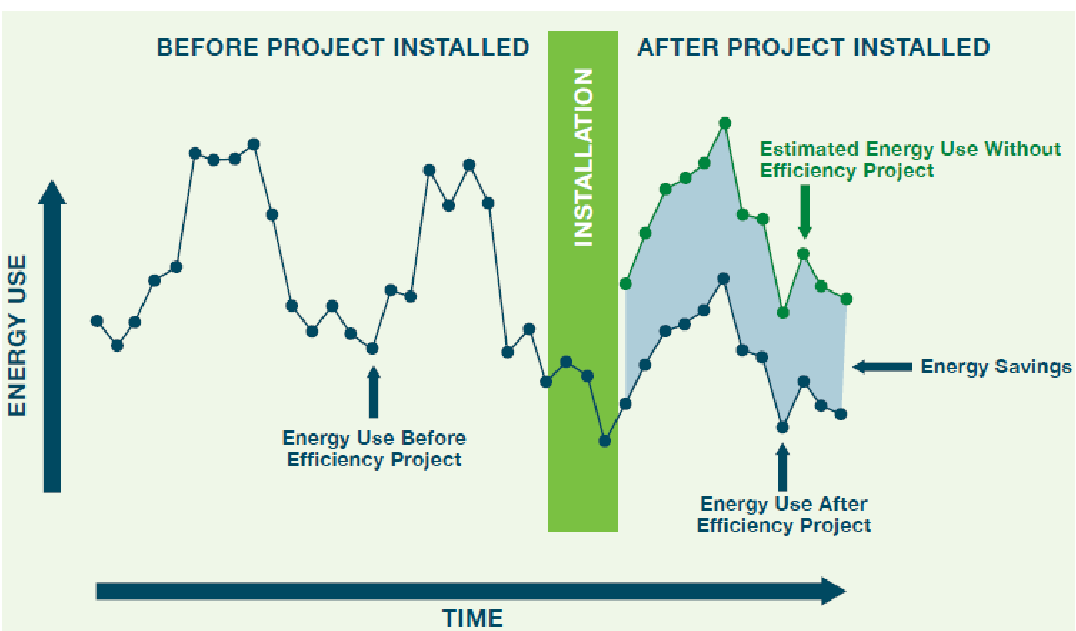
As with all energy efficiency, savings can never be directly measured because they are the difference between how much energy was actually used and how much would have been used if the efficiency improvements had not been installed; this is called the projected baseline. All energy savings are estimates whose accuracy depends on the accuracy of this baseline. Figure 1 provides an example of how savings for an individual building can be estimated.

Energy savings are equal to the projected baseline (which includes adjustments for factors that affect energy usage, such as weather and building occupancy) minus the actual metered usage after an energy efficiency improvement.

The challenges of accurately estimating energy savings do not disappear by using a P4P approach, but the availability of more data combined with advancements in data analytics can potentially improve the calculation of baseline estimates and lower the cost of measuring and verifying (M&V) the energy savings, especially for complex efficiency projects with multiple measures that might include a new furnace, insulation, efficient lighting, and an advanced thermostat, for example. P4P is also useful for behavioral and operational efficiency programs where it may not be appropriate to rely on deemed savings.[7,8] For example, a behavioral program might promote simple habit changes, like encouraging students and teachers to turn off lights and equipment when not in use at a school. Or an operational program might train a facilities manager at a large office building to more efficiently operate heating and cooling equipment to meet the occupants' needs.

