

Appendix F
EM&V Lessons Learned

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A. Residential Sector EM&V Summaries and References

Summaries from previous evaluations cycles informed SCE's intervention strategies reflected in the business plan. The Residential sector has substantially more studies than other sectors, summaries below are presented as a high level summary for the key learnings by the relevant market actor for recent EM&V reports.

1. Key Take-Away for Residential New Construction (Target: SF/MF Builders)

The IOU Multifamily New Construction (MFNC) program appears to be a secondary factor compared to these other market factors and interventions (CTCAC funding, other green building programs – LEED / GPR, reach codes), which appear to be more significant drivers of efficiency in the MFNC market. In another words, there are many factors and sources of funds driving the MF new construction market, the utility's program intervention is not considered to be a primary factor.

While California Advanced Homes Programs (CAHP) successfully moved many builders and developers progressively beyond Title 24 energy efficiency standards toward ZNE, the program is not cost-effective. Additionally, only 1% of new homes built achieved these standards. By 2020, ZNE becomes a Codes & Standards requirement. At that point, there would be no energy savings for this program design. We need to let California Codes and Standards to move this market segment.

2. Key Take-Away for Homeowners, Renters, and Consumers

a. Lighting

Upstream lighting program interventions continue to generate robust energy savings for the SCE EE portfolio and successfully transforming the market. Meanwhile, LED measures and Top-Half requirements represent energy savings opportunities for the next few years but will be impacted from a programmatic standpoint.

b. HVAC, Home Cooling

The aggressive Title-24 ratchet for HVAC systems in California has left little room for programmatic energy savings, but the market transformation goals are not yet reached. Codes and standards are positively influencing the sale of high-efficiency units but permitting remains a large challenge. More can be done to support this market, an indirect impact program approach using education and training as intervention is a good option.

c. Home Energy Advisor/UAT and Behavior

i. Behavior

HER implementation will continue to be important to generate cost effective energy savings but this will become harder and harder to maintain for a wide range of reasons (e.g., need for targeting of higher-usage customers, dynamic rate implementation, concern for double counting, and behavior savings effective useful life).

ii. Home Energy Advisor / UAT

This is a good candidate to become statewide tool, except for the challenge of the required integration with each IOU's billing system. For the near-term, UAT will continue to linger and be a costly challenge for implementation. For energy savings, UAT will face the same "double counting concerns" as the behavior program.

d. PLA, Home Appliances

The California Plug Load and Appliances Program have been extremely successful. This is proven by year-after-year of CLASS study results. It is time to take a more focused market transformation approach to this class of measures. SCE supports the proposed RPP program, except this program should be implemented in a more rigorous manner to support only measures with above-code (i.e., above EnergyStar) savings.

e. EUC-HU, Comprehensive Retrofit

This non-cost-effective program has been trying to engage customers and contractors since 2011. Today, this program has customer demand that far out-paces its ability to serve (owing to insufficient program budget, given the program demand and cost). Presently, the statewide program team is working to curtail its program offers (size of the rebate and duration of the incentive) to make ends meet. While this is something to celebrate, none of the studies below predicted this outcome. The challenge for the EUC-HU program is to forecast the S-shape adoption curve given varying incentive levels to maximize energy savings and cost-effectiveness.

Given the size of necessary household investment, it is not clear that Residential Comprehensive Retrofit projects meet the criteria of market transformation. There is plenty to be done without calling this a market transformation intervention. Ongoing contractor and homeowner training to improve the understanding of energy efficiency will contribute to the overarching SB 350 implementation. Other programmatic solutions will be necessary in the future.

3. Key Take-Away for Residential Retrofit – MF Property Owners and Managers

Need to improve program targeting to reduce free-ridership (i.e., targeting high EUI and/or low building score buildings, older buildings, and etc.)

Understand that Affordable Housing entities may have access to other financial resources, making the utility intervention (i.e., a program rebate) to be one of the reasons for energy upgrade (i.e., a part of the attribution).

A Single-Point-of-Contact (SPOC) approach is needed to support major accounts as well as supporting the more numerous smaller properties (i.e., major-account-SPOC and Contractor-SPOC).

All MF upgrades and investment will be evaluated using a Return-On-Investment (ROI) approach, a comprehensive do-it-all-today approach is not likely to work due to competing business needs.

Split-incentive will continue to be an issue for major improvements concerning tenant units, unless the improvements can also improve property value and curb appeal overall.

