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Southern California Edison

Energy Efficiency Business Plan

Residential Sector

DRAFT October 28, 2016

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I. Executive Summary

Southern California Edison's (SCE) vision for the residential sector is to increase customer adoption of energy efficiency improvements, enhance customers' abilities to self-serve and target market actors to maintain cost-effectiveness. Residential sector customers are the most numerous and a highly diverse customer base in SCE's territory spanning single-family and multifamily sub-sectors. Residential customer and market actor participation in Demand Side Management (DSM) and energy efficiency (EE) offerings are driven by the characteristics of their market and the barriers limiting their adoption. The opportunities and drivers vary based on factors such as income, housing condition, homeownership, financial reward and technology preference.

SCE's approach to the residential sector is to pursue EE savings in alignment with the sector's market potential opportunities and customer preferences in order to meet the States' energy efficiency savings goals, California Long-Term Energy Efficiency Strategic Plan (CLTEESP) and supporting Action Plans objectives. Current market, policy and industry trends are affecting how programs are delivered to the market and the ability to deliver cost-effective portfolios. SCE will use its experience in delivering offerings by supporting best practices and expand offerings available under new legislative changes to deliver a cost-effective portfolio.

In order to achieve the residential sector's goals, the sector portfolio's composition will change dramatically. Traditional lighting interventions will be scaled down to meet more specific opportunities available after code changes. Customer engagement and enablement through behavioral and program offerings will play an increasing role. A challenge will be the need to deliver a more cost-effective approach for customers to perform retrofits by pursing new approaches such as a meter based, pay-for-performance and residential direct install offerings. These adjustments will require targeted investment and the scaling back of other historical approaches. To do so, SCE will utilize these overarching strategies to enhance the current portfolio:

Strategy 1: Enable cost-effective third parties to promote far-reaching and scalable solutions.

Strategy 2: Streamline program offerings by increasing the utilization of up/mid-stream or self-service delivery channels and reducing the number of customer touchpoints**.**

Strategy 3: Expand customer engagement through data access to their energy use.

Strategy 4: Expand behavioral interventions to enable deeper adoption of energy efficiency, and

Strategy 5: Leverage alternative cross cutting portfolio resources to enable market transformational activities within the residential sector.

II. Sector Profile

A. Characteristics

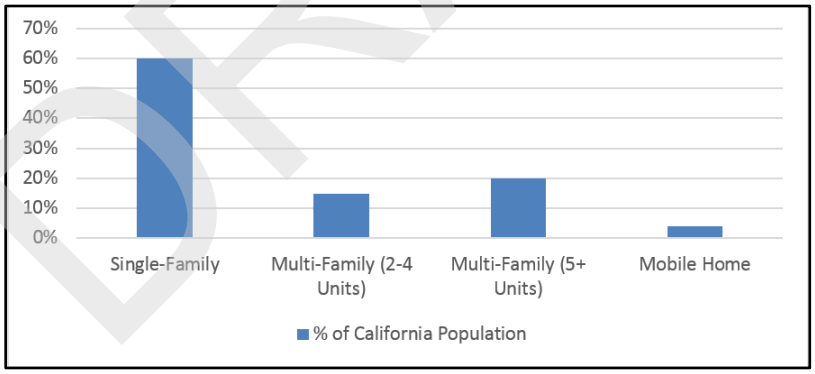
Southern California Edison's residential sector includes more than 14 million people utilizing more than **4.4** million service accounts spanning eight climate zones. Collectively, the residential sector comprises 87% of SCE's total service account volume.

Residential customers are concentrated in urban centers surrounding the outskirts of Los Angeles and surrounding urban centers such as Santa Ana, Riverside and Santa Barbara. Rural and sububan communities tend to coincide where land use has historically been for agricultural purposes, such as Tulare County in the northern part of SCE's service territory.

The residential market primarily consists of Single-family households. Multifamiliy is the second largest sub-segment followed by Mobile Homes with less than 5% of SCE's residential sector.[1] The Figure below shows the percentage of SCE's total residential sector for each premises type.

The scale and diversity of SCE's residential sector requires SCE to address a wide range of needs that may have competing priorities. Customers' energy use and their participation in DSM programs are affected by their type of residence, socio-economic status, and their connection to the property and its location.

Figure 1. Residential Households by Building Type

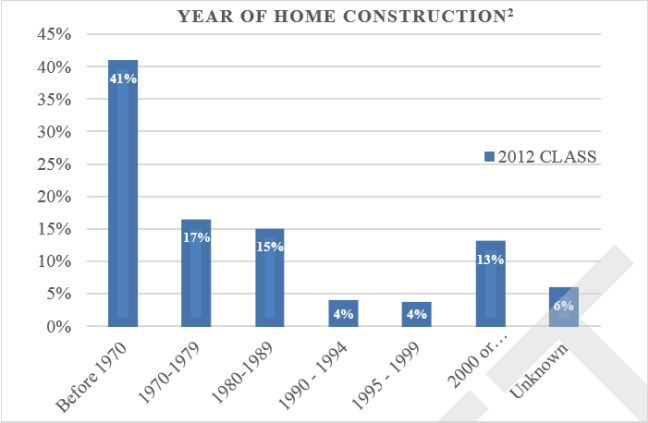


Single-family dwelling units typically have higher energy usage than their multifamily counterparts while mobile homes have an energy consumption pattern that falls between the two. While the size of the property influences these comparative energy consumption patterns, a primary driver affecting the level of efficiency of a property is the age of the home. The age of the property can serve as a proxy to identify savings opportunities. As noted in the Figure below titled "Year of

[1] California Lighting and Appliance Saturation Survey Table 16. **http://**www.**calmac.org/publications/2014.11_24_WO21_CLASS_Final_Report_Clean.pdf**.