Additionally, the accuracy of savings estimates can improve when analysis is done on a portfolio of projects (as opposed to a single building). For example, a home retrofit program may be able to reliably achieve 15 percent energy savings, on average, over a group of 1,000 homes, while individual homes' savings may vary significantly due to the unique set of conditions and occupants of each. This can also allow the measurement of savings that might otherwise get "lost in the noise" on individual buildings (a small change in energy use can be easier to detect with a large sample size), and is particularly helpful when a grid operator depends on aggregate savings as a grid resource. If these operators have confidence that energy savings will occur, they can reduce

FIGURE 1: ENERGY CONSUMPTION BEFORE, DURING, AND AFTER A PROJECT IS IMPLEMENTED (STATE AND LOCAL ENERGY EFFICIENCY ACTION NETWORK 2010[9])



their purchase of other resources like coal and natural gas. From their perspective, the aggregate impact of energy efficiency is more important than the usage of a single building.

Once the performance (amount of savings) is estimated, the question is then how to pay for or incentivize these savings. Most P4P programs pay over time, at least over a couple of years, to ensure that the savings materialize and are persistent. There are two primary ways that P4P programs have historically paid for energy efficiency savings:

- **Standard-offer programs** set a price per measured unit of energy savings (e.g., 5 cents per kilowatt-hour saved); some programs differentiate payments based on the measures used to achieve savings in order to meet program goals.
- **Bidding programs** allow program implementers, aggregators, or customers to compete for contracts that specify an amount of savings to be achieved over a multiyear period. The program can be structured as an auction or another type of competitive solicitation where price and other factors are considered to select the winning bidders.

The payments usually come from customer-funded utility programs that value the public benefits provided by energy savings. Most often, utilities work through third-party program implementers or aggregators who engage directly with building owners. Programs often exist as part of a utility's energy efficiency portfolio, though there are several examples where efficiency competes with supply-side generation and other resources. There are also several private-sector business models that incorporate P4P elements to pay for efficiency investments using the cash flow from the energy savings, often outside of utility customer-funded EE programs, such as energy-savings performance contracts offered by energy service companies (ESCOs).[10]

LESSONS FROM THE CASE STUDIES

It is time to take a fresh look at P4P programs. As described in the full report, experience with P4P programs in the 1980s and 1990s convinced some policymakers that P4P was often more expensive and more complicated to run than deemed savings programs.[11] However, improved capability to analyze large data sets of metered energy usage and new business models may lower the costs of these programs. Some of the key lessons for policymakers on cases where P4P is best suited, the limitations of P4P, and how P4P might encourage new business models are described in this section, drawn from analysis of the 22 case studies listed in Table 1, as well as from a survey of the literature and interviews with program and policy experts.

TABLE 1: P4P CASE STUDIES

STUDY TYPE	STUDY NAME	STATE	DURATION
P4P Energy Efficiency Programs	Con Edison Integrated Demand-Side Management Bidding	NY	1990–2003 (13 years)
	Public Service Electric & Gas Standard Offer	NJ	1993–Present (23 years)
	Non-Residential Standard Performance Contract (1998—1999)	CA	1998–1999 (1 year)
	Energy Services Industry Program Standard Performance Contract—NYSERDA	NY	1999–Present (17 years)
	Non-Residential Standard Performance Contract (2000—2005)	CA	2000–2005 (5 years)
	Texas Standard Offers	TX	2000–Present (16 years)
	Con Edison Targeted Demand-Side Management	NY	2003–Present (13 years)
	University of California/California State University/Investor-Owned Utilities Monitoring-Based Commissioning	CA	2004–Present (12 years)
	Independent System Operator—New England Forward Capacity Market	New England	2006–Present (10 years)
	Opower Behavioral Energy Efficiency	Across US	2008–Present (8 years)
	Bonneville Power Administration Strategic Energy Management	Pacific NW	2009–Present (7 years)
	New Jersey Commercial & Industrial Pay for Performance	NJ	2009–Present (7 years)
	Southern California Edison Local Capacity Requirement Request for Offers	CA	2013–Present (3 years)
	Seattle City Light Commercial Pay for Performance	WA	2013–Present (3 years)
	Pacific Gas & Electric Commercial Whole Building Program	CA	2013–Present (3 years)
	Efficiency Vermont Continuous Energy Improvement	VT	2014–Present (2 years)
	National Grid P4P for Monitoring-Based Commissioning and Retro-Commissioning	MA	2014–Present (2 years)
	Pacific Gas & Electric Residential Pay for Performance	CA	2016–Present (0 years)
P4P Business Models	ESCO Energy Savings Performance Contracting	Across US	1980–Present (36 years)
	Metrus Efficiency Services Agreement	Across US	2009–Present (7 years)
	Sealed Managed Energy Savings Agreement	NY	2012–Present (4 years)
	Metered Energy Efficiency Transaction Structure	WA	2015–Present (2 years)