B. Non-Residential Sector EM&V Summaries and References

Table 1 identifies relevant studies in the Commercial, Industrial, and Agricultural sectors and described key lessons from the studies that have informed SCE’s development of its 2018-2025 portfolio.

Table 1. EM&V Lessons Learned Report Summary

Sector Applicability <i>(C = Commercial; I = Industrial; A = Agricultural)</i>	Study Name	Lessons Learned & Fit with Strategy
C	Statewide Benchmarking Process Evaluation NMR Group Inc 4/12/2012 CPU0055.02	<p>It is clear the implementation of California benchmarking goal can be challenging. There is a long list of implementation and market barriers for this activity as outlined above.</p> <p>There is another impediment to this program to date. The California IOUs have not been able to claim energy savings from Benchmarking program results to date. As indicated by this study, many workshop participants cited the information for Building Score and EUI really modified their energy usage behavior. The study consultants indicated the fact that it should be possible to measure energy savings from the benchmarking program intervention.</p>
C, I, A	Impact Evaluation of 2013-14 Commercial Quality Maintenance Program (HVAC3) DNV GL 4/1/2016 CPU0117.01	<p>As a result of a previous study and the 2013 HVAC disposition, SCE is transitioning from an aggregated-approach to its QM offerings, with SCE measures consolidated into 4 measures, to PG&E’s individual measure approach with over 40 measures, tracking individual treatment by equipment type. The ED preferred the individual treatment WP approach and this is the reason for SCE adopting the PG&E disaggregated WP approach, even though this current study has showed that the aggregated approach has a higher realization rate (82% vs 43%-56% for the other IOUs)</p> <p>Generally, SCE continues to review barriers outlined by participating contractors, customers, and the CPUC and to evaluate opportunities to improve the cost-effectiveness of the program. SCE has (a) streamlined the program’s incentive processing for customers by</p>

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		<p>reducing hands-off and touch points, (b) reduced third-party software support issues, (c) held stakeholder forums with all stakeholders to obtain input into the assessment process, (d) in 2016, SCE planned and aligned administrative program improvements,</p> <p>Data Collection: Program manager continues to align implementers' data on the installed measures, with the standardized savings claims database submitted to the CPUC.</p> <p>Workpaper: SCE recently overhauled its CQM Work paper for CPUC approval to claim energy savings by individual treatment performed vs a weighted expected savings per unit. This will result in more accurate energy savings claimed and TRC improvement. SCE is also working on improving the link between claimed savings and the implementer data because this could be contributing to some low realization rates.</p> <p>Changes to programs, measures, and the evaluation of impacts present challenges to assessing and tracking program performance, and as a result, SCE continues to maintain on-going documentation of CQM program improvements. This enhances the evaluability of the program.</p>
C, I, A	Impact Evaluation of 2013-14 Upstream HVAC Programs (HVAC1) DNVGL 4/1/2016 CPU0116.01	<p>Explored market opportunities to adjust and enhance performance tiers for all categories affected by 2015 Federal code updates</p> <p>Actively promote the program to build on contractor, distributor and manufacturer participation and engage those who have not yet participated, to increase distributor participation and increase growth in overall program participation</p> <p>Continues to promote new technologies and/or related equipment categories, such as package equipment that meets or exceed the U.S. DOE "RTU Challenge," variable refrigerant flow equipment, ductless equipment, air-cooled chillers and water-cooled chillers.</p>
C, I, A	2013 Custom Impact Evaluation Industrial, Agriculture and Large Commercial Itron Inc. 7/17/2015 CPU0107.01	<p>This study found SCE's Custom Calculated Program to have a lifecycle gross realization rate of 0.52 and a weighted Net-To-Gross (NTG) of 0.57. To improve on these results, while improving program cost-effectiveness, the nonresidential Custom Calculated Program must improve on program's process and procedure.</p> <p>As indicated in the summary, proper baseline specification and more accurate reporting of operating conditions can improve program's gross realization rate.</p> <p>To improve on program NTG, the program must improve on its targeting and customer measure recommendation to focus on attributable actions due to program intervention.</p>
C, I, A	Evaluation of the Southern California Edison Commercial Midstream LED Lighting Distributor	<p>As a result of this study, SCE scaled its Lighting Distributor Program as a midstream offering. This program has been very successful to date. It is important to note that this midstream distributor program is designed to serve commercial and other nonresidential customers.</p> <p>With the success of this Lighting Distributor Program and the pressing need to improve program cost-effectiveness, in 2017, the</p>