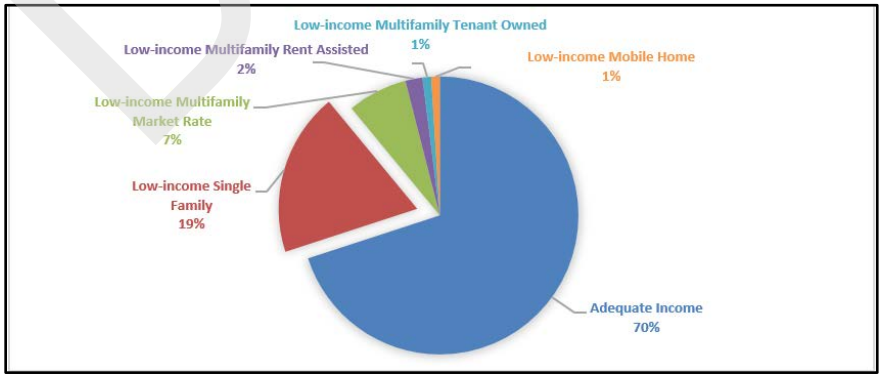
Home Construction," 41% of homes in SCE's service territory were built prior to the advent of Title 24 Codes and Standards in 1974.

Figure 2. Year of Home Construction Chart



Building age can help target opportunities associated with larger system in the household such as Heating, Ventilation and Air Conditioning systems (HVAC) or building envelop and shell measures like insulation. Opportunities in each household are defined by the customer's ability to adopt more efficient technologies or the ability to influence a consumers behavior. However, as part of residential market characterization it is important to note that 42% of occupants rent their homes,[2] which affects a consumer's willingness, and incentive, to make improvements where the owner may be the primary beneficiary or vice versa. Figure three below shows the percentage of housholds by income and housing type with approximately 19% that fall outside of the multifamily space qualifying as low-income.[3] These constrained customers have additional barriers blocking and/or adopting EE in the residential space, which requires a tailored approach for delivering DSM to customers.

Figure 3. Statewide Electricity Consumption per Household



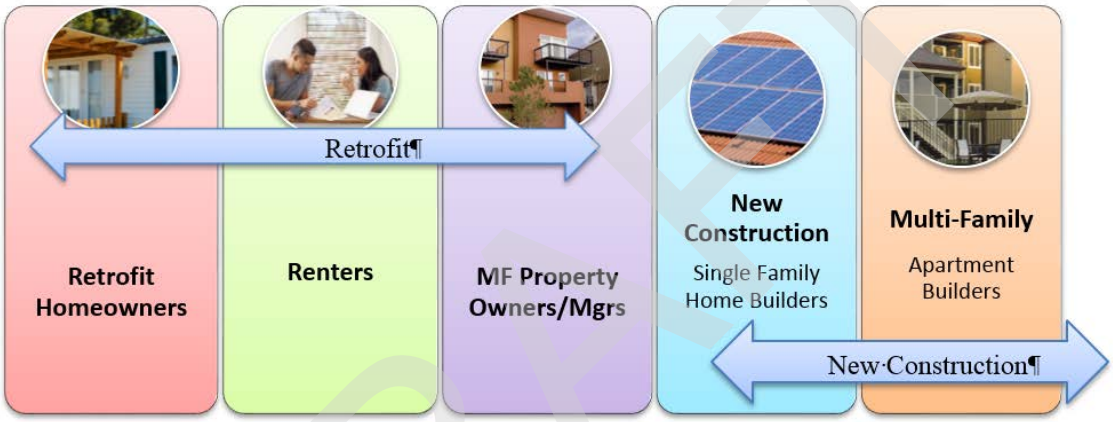
[2] California Lighting and Appliance Saturation Survey - Table 17, IOU Electric Territories. **http://www.calmac.org/publications/2014.11_24_WO21_CLASS_Final_Report_Clean.pdf.**

[3] ESA Multifamily Segment Study: 2011 American Community Survey and 2011 American Housing Survey.

1. Customer Landscape

The residential customer landscape consists of primary market actors focused on Homeowners and Renters, Multifamilty Building Owners and Facility Managers, and New Construction Builders and Developers. The delivery of offerings in the residential space must address the appropriate decision-makers' individual customer characteristics. Homeowners, Renters, and Multifamily Building Owners and Managers are generally involved in Retrofit EE activities while Builders and Developers are involved in New Construction EE activities. The most simplistic view of residential customers and the market actors can be categorized as shown in the following illustration:

Figure 4. Residential Customers and Market Actors



a. Homeowners and Renters

The Single-Family market (buildings with 1-4 dwelling units) is a difficult market to drive deep energy savings due to the diversity in housing stock, socio-economic and demographic makeup, property owner preferences, behaviors, customer awareness of energy, and differences in climate zones. Multifamily space also faces similar challenges. Within the residential sector, ownership can apply to both single-family housing as well as multifamily condominium owners. Renters occupy both markets and face similar consumer choices, regardless of ownership, in areas such as lighting or plug loads and appliances, but face much different choices in replacing systems or making changes to the building envelop. The table below summarizes likely attributes of SCE's customer base by county which can drive targeted efforts c

Table 1. SCE Demographics Overview[4]

County	Median Household Income	Families Below Poverty	Bachelor's Degree or Higher (Age 25+)	Home Ownership
Ventura	$73,044	9%	31%	65%
Orange	$72,856	9%	37%	59%
Santa Barbara	$64,571	10%	30%	53%
Mono	$60,307	5%	29%	56%
Los Angeles	$54,514	15%	30%	47%
Riverside	$53,013	14%	20%	67%
San Bernardino	$50,644	16%	18%	63%
Inyo	$49,203	8%	21%	63%
Kings	$48,223	17%	12%	54%
Kern	$48,177	20%	15%	60%
Fresno	$42,917	23%	19%	55%
Tulare	$41,336	24%	14%	59%

Within the coastal areas, Orange and Ventura County residential customers have the highest percentages of income and college education. Whereas other areas such as Tulare show highest percentage of customers below poverty levels. Solutions for residential customers will have to incorporate these unique characteristics to identify the best approach for the residential sector. In the multifamily space, large, external or system changes are managed by the property owners or facility managers. For retrofits, SCE focuses on single-family home owners and multifamily building owners. Renters / Consumers can be viewed as occupants of SF and MF buildings where larger investments are controlled by the owners/managers but maintain more control of their EE investment inside the home and the management of their energy use.