P4P programs can aid in assessing savings from complex, multi-measure efficiency projects that include behavioral or operational efficiency, where it is difficult to deem savings in advance.

PROMISING OPPORTUNITIES FOR P4P

There are a number of savings opportunities for which P4P may be particularly well-suited:

- P4P programs can aid in assessing savings and motivating persistence in savings from **complex, multi-measure efficiency projects** including those with **behavioral or operational changes**, where it is difficult to deem savings in advance. This will be important in states with bold efficiency goals that have already captured much of the low-hanging fruit—the easiest-to-obtain savings—from energy efficiency.
- **P4P has been most successful when aimed at aggregators rather than individual customers.** Aggregators provide energy program services to multiple building owners and can include energy service companies (ESCOs), program implementers who work with utilities, and new private businesses that help customers finance and manage projects. Aggregation of savings from a group of buildings improves the accuracy of savings estimates. Further, P4P approaches that make payments to aggregators are better able to drive innovation in energy efficiency service delivery, because competition among aggregators to attract customers and private investors can lower costs of delivering energy savings. In contrast, the few P4P programs aimed at individual customers (e.g. large commercial or industrial businesses) have attracted relatively low participation. When aimed at individual customers, P4P incentive designs have often proved less successful than standard utility rebates at overcoming customers' barriers to investment in efficiency improvements. Many customers prefer predictable, upfront rebates that offset installation costs, as opposed to P4P payments that come later, after a year or more of performance, and are variable based on the amount of savings achieved.
- P4P programs can deliver **efficiency as a verified energy or capacity resource for the electric power system.** Recent competitive solicitations in California and New York have procured energy efficiency to avoid overloading the wires that connect the electric grid, displace supply-side energy generation, and defer upgrades to transmission and distribution infrastructure. Energy efficiency can also be bid into wholesale forward capacity markets—which purchase resources for projected energy needs in the future—as a system capacity resource. Because P4P programs can be targeted to specific locations and incorporate rigorous evaluation, they are able to effectively deliver efficiency savings as a resource that the grid can count on to ensure customers' energy needs are met, displacing purchases of such resources as coal or natural gas, for example.
- P4P programs shift the risks and rewards for all entities involved: participants, utilities, aggregators, and regulators. Notably, **P4P generally shifts responsibility for obtaining energy savings from utilities and program administrators to aggregators, implementers, or individual customers** (depending on the program design). This can be effective at motivating persistent savings when the entity bearing the performance risk is responsible for installing and maintaining the energy-saving measures. However, some programs can create uncertainties for aggregators or customers, such as how savings will be calculated and how contracting and payment timelines will be configured. Unless these aspects of the program are made clear and manageable, this increases risks for aggregators or customers that can translate into lower participation and higher program costs.

P4P is not appropriate to replace a range of utility programs that either do not have a metered baseline, like new construction programs, or are not tied to measurable savings at a specific customer site.

