Integrating Demand Response in Third Party Implemented Energy Efficiency Programs

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ABSTRACT

California utilities have managed the implementation of energy efficiency (EE) programs for over two decades. Recently, the California Public Utility Commission (CPUC) has mandated as part of the California Long Term Energy Efficiency Strategic Plan that California utilities implement integrated demand side management (IDSM). To do this the utility must ensure when an EE project is investigated, demand response (DR) opportunities are also explored and implemented as appropriate.

Southern California Edison (SCE) manages 23 market segment specific third-party implemented programs. These programs provide audits, technical calculation assistance, and project management services to assist customers in identifying and installing EE opportunities. In parallel, SCE's Technical Assistance and Technology Incentives (TATI) program provides customers with engineering services that develop DR audit recommendations and incentives for installing DR enabling measures.

In an effort to implement IDSM, SCE is piloting the integration of the TATI process into two of their EE programs focused on retail and commercial office buildings. This entails the integration of program forms, legal agreements, program and system processes, and both customer and vendor incentives. Customers choosing to participate reap the benefits of reducing their current energy base load and then receiving per event incentives for reducing their demand. As a result, more customers are now implementing comprehensive IDSM solutions for projects that in the past focused solely on EE.

This paper will walk through the motivation and challenges of IDSM in California, explain the current design and payment structures of "siloed" EE and DR programs and detail the process established in two pilot EE programs to include DR technologies. Finally a case study is presented outlining the benefits of IDSM.

Integrated Demand Side Management in California

The California Long Term Energy Efficiency Strategic Plan (Strategic Plan or Plan), published in 2008 and updated in 2011 by the California Public Utilities Commission, sets ambitious efficiency goals for the state, including achieving zero net energy (ZNE) new construction in the residential sector by 2020 and commercial sector by 2030. The Plan was crafted to include a combination of efforts to achieve these goals, ranging from utility programs to codes and standards to market transformation initiatives. In addition, the CPUC directed the Investor Owned Utilities (IOUs) in the 2009-11 (2010-12 for EE) proceedings to integrate programs across energy efficiency, demand response and low income energy efficiency.

The stated Vision for the Plan read: "Energy efficiency, energy conservation, demand response, advanced metering, and distributed generation technologies are offered as elements of

an integrated solution that supports energy and carbon reduction goals immediately, and eventually water and other resource conservation goals in the future" (CPUC 2011).

This recommendation is driven by the historic "siloed" activities of DSM options for energy consumers within regulatory bodies, utilities, environmental organizations, and among private sector service providers. Programs are often focused on mass delivery and promotion of individual products, for example efficient air conditioners, rather than on integrated packages of measures. This current narrow focus on a single product offering does not maximize energy savings nor minimize the costs of program delivery.

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

The first step towards achieving the objectives outlined in the Strategic Plan was to provide comprehensive energy efficiency programs to utility customers. As a result, SCE offered market segment specific – but comprehensive – third party implemented programs to their commercial and industrial customers. Market segments addressed in the 2010-2012 EE program cycle include: healthcare, primary and fabricated metals, food & kindred products, nonmetallic minerals and products, lodging, chemical products, oil production, retail, beverage manufacturing, data centers, industrial gasses, petroleum refining, schools and commercial office buildings. Similarly, comprehensive demand response solutions are offered through the Technical Assistance and Technology Assistance program. The program designs and related payment structures are presented in the next section.

The next step towards IDSM was to develop a comprehensive integrated approach. A comprehensive integrated approach is one that implements multiple measures (e.g., lighting, HVAC, refrigeration and insulation) and multiple programs (e.g., Energy Efficiency, Demand Response) and is supported by multiple tools and resources (e.g., rebates and training, outreach, coordination and information sharing). In an effort to provide a comprehensive integrated approach, Southern California Edison bundled the DSM opportunities (energy efficiency, demand response) in two pilot integrated, third-party programs to better meet the specific energy needs of its customers and further the efforts of the Strategic Plan. These two programs, focused on retail and commercial office buildings, were designed to be EE third party implemented programs with the option of also implementing DR measures. The priority of the programs is to achieve energy efficiency savings, with bonus payments to the implementer and the customer if DR measures are identified and installed.