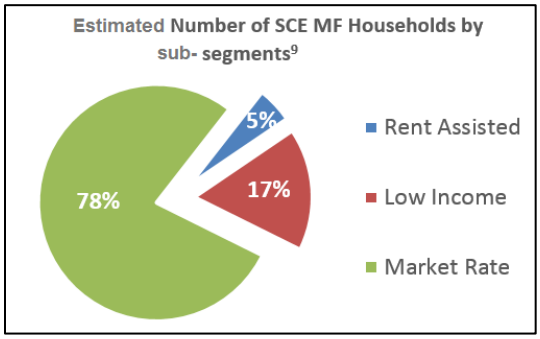
b. Multifamily Facility Owners / Property Managers

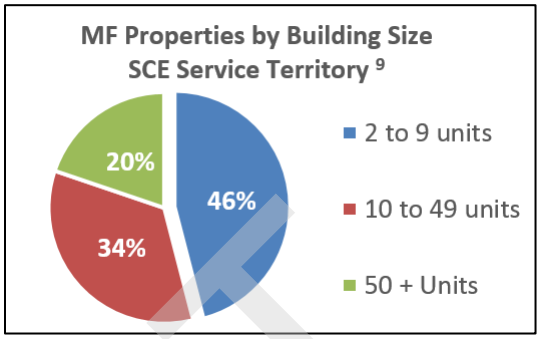
The Multifamily subsector is complex and is composed of numerous distinct housing types and tenants with Facility Owners or Property Managers of various levels of sophistication. MF properties are essentially commercial investments for property owners and operators. While individual dwelling units function essentially as SF homes, EE is one of multiple investment

[4] Source: Nielsen 2015 estimates based on U.S. Census Bureau data.

decisions for MF property owners who have many demands on their resources. MF buildings are regulated under both commercial and residential building codes depending on the property size.[5, 6]

Figure 5. MF Households & Properties in SCE's Service Territory





Typically there are three additional factors that change the approach to working with property owners that must be accounted for in the MF sub-sector: (1) Size of the units (i.e., 2-4 units to 50+ units), (2) size of the portfolio (i.e., large amount of properties or few properties.), and (3) rental rates (market, low-income,etc.) Because the composition of the property owners may have any combination of three, a coordinated approach is especially sensitive in this subsector in order to maximize EE savings, product offerings and customer satisfaction.

Rental rates and income levels will influence customer perspectives and ability to adopt EE measures. Alignment between low-income and MF offerings in the subsector have been requested by other proceedings and industry actors which will be further explained in additional barrier identification in ***Section B.3***.[7]

c. New Construction Builders and Developers

A majority of EE spending is focused on existing buildings but additional factors for consideration are trends in the market place for new construction, building type and location of building within the sector. Builders and Developers are the primary focus of the Residential New Construction market.

5 **https://webtools.dnvgl.com/RASS2009/Uploads/2009_RASS_ExecSummary_FINAL_101310.pdf.**
6 **California Lighting and Appliance Saturation Survey - Table 17, IOU Electric Territories**.
7 **ESA Program Multifamily Segment Study Volume 1: Report**. **ESA Program Multifamily Segment Study Volume 1: Report.**

2. Electricity Consumption

The residential sector represents 35% of total energy usage when compared to the non-residential sector using more than 25,000 gigawatt hours of electricity as shown in Figure 6. While it is not the largest sector of electricity consumption, this sector still accounts for a significant amount of SCE's usage, associated greenhouse gases and EE opportunity. Between MF and SF households, a majority of residential sector electrical usage resides with SF households at approximately 75% of usage vs. 25% for MF. This demonstrates a further differentiation between the two segments and the approaches necessary to meet the customer energy needs in both subsectors.

Figure 6. Residential & Nonresidential Annual GWh Consumption

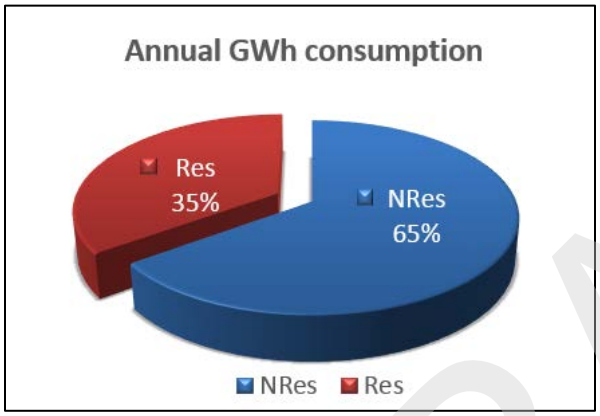
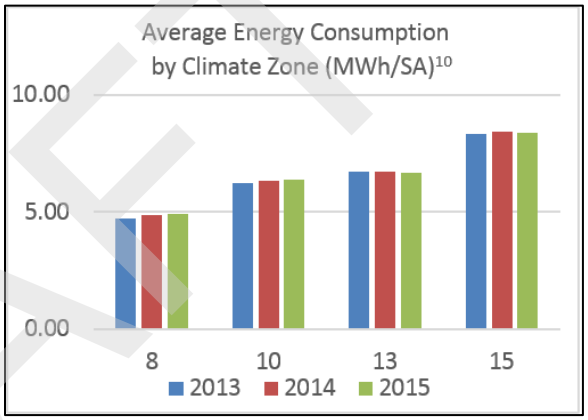