LIMITATIONS OF P4P

Unless carefully designed, P4P programs may skim off only the cheapest and easiest-to-acquire energy efficiency, leaving significant savings opportunities on the table. For example, several early programs were getting only lighting upgrades until the program explicitly encouraged more comprehensive projects. P4P is also not appropriate to incentivize all types of energy-savings opportunities. P4P limits include the following:

- **Although P4P can be an important part of a utility energy efficiency portfolio, it is not a good match for all situations.** P4P approaches are well-suited to comprehensive projects in the commercial and industrial sectors that can meter savings and shift program design risk—and responsibility—to aggregators. There may also be potential for aggregated programs in the residential sector, but there is little P4P program experience in the residential sector to date. P4P may not be appropriate for buildings with energy usage that fluctuates in ways that are difficult to predict (that is, in ways that are not based on weather, occupancy, or other identifiable factors). P4P also may not be a good fit for hard-to-reach customers, such as low-income households and small businesses where energy savings can be more expensive and complicated to obtain, unless specially designed to meet the needs of these customers.

- **P4P is not appropriate to replace a range of efficiency programs that either do not have a metered baseline, like new construction programs and codes and standards, or are not tied to measurable savings at a specific customer site,** such as upstream programs that work with product manufacturers, midstream lighting and HVAC programs that provide discounts for efficient products at the point of sale (without tracking where the efficient equipment is installed), and other market transformation programs that may have longer-term and more diffuse impacts.

ENGAGING THE PRIVATE SECTOR

P4P models have the potential to engage the private sector in scaling up energy efficiency investments and savings. Private investors and companies may have more flexibility to experiment and take on performance risk than utilities. In order to drive energy efficiency innovation, P4P approaches should be open-ended enough to allow the private sector to offer creative service delivery approaches to drive energy savings. Program design considerations for engaging the private market through P4P approaches include:

- **Standardized measurement and verification (M&V) methods.** Development of standardized M&V methods for establishing baselines and calculating energy savings is a critical step to enabling a competitive market for energy efficiency services. M&V standards can reduce costs for aggregators and other implementers and ensure that efficiency savings are being counted consistently and transparently by all parties.
- **Data access.** Building owners and their service providers (such as program implementers or aggregators) need modern utility systems to obtain energy and water usage information in consistent, machine-readable formats. For example, the U.S. Department of Energy's Green Button initiative (http://www.greenbuttondata.org) provides protocols for enabling customers to more easily access their data.
- **Market access and fairness.** Competitive solicitations for aggregators should be transparent and conducted often enough to allow new companies to participate.

It is worth noting that there are ways to promote innovation in energy efficiency program delivery other than turning service delivery over to the private market. It is possible to give utilities and other energy efficiency program administrators the flexibility to continually improve programs, adjust portfolios based on evolving goals or market needs, and pilot innovative approaches.

RECOMMENDATIONS FOR POLICYMAKERS

Policymakers should experiment further with P4P programs to learn more about the best applications of these programs, given that they offer both key opportunities and have important limitations. **One no-regrets step is to begin tracking real-time metered savings alongside the deemed and modeled savings estimated by traditional programs, to assess where a shift to P4P approaches may be appropriate.** It is also clear from experience to date that certain program elements should be considered to improve outcomes:

- **Screening for buildings with predictable energy usage and paying incentives for a portfolio of projects**, rather than individual projects, can increase the accuracy of savings estimates and lower the risk of not meeting targets.
- **Designing incentives to encourage more comprehensive projects**—such as tiered incentive payments for different savings levels or higher-potential measures, minimum savings level requirements, or requirements for projects that include multiple measures (e.g., not just lighting)—will enable programs to achieve savings beyond the lowest-hanging fruit.
- **Pairing payments for installation milestones with performance-based incentives** can alleviate some of the upfront financial burden of energy efficiency measures for aggregators and customers. For example, some P4P programs provide a partial incentive once the measures are installed, and then additional payments once the savings are measured over time. Aggregators could pass along an advance payment to customers to help with the initial energy efficiency investment, or the project might be financed based on the stream of payments expected from the project.

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- **Standardizing M&V metrics** to verify and compare savings estimation models can help make savings calculations more transparent and auditable, especially when comparing savings estimates from both proprietary and public software that analyzes metered data.
- **Quickly communicating feedback** on energy savings numbers through seasonal or monthly reports to program implementers and aggregators can allow for rapid improvements and increased savings.