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	Pilot Program Evergreen Economics 5/13/2015 SCE0376.01	nonresidential programs are proposing to expand its mid-stream offering to cover additional lighting measures and adding other technologies that lend themselves to capturing savings through distributor/dealer/wholesaler; like food service and potentially controls.
C, I, A	Nonresidential Downstream Lighting Impact Evaluation Report Itron Inc. 8/26/2014 CPU0078.01	<p>It is clear that the IOUs could improve program process and procedure to improve program's gross realization rate. The importance of lighting measures in the IOUs nonresidential program portfolio will continue to be important, however, much of the energy savings have diminished due to workpaper and Codes and Standards updates.</p> <p>For Large Footprint Customers, this short list of customers is likely to continue to receive downstream lighting incentives and services, allowed by Codes.</p> <p>For all other customers, these above-code lighting measures will be delivered via the Distributor Channel to provide broader customer reach and more cost-effective delivery.</p>
C, I, A	California Nonresidential Program Assessment Study – IOU Core Calculated Program Group Report Itron, ERS 12/24/2012 CPU0103.01	SCE has continued to (a) offer comprehensive bonus opportunity to encourage the development of projects with deeper energy savings and demonstrated DSM activities, (b) has integrated retro-commissioning into the Custom Retrofit Offering, which eliminated the need for a separate retro-commissioning program, (c) and implemented a requirement for project narratives for all large Customized Retrofit projects to demonstrate program influence on all project submissions, increase project quality, reduce cycle time for CPUC ED reviews and decrease the number of declined projects, (d) and Implemented a \$2,200 minimum incentive project submission threshold to increase program cost-effectiveness.
C, I, A	2013 Custom Impact Evaluation Industrial, Agriculture and Large Commercial, by Itron July 17, 2015 CPU0107.01	<p>Key study findings include:</p> <ul style="list-style-type: none"> • A life-cycle gross realization rate of 0.52 and a weighted Net-To-Gross (NTG) of 0.57. • To improve on these results, while improving program cost effectiveness, the non-residential Custom Calculated Program must improve on program's process and procedure. • Proper baseline specification and more accurate reporting of operating conditions can improve program's gross realization rate. • Better targeting and customer measure recommendation to focus on attributable actions due to program intervention would help improve NTG. This may include not engaging on replacing burn-out measures, encouraging the customers to opt for above-code equipment for upgrades. <p>SCE plans on a number of process and procedure improvements to support above as part of its sector strategies.</p>

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C, I, A	Nonresidential Downstream Lighting Impact Evaluation Report By Itron, 8/26/2014 CPU0078.01	Key study findings include: <ul style="list-style-type: none"> • IOUs could improve program process and procedure to improve program's gross realization rate. SCE expects that, in the future, larger customers will continue to receive customized downstream lighting incentives and services, allowed by Codes. Other customers will receive these types of measures via distributor channels to broaden customer reach and provide more cost-effective delivery.
C, I, A	Evaluation of the Southern California Edison Commercial Midstream LED Lighting Distributor Pilot Program, By Evergreen Econ 5/13/2015 SCE0376.01	<ul style="list-style-type: none"> • SCE scaled its Lighting Distributor Program into a midstream program intended for non-residential customers through assistance provided by this study and its findings. • SCE plans to expand midstream offerings to cover lighting, HVAC, and other motors/pumps related measures and applications.
C, I, A	California Nonresidential Program Assessment Study – IOU Core Calculated Program Group Report By Itron/ERS 12/24/2012 CPU0103.01	In partial response to this study's findings, SCE has <ul style="list-style-type: none"> • Continued to offer its comprehensive bonus opportunity to encourage the development of projects with deeper energy savings and demonstrated DSM activities; • Integrated retro-commissioning activity into the Customer Retrofit Offering, which eliminated the need for a separate retro-commissioning program; • Implemented a requirement for project narratives for all large customized retrofit projects to demonstrate program influence, increase project quality, reduce cycle time for CPUC reviews, and decrease the number of declined projects; and • Implemented a \$2,200 minimum incentive project threshold to increase program cost-effectiveness.