Figure 7. Average Energy Consumption by Climate Zone

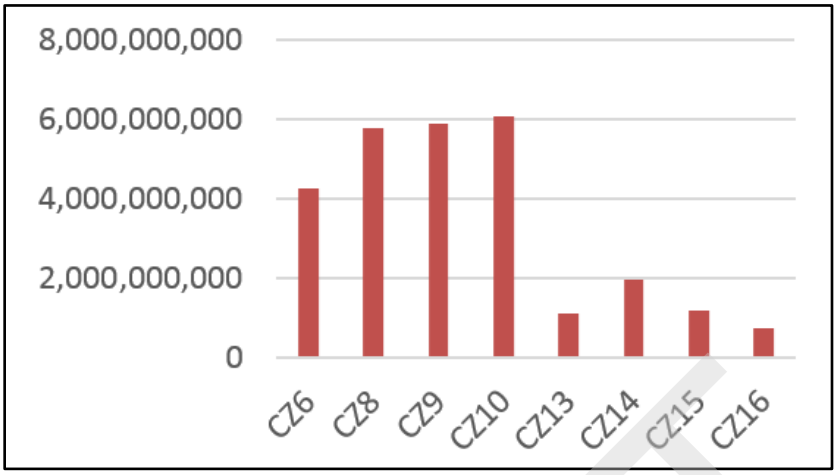


Within SCE's territory, climate zones (CZ) are a primary driver associated with customers' energy use and are critical for targeting energy savings. Figure 7, "Average Energy Consumption by Climate Zone," shows that homes within Climate Zone 8 use less than 5,000 kWh per year while residential customers in Climate Zone 15 use more than 8,000 kWh.[8] Consumption may be out of necessity (e.g., air conditioning, larger home, more occupants, etc.) rather than inefficiency, but it can be used to develop a baseline for identifying abnormal use and absolute energy usage opportunities.

As shown in Figure 8, following, Climate Zone 6 represents 16% of total kwh usage and 19% of all service accounts. The majority of residential customers live in Climate Zones 8 (Inland Coastal), Climate Zone 9 (Inland Valley), and Climate Zone 10 with more than 65% of the total residential electrical usage.[9] Targeting customers based on this type of information will be necessary in order to increase cost-effectiveness and achieve resources acquisition goals.

[8] Southern California Edison Customer Service System.
[9] Southern California Edison Customer Service System.

Figure 8. Residential Electricity Usage by Climate Zone



3. Sector Potential

To determine the EE goals in this plan, SCE relied on past participation in its residential programs and the 2015 California Energy Efficiency Potential Study (Potential Study). This study reports three different scenarios – the technical, economic and market potential for all four California IOUs. The economic and market potential set portfolio level goals for the IOUs. Completing the goal setting process at the portfolio level and not at the sector level provides PAs necessary flexibility to achieve cost-effective offerings to benefit ratepayers and to develop offerings that may need time for growth, such as market transformation activities. Sector potential is informed by past program participation, saturation studies, and market trends.

a. Past Participation: Residential[10]

Past participation in the residential sector shows that directionally, program performance and energy savings align with the potential within the sector. (See Figures 9-11, following). While energy and demand savings goals are appropriately established at the portfolio level and cost-effectiveness is similarly measured at the portfolio level, it is important to recognize the impact of the Residential sector on the portfolio. Residential portfolio cost-effectiveness has declined over time, necessitating changes to the Residential sector strategy, such as those described herein.

i. Observations

EE programs in the residential sector face competing priorities for SF property owners and renters. To be successful, EE must provide value to owners and be able to meet other needs, such as comfort and air quality.

[10] **California EE Statistics**.

Renters/Owners alike must see the advantage of efficient products and the ability to manage their energy consumption.

Figure 9. 2013-2015 Energy Savings Gross Annual kWh by Type of Home

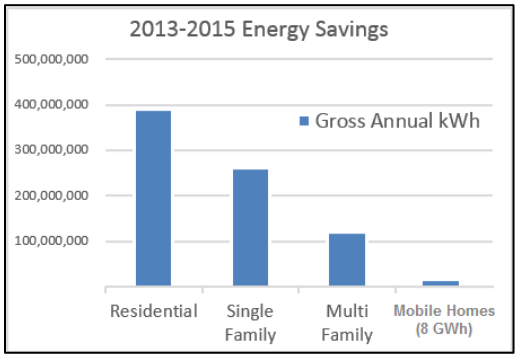


Figure 10. 2013-2015 Energy Savings Gross Annual kWh by Measure

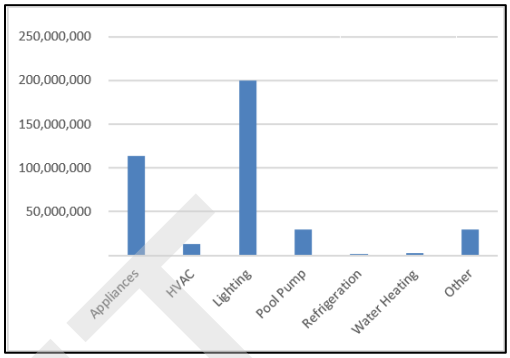
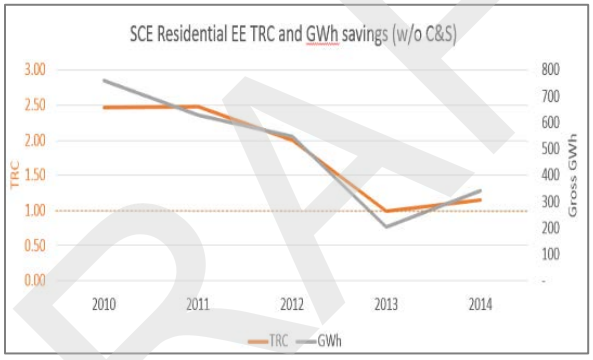


Figure 11. SCE Residential EE TRC and GWh Savings (w/o C&S)



b. Program-Specific Challenges

In review of current approaches to capturing market achievable potential SCE has specifically identified approaches that are not currently effective at capturing cost-effective energy savings. For example, in 2013-2015 portfolio, specific programs have Total Resource Cost test benefit-cost ratios of less than "0.15" including: Energy Upgrade California and Residential HVAC.[11] Other offerings are facing similar challenges due to code impacts taking place in 2016 such as in Residential New Construction and in 2018, Primary Lighting will face similar issues. Historical approaches to areas such as Plug loads have seen a targeted focus on pool pumps and refrigerator recycling, the latter having transformed the market and no longer cost-effective for program delivery.