The pilot, integrated third-party programs were specifically structured to capture lost opportunities in two ways:

1) Programs target specific gaps or lost opportunities in key market segments: offices and retail;
2) Programs encourage third parties to identify integration opportunities (e.g. Demand Response, Distributed Generation/Solar) within the traditionally energy efficiency focused projects.

As a result, the two pilot programs outlined target goals with incentives for segment-specific, integrated projects. In addition, program management within EE and DR worked closely to provide the foundation necessary to facilitate the integrated projects (e.g. program documentation, workflow systems, etc.).

Third-Party Implemented EE Program Design and Payment Structure

Customers seeking to reduce their energy consumption through EE measures can take advantage of the standard market segment specific 2010-2012 energy efficiency pay-for-performance (PFP) third-party implemented programs. These programs provide technical assistance for identifying opportunities, developing project feasibility studies, providing project management assistance, and performing all measurement and verification services as necessary for the installation of high-efficiency equipment, and/or process system efficiency improvements to obtain incentives. SCE implements these programs targeted at specific market segments utilizing Energy Services Professionals ("Implementers") under Purchase Order (PO) agreements.

In addition to the PFP programs, SCE manages third-party implemented Direct Install and Turnkey programs which provide no-cost/low-cost installations to schools, small businesses and entertainment centers.

Implementer Payment

Program implementers are paid using a performance-based model. The payments are designed to cover the full cost of project development and implementation including the initial audit, energy modeling, project management, verification of savings and incentive payout. One important aspect of the program model is implementers are not incentivized to perform the actual installation of measures, but are only paid for actually installed and verified projects.

The payments are made on a $/gross kWh basis and are divided into three types of progress payments, known as milestone payments. The milestone payments are as follows:

- Milestone Payment #1: This payment is payable upon acceptance of the project feasibility study (PFS) by the SCE contract manager. At this stage a project has been identified, the implementer has calculated potential energy savings and demand reduction, and the customer has expressed interest in applying for an incentive. Because calculations have not yet been verified by SCE and incentive budget has not been committed, this is considered a "pre-commitment" (SCE 2012).
- Milestone Payment #2: This is payable upon approval of proof of equipment order documents by the SCE contract manager. At this stage the calculations have been verified by SCE using a third-party reviewer, and an estimated incentive based on the approved savings is reserved and communicated to the customer. The customer has also signed an agreement with SCE ("Customer Agreement") agreeing to the terms of the program. This is considered a "commitment" (SCE 2012).

- Milestone Payment #3: This payment is payable upon installation, verification and approval of energy savings. At this stage, the project is installed, operational and fully commissioned. SCE has inspected the installation and determined the final project savings. The project savings can be claimed by the program at this stage (SCE 2012).

In certain scenarios requiring extended measurement and verification (M&V) of installed measures to determine savings, the third milestone may be split into two payments. The final payment always considers actual verified savings, and is trued up to consider whether other milestones were over or under paid based on the final savings.

Customer Incentive Payment

Third-Party Implemented Programs allow for the implementation of any statewide approved EE measure whether they are itemized (Deemed Solutions) or customized (Calculated Solutions). The incentive payment for itemized measures are based on the deemed per-unit amount set forth by SCE. The incentive payment amount for customized measures is based on a flat incentive rate (per kWh) applied to one year of energy (kWh) savings, plus a flat incentive rate (per peak kW) applied to the resultant permanent peak demand reduction. Figure 1 shows the incentives by end-use. Energy efficiency incentives are paid on the energy savings and permanent peak demand reduction that exceeds baseline energy performance. Baseline energy performance includes state- and federally-mandated codes, industry-accepted performance standards, and other baseline energy performance standards as determined by SCE. The customized incentive rate depends on the type of efficiency measure installed (lighting, AC&R I, AC&R II) as shown in the table below (SCE 2012).