Sector Applicability <i>(C = Commercial; I = Industrial; A = Agricultural)</i>	Study Name	Lessons Learned & Fit with Strategy
C, I, A	<p style="text-align: center;"> Measure, Application, Segment, Industry (MASI): Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries, By Navigant Consulting & ASW Engineering 2/27/2015 SCE0377.02 </p>	<p>Key study findings include the following:</p> <ul style="list-style-type: none"> • Each customer segment's motor/pump applications and energy efficiency level may vary based on their business focus; • For some of these customers, energy efficiency is not a priority. For others, such as refineries, maximizing production would take a priority over energy efficiency upgrades. • A mandatory short pay-back requirement (i.e., less than two years) is another difficult barrier to overcome. <p>SCE plans to respond to these challenging findings by varying its available services based on customer size. Larger energy users would have a range of services available to them. Smaller and mid-size customers would largely be limited to midstream services via distributors.</p>
I, A	<p style="text-align: center;"> Measure, Application, Segment, Industry (MASI): New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling By Navigant Consulting & ASW Engineering 3/31/2015 SCE0377.07 </p>	<p>Key study findings include:</p> <ul style="list-style-type: none"> • Major and minor oil producers do not behave the same and industry practice is not common to all. • It is a good idea to tailor the program offering based on the size of the customer in this segment. <p>These recommendations are consistent with SCE's planned approach to delivering services in the Industrial sector. SCE aims to offer custom-tailored direct services to major producers. For smaller producers, SCE will leverage a distributor-based program delivery approach focused on focus on lighting, HVAC and pump/motor measures.</p> <p>A study to investigate ISP gaps between the large and smaller producers may be required in the future as well.</p>

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I	Measure, Application, Segment, Industry (MASI): Food Processing Industry By Navigant Consulting & ASW Engineering 3/31/2016 SCE0377.06	Key study findings include: <ul style="list-style-type: none"> • Metrics besides account size (kW, kWh) should be considered to better evaluate industrial food processing customers. • Identifying energy intensity for key industrial sectors could be needed as part of benchmarking information collected. Critical factors that drive energy usage may be more about volume of production than site-specific energy efficiency. A key list of measures and services to support industrial customers was also identified that informs SCE's future approach in this sector. Besides the need for SEM, energy audits, energy management tools, and improved training for non-energy staff, water awareness and recycling opportunities were also identified. Industrial segments that are both energy and water intense include cheese manufacturing, fruits/vegetables processing and canning, and wineries.
A	SDG&E Cannabis Agriculture Energy Demand Study by Evergreen Econ July 17, 2016 SDG0301.01	Key study findings include: <ul style="list-style-type: none"> • Almost all utilities in regions with legal recreational cannabis growth reported an increase in energy demand due to increases in growing operations. • Electricity costs comprise between 20 and 50 percent of growers' operational costs. • Lighting is the biggest source of energy consumption, particularly in indoor and greenhouse operations. • While some cannabis growers have chosen to install LEDs, a preference for T5s remains due to the belief of many growers that crop yield with LEDs is lower, and upfront cost for LEDs is prohibitory given the numerous start-up costs for new facilities. • The benefits of indoor growing are at the expense of increased energy usage compared to greenhouse and outdoor growing. SCE plans to explore future strategies targeting this potentially emerging marketplace in its territory.
A	Measure, Application, Segment, Industry (MASI): Agriculture by Navigant 3/31/2015 SCE0377.03	Key study findings for greenhouse and irrigated agriculture market segments include: <ul style="list-style-type: none"> • While growers consider water and energy efficiency to an extent, their primary concern is the health and yield of their crops. • Growers will select equipment based on the needs of the crop that they are growing. This may mean that growers will forego systems that are more efficient because the crop requires more water to grow. • The source of an operation's irrigation water can also play a large role in growers' equipment decisions, particularly in irrigated agriculture operations. SCE plans to explore future strategies targeting combined water and energy savings that would look to leverage findings from this study.

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A	SDG&E Agricultural Sector Market Study by Evergreen Econ 3/26/2015 SDG0292.01	Key study findings include: <ul style="list-style-type: none"> • Customers are interested in saving water and in water-related measures. • Barriers to participation reported by customers included lack of awareness and information. • About half of customers reported that the rebate amounts are too low, and most of the remainder report that the amounts are just right. • Additional measures that save energy in this sector that may be worth considering. • Updating the terminology used to describe energy efficiency measures for this sector. SCE plans to explore incorporating findings from this study into current or future strategies.