Utilities and other energy efficiency program administrators should run P4P pilots to test M&V methods and advancements in energy data analytics. Going forward, the rapid sharing of lessons learned—across program administrators, implementers/aggregators, the private sector, and regulators—will be essential.

CONCLUSION

P4P programs will never be a substitute for all energy efficiency programs, nor can they (or other energy efficiency programs) replace the clarity and motivation of state energy efficiency goals.[12] But with certain features described in this issue brief, new P4P programs are a promising way to achieve energy savings and attract private-sector engagement in efficiency. A primary difference between P4P and other program types is that the *performance risk* is more directly borne by the entity responsible for installing and maintaining the energy-savings measures (rather than the utility or other program administrator). The implications of this on program *outcomes* will need to be carefully examined by policymakers. While it makes intuitive sense to place performance risk on the party directly implementing or overseeing energy efficiency improvements, more experimentation is required to better assess the relative performance of different program approaches. It is not yet clear if P4P models will be able to achieve *more savings* than traditional efficiency programs, achieve savings at a *lower cost*, or attain *different types of savings*.

Advancements in data analytics have the potential to streamline the calculation of baseline estimates and also lower M&V costs, especially for comprehensive retrofit projects with multiple energy efficiency measures, as well as projects focused on behavioral and operational efficiency where it is difficult to deem the savings in advance. Utilities and other energy efficiency program administrators—particularly those in states with ambitious climate goals—should consider using P4P approaches to obtain greater savings from these types of projects in particular. P4P may also have an important role to play in solicitations to pay for energy efficiency as a resource to lower capacity needs, displace supply-side energy generation, and defer upgrades to transmission and distribution infrastructure. We recommend that policymakers and advocates support new P4P pilots, though a wholesale move toward P4P programs is not yet warranted based on the evidence to date.

ENDNOTES

1 Lara Ettenson and Christa Heavey, "California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals," Natural Resources Defense Council and Environmental Entrepreneurs, August 2015, https://www.nrdc.org/resources/californias-golden-energy-efficiency-opportunity.

2 For example, an energy efficiency resource standard (EERS) establishes specific, long-term targets for energy savings that utilities or nonutility program administrators must meet through customer energy efficiency programs. Most leading EE states have some form of an EERS. *See:* American Council for an Energy-Efficient Economy (ACEEE), "Energy Efficiency Resource Standards," n.d., http://aceee.org/topics/energy-efficiency-resource-standard-eers.

3 Consortium for Energy Efficiency, "Annual Industry Report: 2015 State of the Efficiency Program Industry," March 18, 2016, https://library.cee1.org/content/cee-2015-state-efficiency-program-industry.

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8 Ethan Rogers, et al., "How Information and Communications Technologies Will Change the Evaluation, Measurement, and Verification of Energy Efficiency Programs," American Council for an Energy-Efficient Economy, December 2015, http://aceee.org/research-report/ie1503.

9 State and Local Energy Efficiency Action Network. 2012. *Energy Efficiency Program Impact Evaluation Guide*. Prepared by Steven R. Schiller, Schiller Consulting, Inc., www.seeaction.energy.gov.

10 *See, for example,* Lawrence Berkeley National Laboratory's work on ESCOs and Energy Saving Performance Contracting, collected at https://emp.lbl.gov/projects/energy-saving-performance.

11 *See, for example,* Charles Goldman and Suzie M. Kito. "Demand-Side Bidding: Six Years Later and the Results Are Coming In," Lawrence Berkeley National Laboratory, 1994; *and* Charles Goldman et al., "California's Nonresidential Standard Performance Contract Program," Lawrence Berkeley National Laboratory, August 1998.

12 For a map of states with energy efficiency resource standards, see ACEEE, "Energy Efficiency Resource Standards," http://aceee.org/topics/energy-efficiency-resource-standard-eers.