Figure 1. 2010-2012 Customized Energy Savings Incentive Rates

Measure Category	Annual Energy Savings Incentive Rate (kWh)	Peak Permanent peak demand reduction Incentive Rate (kW)
Lighting (Fluorescent, Other Lighting, or Lighting Controls)	$0.05 per kWh saved	$100 / kW
Air Conditioning and Refrigeration (AC&R) I	$0.15 per kWh saved	$100 / kW
Air Conditioning and Refrigeration (AC&R) II	$0.09 per kWh saved	$100 / kW
Motors and Other Equipment	$0.09 per kWh saved	$100 / kW

2010-2012 Third-Party Implemented Program Policies and Procedures Manual for Business

The validated savings in the final installation report are used to calculate the customer incentive. For measures requiring extended M&V plans that exceed 60 calendar days, 60% of the incentive is paid when the initial installation report is approved by the SCE contract manager. At the completion of the M&V plan, and once the final Installation Report is approved by the SCE contract manager, the remainder of the incentive is paid to the customer.

The TATI Demand Response Program Design and Payment Structure

Customers seeking assistance and incentives for demand response (DR) measures will typically apply for the SCE Technical Assistance and Technology Incentives program (TATI). This program provides eligible business customers free DR site assessments and offers financial incentives for installing eligible DR equipment that can be used to reduce electricity usage during periods of peak demand. The installed DR equipment gives customers increased flexibility to participate in other demand response programs that provide additional energy-saving incentives.

Technical Assistance

The technical assistance process is initiated by the SCE customer account representative and the customer. Account representatives work closely with customers to determine a business' demand response potential and help them complete registration forms enabling SCE to schedule a preliminary assessment to be performed by an SCE-contracted engineer. The engineer conducting the preliminary assessment will determine whether a more in-depth technical audit of projected load reduction potential in the facility is recommended. SCE pays for this preliminary assessment and there is no charge to the customer. Customers also have the option to use an engineer of their choice to conduct a preliminary assessment. Costs associated to this option are the customer's responsibility.

If a technical audit is recommended and accepted by SCE, the engineer will identify applicable demand response practices and methods, and recommend measures and technologies to achieve demand response potential. The customer is not required to proceed with the installation of recommended measures (SCE 2011).

Technology Incentive

Technology incentives are available to eligible customers for the installation of qualifying DR technologies. Qualifying technologies include, but are not necessarily limited to, energy management systems, dual-level lighting, remote controlled switches, building automation systems, demand control software, and/or other enhanced automation technologies. These are designated as part of the technical assessment.

Once a customer elects to proceed with installation of qualified equipment, the customer must submit an Energy Management Solutions Incentives Application to apply for technology incentives. The application is then processed, eligibility is confirmed and if funding is available, a reservation is held for 180 calendar days. The customer may then proceed with the installation of the DR technology.

Upon completion of the project installation, the customer is then eligible to redeem the technology incentives. SCE will carry out the measurement and verification of the facility's load reduction potential from the qualifying technology, and an incentive is paid out based on measured and verified load reduction.

Customers can receive technology incentives of up to $125 per kW of verified load reduction. Customers can also be eligible for up to $300 per kW of verified load reduction for installing technologies that reduce electricity use during peak periods without manual intervention (Automated Demand Response – Auto DR) (SCE 2011).

Integrated Third-Party Programs

In an effort to integrate DR and EE technologies into comprehensive projects, SCE is piloting the integration of the TATI process into two standard EE pay-for-performance programs, the Retail Energy Action Program (REAP) and the Commercial Utility Building Efficiency (CUBE) program. These programs, implemented by The Trane Company, focus on comprehensive projects in retail and commercial buildings. Trane had already been selected to implement both EE programs prior to integration and was ideally positioned to pilot the integration of EE and DR provided their expertise in HVAC and control systems. The primary focus of these programs is to develop EE projects in their respective market segments, but the option of developing EE and DR integrated projects was added to the program scope.