[11] California Public Utilities Commission, "California Energy Efficiency Statistics."

c. Past Participation and Expenditures: Multifamily[12, 13]

Figure 12.
MFEER & ESA Program Participation 2008-2015

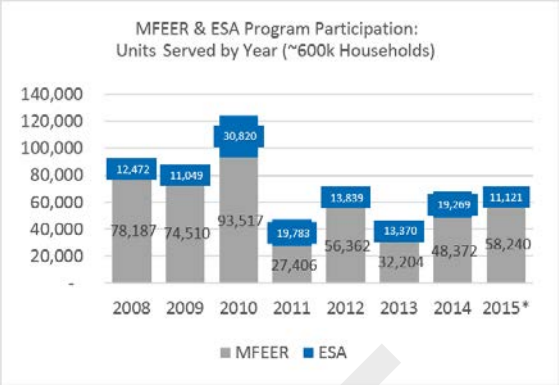
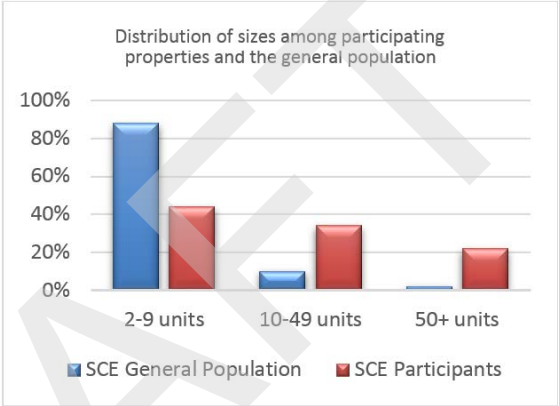


Figure 13.
Distribution of Sizes Among Participating Properties & General Population



ii. Observations

Energy efficiency is a relatively low priority for multifamily property owners, like all businesses, they have many demands on their resources. To be successful, owners must fully see the value proposition of EE to compare investment against general building maintenance and other ongoing activities. Owners also need to be aware of the long-term savings potential of EE upgrades. SCE's proposed EE investments must rise above these day-to-day operational needs to get proper attention. Additionally, targeting larger properties reaches more projects with fewer contacts as shown in Figure 7.[14]

d. Residential New Construction

Housing trends and building types in SCE's territory are further explored in the market trends section. Please see Section II. B.

[12] Internal Customer Program Data – Figure 6.
[13] *2010-2012 PG&E and SCE Multifamily Energy Efficiency Rebate Program (MFEER) Process Evaluation and Market Characterization Study*, CALMAC # PGE301.01 (**http://www.calmac.org/publications/MFEER_Process_Evaluation_FINAL_130415.pdf)**.
[14] Ibid., Page 40, Figure 3.

iii. Observations

Diminished energy savings returns are affecting building above and beyond Title-24 to support the ZNE new construction requirements. By 2020, the California new construction market will follow new Codes and Standards subject to the CEC's test for cost-effectiveness. There are still many possible program interventions including improving the value proposition of ZNE qualified homes and providing tools for new builders to help transition this market.

e. Residential Market Potential

Figures 14 and 15[15] break out SCE's potential for the residential sector by end use. SCE's market potential is a subset of economic potential and included expected EE savings based on anticipated program funding levels and customer participation given market influences and barriers. Table 2 and Table 3 show GWh and MW potential savings by residential sub-sector for 2017 – 2024.

Figure 14. Residential GWh Market Potential

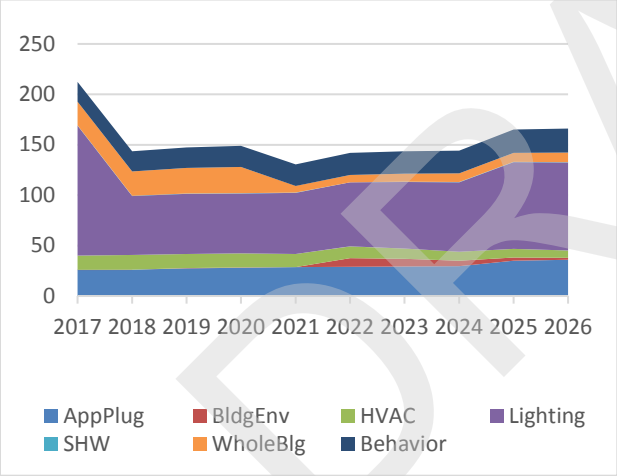
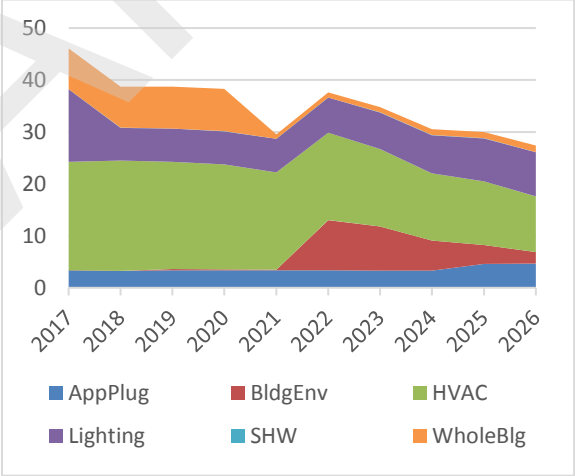


Figure 15. Residential MW Market Potential



The Residential Sector's primary areas of potential remain in the lighting end use within the Single-family market followed by appliances and whole building end use which are similar in orders of magnitude. Recent changes between the 2015 Potential Goal Study[16] and AB 802 Technical Analysis[17] view on historical EE savings shows an increase in HVAC potential due to "modelling changes and an increased adoption of to-code systems" as well as an increase in the Service Hot Water end use. Navigant's analysis also shows

[15] Navigant AB802 Technical Analysis "Pre-802 Framework."
[16] "Energy Efficiency Potential and Goals Study for 2015 and Beyond," Navigant Consulting, Inc., Sept. 2015.
[17] Navigant AB802 Technical Analysis "Pre-802 Framework."

that HVAC, in the residential sector, must steer efforts to capturing Stranded Potential, defined as "capturing savings from old equipment beyond its useful life" and not capture savings expected through the regular turnover of equipment in the market. As noted by Navigant, targeting HVAC measures will be beneficial for reducing these risks and is less applicable for measures targeting the building envelope.

A further investigation into the 2017-2024 market potential demonstrated significant changes in the residential sector as it is viewed today. The Potential Study reports near term declining IOU program market potential. The majority of the decrease in market potential can be attributed to a changes in lighting codes but a few other factors will continue to shift the sector's potential:

Table 2. Residential GWh Market Potential [18]

Sector	2017	2018	2019	2020	2021	2022	2023	2024
MF	22.2	15.5	16.6	15.7	9.9	10.5	11.1	12.0
SF	163.5	99.5	101.0	100.8	88.0	90.3	92.4	94.9
Res.[19]	205	135	138	137	119	123	126	130

Table 3. Residential MW Market Potential

Sector	2017	2018	2019	2020	2021	2022	2023	2024
MF	4.0	3.4	3.5	3.4	1.1	1.1	1.2	1.5
SF	31.6	23.7	22.9	21.9	16.0	15.3	14.6	14.1
Res.	**36**	**27**	**26**	**25**	**17**	**16**	**16**	**16**

Source: "Energy Efficiency Potential and Goals Study for 2015 and Beyond," Navigant Consulting, Inc., Sept. 2015.

f. Changes in C&S and Program Activity

Key contributors include the following:

- 2016 Title 24/20 impacts
- CEC lamp standards: Assembly Bill 1109[20] designates a specific efficacy for lighting products which is a primary contribution in the decrease in SCE's programmatic market potential as the savings potential will be attributed to C&S as opposed to programmatic influences.

[18] "Energy Efficiency Potential and Goals Study for 2015 and Beyond," Navigant Consulting, Inc., Sept. 2015.
[19] Difference between sub segments and totals is due to associate behavior potential.
[20] **AB1109 -California Lighting Efficiency and Toxics Reduction Act**.

- Significant decreases in claimable savings associated with Appliance Recycling measures which is a major contributing factor to the Plug load and appliance end use potential.[21]

g. Recent Policy and Market Trends

Recent policy and market trends will significantly affect the amount and type of potential in the residential market once the Market Potential Goals are updated in 2018:

- Adjusting the Potential goals to an existing conditions and allowing to-code measures will increase the amount of potential within specific end uses as noted above.
- Decrease in avoided cost realized by EE which will place further pressure on the residential sector's available cost-effective potential. [22]
- Potential changes in EE policies, such as cost-effectiveness or market transformation, that may increase the value captured or attributed to EE.
- A shift in the peak times that are most valuable for EE may affect corresponding programmatic solutions and measures.
- Adjusting the Potential goals from Gross to Net based will make delivery channels and realization rates more prominent.

B. Drivers and Applicable Legislation

1. Regulatory Drivers and Applicable Legislation

Regulatory, legislative and policy drivers continue to shape the residential sector landscape. Among the most prominent is the framework established under the California Long Term Energy Efficiency Strategic Plan (Strategic Plan), passage of Senate Bill (SB) 350, Assembly Bill (AB) 802, AB 758 and the associated Existing Building Energy Efficiency Action Plan (EBEE[23]), and AB 793.

- SB 350 (2015) The residential sector will play a supporting role to reach increasing statewide EE targets. Additionally, the bill tasks the CEC with adopting a responsible contractor policy to ensure that ratepayer funded EE measures meet high quality performance standards and reduce energy savings lost due to poor quality workmanship. The bill also addresses workforce development and job training for residents in disadvantaged communities discussed in the WE&T section.

[21] *Appliance Recycling Program Impact Evaluation*, DNV-GL # CPU0092.02, 10/29/2014.
[22] **Avoided Costs: 2016 Interim Update**.
[23] **AB758 Existing Building Energy Efficient Action Plan**.

- AB 802 (2015) Changes to the existing baselines affects certain end uses within the residential sector and may adjust the areas of opportunity within the market. These areas of interest are highlighted in the Sector's potential. Additionally, benchmarking activities and other strategic initiatives are addressed and identified in the intervention strategies tables in Section II, below.
- AB 793: Supporting the development of the energy management technologies and associated strategies are called out in the intervention strategy tables in Section II.
- AB 758: The Existing Building Energy Efficiency Action Plan's specific strategies such as data access and plug load management are called out in the intervention tables in Section II.