As described above, standard PFP programs require implementers to perform audits to identify DSM opportunities resulting in the development of EE-only projects. Since the equipment responsible for DR opportunities were often times already being evaluated for EE potential, it made logical sense that the resulting project development should also include DR measures. Some barriers to this included lack of funding to pay the implementer for the additional time and resources required and the customer for technology incentives (EE funds cannot be used for DR). In addition, different and conflicting processes (i.e. program documentation, approvals, timelines, etc.), and contracts that did not fully support the activity (i.e. goals, compensation structures) created additional challenged in integrating the DSM approaches.

In order to put into operation a framework to support this integration, a comprehensive effort was put forth by a team composed of representatives of the market segment solutions group and the TATI program. A necessary step was to ensure that SCE and CPUC requirements were met and the proper controls were in place to verify all savings. All program documentation was updated to ensure both the terms and conditions of the programs were consolidated, integration of the workflow process and program forms was performed, and policies and procedures were reviewed for overlap or conflicts. Each change had to be reviewed by regulatory staff in each group in order to ensure compliance of the new process.

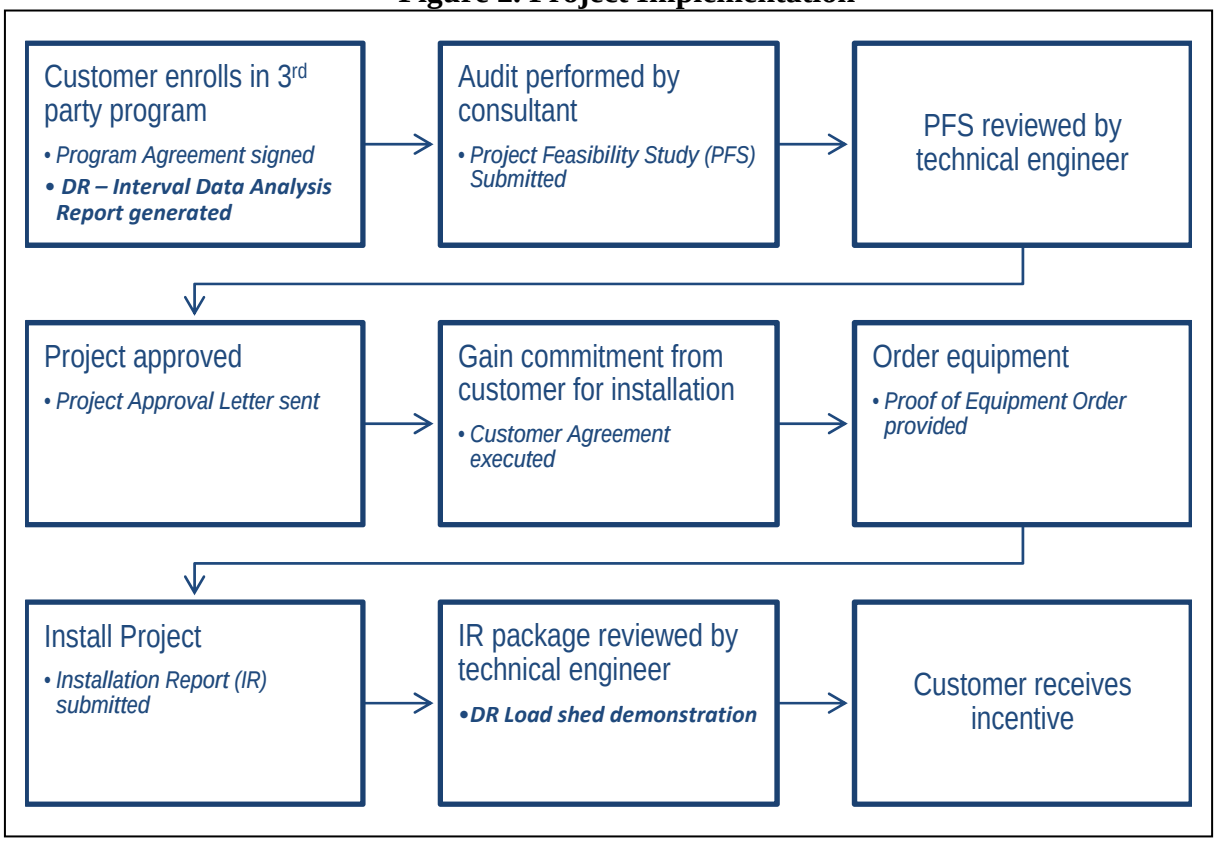
Additionally, a compensation structure for payment of the DR energy savings to the implementer was established. The additional milestone payments were created alongside the existing EE project milestone payments. The payments coincide with the existing milestone 1 and 3 payments. At each of these milestones the implementer may invoice for 50% of the DR payment. In the event a project is not installed or the load shed cannot be verified, any payments made to the implementer are recuperated by the utility.