In addition to the Strategic Plan there are a number of subcomponents that specifically developed their own action plan including the Residential Zero-Net Energy Action Plan as well as a separate but complementary plan for Lighting. The goals of the long term strategic plan align with long-term policy drivers to shape the business plans within the residential sector

The Strategic Plan[24] identifies the following goals for the Residential segment:

- New construction will reach ZNE performance (including clean, onsite distributed generation) for all new single and multifamily homes by 2020. (Linked to ZNE/NC in the BP).
- Home buyers, owners and renovators will implement a whole house approach to energy consumption that will guide their purchase and use of existing and new homes, home equipment (e.g., HVAC systems), household appliances, lighting, and "plug load" amenities. (Linked to Homeowners/Renters in the BP).
- Plug loads will be managed by developing consumer electronics and appliances that use less energy and provide tools to enable customers to understand and manage their energy demand. (Linked to Homeowners/Renters in the BP).
- The residential lighting industry will undergo substantial transformation through the deployment of high-efficiency and high-performance lighting technologies, supported by state and national codes and standards. (Linked to Homeowners/Renters in the BP, but cross cutting).
- 100% of Multifamily homes to have 40% reduction in purchased energy from 2008 level. (Linked to MF properties and renters in the BP).

The CPUC has issued guidance for program administrators to identify how policy and adopted bills will help shape the EE business plans. Relevant legislative and

[24] **CPUC Energy Efficiency Action Plan(s).**

regulatory drivers and proposed strategies to address these directives and identify how SCE will help better serve our residential customers and communities are provided within this the Portfolio Chapter and the interventions in Section II.

2. Market Trends

a. Financing Access to DG and EE Through Emerging / Matured Markets

Significant advances have been made in the residential financing market space using a Property Assessed Clean Energy (PACE) financing approach which allows homeowners to make energy- and water-efficiency improvements and to pay for them over time through their property tax bill. According to Renovate America,[25] financer of the HERO program, the program has grown to operate in 370 communities in California, within 37 counties and has helped 50,000 homes conserve 7.8 billion kWh of energy.

b. Cost Reduction Associated with Renewable Energy

In addition to financing, the residential market space has seen a continued decrease in the cost in the renewable energy magnifying an alternative DER to reducing GHG. For example, the average solar system cost, according to the **Solar Energy Industry Association**,[26] has decreased from $8.00 per watt in 2008 to less than $4.00 in 2014.

c. Procurement, Targeting and Locational Offerings

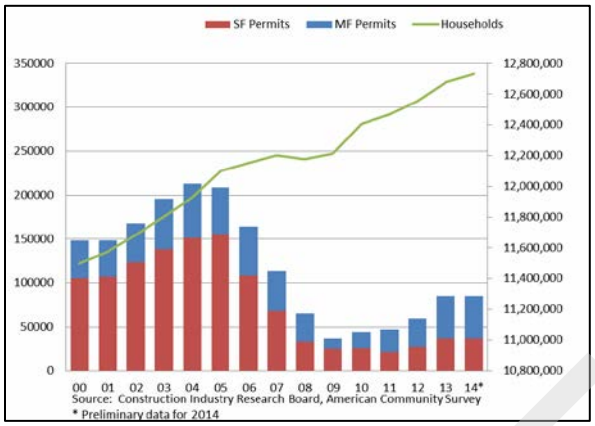
SCE began investigating this approach through the PRP Pilot and LCR-RFO solicitations which have expanded as additional proceedings and understanding of Distributed Energy Resources evolve. In line with recent regulatory changes, SCE recognizes external actors play a partnering and primary role in meeting the needs of procuring EE and will leverage its experience.

d. Changes in the New Construction Market

As noted in California's Housing Consolidated Plan:[27] "Between 2000 and 2010, the number of building permits for single-family development has outpaced those for multifamily development. Since 2011 multifamily development is occurring at a higher rate than single-family development. This type of development is more likely to be on infill sites and will likely serve renters rather than owners."

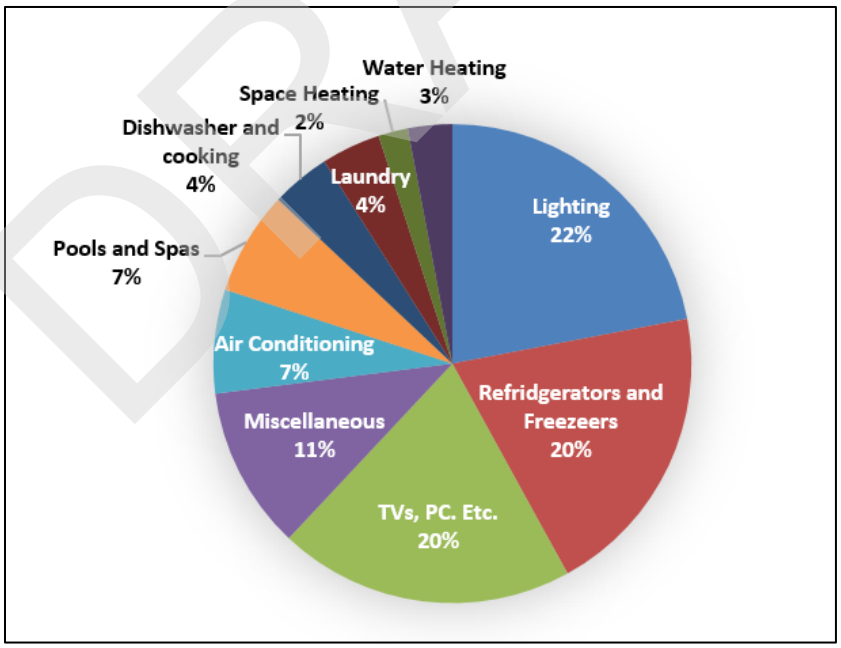
25 **"California HERO Program Creates 10000 New Jobs,"** PRNewswire.
26 **"Solar Energy,"** Bloomberg.
27 **State of California 2015-2020 Federal Consolidated Plan.**

Figure 16. SF v. MF Building Permits 2000-2014



The trends described above and depicted in Figure 16 show an increasing focus on meeting housing needs through the Multifamily space and further infill development vs. single-family construction. This trend has impacts other than identifying areas of opportunity within the new construction space; specifically, impacts of this trend have the potential of placing larger pressures on existing utility infrastructure and requiring significantly different solutions for meeting ZNE.