All changes required both Legal and Management review and approval. Overall integration of the programs, in partnership with the DR team, took six months to finalize and implement.

Integrated Project Implementation Process

The new integrated program process is the same as the standard PFP process with a few additional steps required to validate the DR measures. Figure 2 outlines the project implementation from enrollment to customer incentive and completion.

Figure 2. Project Implementation



Customer enrolls in 3rd party program. The implementer is required to develop a project scoping document which briefly describes the project and is to be submitted to SCE. This document provides the SCE contract manager with enough material to validate that the project fits within the program and will be eligible for EE and DR customer incentives. For projects with DR measures, SCE will submit an integral data analysis report (IDAR) to the implementer in order to properly calculate potential load reduction. The IDAR defines and summarizes the electricity demand behavior patterns for the SCE customer. This summary will assist in determining the amount of curtailable load that is available and the optimal times in which demand response procedures can be implemented.

Audit performed by consultant. The implementer will then proceed to work with the customer to develop a project. This includes carrying out energy audits of customer facilities and developing a project feasibility study detailing estimated energy savings, estimated measure costs, estimated incentives and calculated return on investments to the customer. If a customer expresses interest in applying for these incentives, the implementer will in turn submit the project to SCE along with all relevant supporting documentation including calculation files. In

this step, the standardization and integration of EE and DR program documentation described in the previous section has resulted in a reduction of approximately half the required paperwork compared to a customer implementing a project through both the TATI and the standard PFP programs.

PFS reviewed by technical engineer. Next, the project is subject to an external review. SCE contracts with third-party engineering firms to evaluate the project documentation submitted by the implementer and conduct a pre-installation site inspection to validate that the project has not yet been installed. The technical engineer validates and may revise the submitted estimated energy savings, DR load reduction, and/or incentive calculation. In addition, the reviewer evaluates and may revise the submitted M&V plan. Once they submit a project recommendation to SCE, a secondary review may be done through SCE's internal Energy Engineering Group (EEG). With the exception of the DR load reduction verification; this is the standard approach to verifying EE-only PFP projects.

Project approved. Once the review is completed, a project approval letter is sent to the customer detailing the SCE approved estimated incentive and related energy savings and load reduction.

Customer commitment/Equipment order/Project installation. If the customer wants to proceed with the project an agreement is signed between them and SCE. At this time they may proceed with the installation of the project. At this point, the customer may decide to proceed with both the EE and DR projects or with the EE project alone. If a customer decides they only want to work on DR opportunities, they must apply through the TATI program.

Once the installation is complete, the implementer submits a signed installation report package supporting that all project measures have been installed, fully commissioned, and are fully operational. As part of the package, project invoices and revised computer models are submitted detailing the final installed project.

IR package reviewed by technical engineer. After receiving the installation report package, the third-party technical engineer evaluates the submittal package and will conduct a post-installation inspection to verify project installation and ensure the scope of work has not been altered from the agreed-upon PFS. For projects with DR measures, a verification/demonstration of the load shed capability and functionality of the equipment will be performed during the post-installation inspection. This allows the utility to ensure that load reduction takes into consideration the new baseline after the EE project is installed.

Customer receives incentive. After SCE approves the installation report, the incentive check is processed and sent to the customer, and the project is considered completed. The DR incentives are funded through the technology incentive part of the TATI program, while the EE incentives are funded through the third-party PFP program.

Case Study: Financial Statement Services Inc.

In August of 2011, Financial Statement Services Inc. (FSSI), located in Santa Ana, CA, entered into the Commercial Utility Building Efficiency (CUBE) Program with SCE and Trane. FSSI is a full-service print and mail leader specializing in the design/redesign, production and delivery of high-impact statements, letters, notices and other time-critical customer communications.

The first step in the process was to conduct a thorough energy analysis of the facility, identifying the EE measures that would significantly reduce FSSI's operating costs. These measures were determined to be lighting, lighting controls and increased HVAC control capabilities. There are rooms dedicated to printing which generate a large heat load for the building.

In addition, it was noted that FSSI had large on-peak energy load making them a perfect candidate for DR. The measures identified were; shutting off 50% of hallway and non-critical area lighting, drifting space temperatures in non-critical areas by 3 degrees Fahrenheit, limiting air handler fans by 25% and pre-cooling the building prior to the beginning of the DR event (Trane Ingersoll Rand 2011).

After generating the energy model it was determined that the total energy reduction for the EE portion of the project would total 369,881 kWh and 39 peak kW demand. This would result in an annual savings of $55,481 directly impacting the bottom line of FSSI (Trane Ingersoll Rand 2011).

The conservative model also showed that during DR events FSSI could reduce an average of 62 kW FSSI (Trane Ingersoll Rand 2011). During the performance evaluation conducted with Trane, SCE verified the actual load reduction was to be 107 kW, surpassing the calculated amount by 58%.

The final EE rebate totaled $22,626, while the DR incentive totaled $31,657. The additional DR rebate incentive from SCE paid for the controls upgrade for FSSI, making the payback of the project 0.83 years. Without the technology incentive or the integration of the technical assessment into the audit phase, the controls system would not have been installed by the customer as the time and cost to determine and prove potential energy savings is too high to make the analysis cost-effective.

FSSI Project Financials

Project Cost - Approximate	$114,000
Annual Energy Savings	$71,863
Energy Efficiency Rebate	$22,626
Demand Response Rebate	$31,657
Simple Payback	0.83 years

Conclusion

Energy Efficiency incentives allow customers to move forward with cost effective investments that reduce their operational costs. These investments in energy saving technologies such as lighting, HVAC and window film are difficult for customers to identify and the high initial capital investment make it difficult for customers to justify expenditures despite a forecasted reduction in operation costs. The incentives and project implementation support provided by the utilities drive these projects to realization while also reducing the electricity procurement cost of the utility.

Modern digital controls in building management systems have become common practice in new construction. These control systems allow facility managers to optimize occupant comfort while minimizing operational energy consumption. In addition, these technologies provide customers with the opportunity to enroll in automated DR programs.

Despite the availability of incentives, controls remain difficult to rebate on in existing buildings because of the quantification methods needed to prove the savings. It is time and data intensive and often not worth the engineering investment to determine exact savings from changes in control systems. As a result, these projects are often not implemented as the customer would be left to pay for the majority of the control system, receiving minimal dollars for EE measures such as optimum start and stop times.

Integrating DR incentives into EE programs allows customers to install or upgrade their control system with most of, if not all, the project paid for through incentives. The DR available technology incentives complement any approved EE incentives on a given project and drive down the total project payback times enabling customers to invest in more measures overall. The HVAC and lighting controls installed for automatic DR capability provide the utility with the ability to automatically trigger demand reductions with customers during peak events without manual intervention resulting in higher reliability of DR participating sites. In addition, these systems provide customers with better control over their business processes by having more dynamic controls in place and provide the customer increased reach into the energy systems of the building allowing for increased energy saving opportunities down the road.

Customers implementing integrated EE and DR projects maximize their rebate opportunity from the utility. Additionally, identifying both EE and DR opportunities at the time of audit and project development saves time and resources and achieves the goal of IDSM.

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