Figure 17. Statewide Electricity Consumption Per Household[28]



[28] **2009 Residential Appliance and Saturation Study.**

e. Trends Driving the Residential Sector

Each of the major energy uses within an existing building define the potential for EE improvements at the home. Figure 9 shows that the largest defined electrical end uses within a home are plug loads at +40%, Lighting at +20%, and HVAC at nearly 10%. Consumption is not always indicative of potential for energy savings but is used to guide investigation of program savings.

The residential HVAC market[29] has seen 16% increases in average efficiency in the market place, but 42% of homes with central systems still have a home with an SEER rating less than 12. Nearly 50% of homes with Central A/C have a unit more than nine years old and and 28% more than 3 years old. Average Central A/C units are getting older, increasing from 11 years to 15 years old between 2005 to 2012 while the average space cooling sytems are newer than in previous studies. In summary, new unit sales are highly efficient units; however, permitted, quality installation are still low and exisitng efficiency potential in the market residendes in older units and ensuring their proper installation and maintainence[30].

All residential customers are faced with decisions about Plug Loads and lighting in their homes. Regardless of ownership, and despite previous efforts, the residential Plug Loads market continues to drive energy consumption in the residential sector. While certain measures in the Plug Load space have realized significant EE savings, miscellaneous Plug Loads are still a concern in the residential sector.[31]

The lighting market in the residential sector has been rapidly changing over the past 10 years with the introduction of Compact Fluorescent Lamps (CFLs) and then Light Emitting Diodes (LEDs), through advancements in technologies as well as increases in codes and standards specifications. Primary considerations for characterizing the lighting market include technology type saturation or adoption of new and highly efficient technologies, as well as the price point as an indicator of the market's maturation as a part of a product's adopted life cycle. In many cases, CFLs and LEDs are competing technologies aimed at driving efficiency over more traditional lighitng soluitions. The Navigant report demonstrated a few significant lighting market characterizations as well as trends within the end-use itself, including:[32]

1. "Within California, CFL shares have decreased, while halogen shares have increased.
2. "Consumers are also purchasing more LEDs in 2014 than 2012.

[29] **California Lighting and Appliance Saturation Study.**
[30] 2018 AB 802 Technical Analysis.
[31] Miscellaneous Energy Loads in Buildings, S. Kwatra, J. Amann and H. Sachs (2013).
[32] **Lighting Savings Overlap Estimates for 2014 IOU Home Energy Report Programs**.

3. "Incandescent lamps continue to be available in California and in the U.S., and purchased by California customers, despite the new lighting requirements."

An additional challenging characterization within the end-use is maintaining high-efficacy lamps on shelves in particular retail channels. For example, high-efficacy lamps comprised over 50% of lamps on shelves in Discount and Grocery stores in 2012, but only 16% in Discount and 29% in Grocery in 2014, demonstrating that delivery channels matter.

LEDs have realized an increase in market share and have experienced significant declines, 16% per year, in cost supporting their "uptake" according to a Navigant study.[33] These characterizations and trends in the marketplace demonstrate that progress has been realized in the lighting sector but will face significant changes post-2017 with impending legislation, efficacy standards, and attribution of savings shifting to Codes & Standards.

3. EM&V Evaluation Takeaways and Key Findings

The market trends described above suggest the following key takeaways for SCE's EE portfolio of programs. A review of relevant past Residential sector studies provided a number of key insights that inform SCE's approach moving forward, as follows:

1. Market actors in the MF sector are fragmented and diverse creating challenges in aligning drivers for increased EE adoption and the sector is hard-to-reach and could benefit from the following: [34]
   - Simplified offerings through changes such as implementing a Single Point of Contact
   - Streamlining customer contact, and
   - Enabling facility managers and building owners to further understand EE value.
2. Deep, holistic and quality home retrofits have high cost relative to expected energy savings making the current design challenging for customers and unattractive for ratepayers. Residential programs, Energy Upgrade in particular, could improve their gross realization and net realization rates, by focusing on the following:
   - Targeting customers better to drive deeper EE savings by focusing

[33] California LED workpaper update study by Navigant.

[34] Examples of ACEEE multifamily reports: ACEE Research Report A122, *Engaging as Partners in Energy Efficiency: Multifamily Housing and Utilities*, by Anne McKibbin and Anne Evens (CNT Energy) and Steven Nadel and Eric Mackres (ACEEE), January 26, 2012, available at **http://www.aceee.org/research-report/a122.**

on specific attributes (i.e., high EUI) [35]

- Messaging is important as comfort drives program participation and may be subject to free-ridership [36]
- Need to improve estimations and associated savings claims [37]
- The residential programs must continue to drive awareness and adoption of industry standards, ACCA 5 and 9 standards, and T24 requirements among contractors and technicians. This and other activities are described in the WE&T and C&S collaboration section (i.e., HVAC and whole home approaches) [38, 39, 40]
- Customer behavior and enablement could be a driver for realizing additional EE savings.

3. Residential lighting has made progress but will face changes in upcoming program cycles as Codes and Standards move to ENERGY STAR® specifications and other compliance requirements.

   - LEDs have realized an increase in market share and have experienced significant declines, 16% per year, in cost supporting their uptake.[41]
   - Consumers are also purchasing more LEDs in 2014 than 2012.[42]

4. Targeted, larger measures, within the plug load and appliance space have seen improvements but selected product categories where sales can be influenced significantly by retailer decisions regarding the merchandise they stock and promote is necessary to curtail growth of plug load consumption.[43, 44]

   - 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.

5. Residential new construction must continue to drive awareness and adoption of industry standards (T24 requirements, modelling, best practices,) among builders and developers.

For additional EM&V summaries and recommendations please see Appendix A titled "EM&V Summaries and References."

[35] *Whole House Retrofit Impact Evaluation of Energy Upgrade California Programs Work Order 46*, DNV-GL, 10/31/2014, CPU0093.01.
[36] Ibid.
[37] *Focused Impact Evaluation of the 2013-2014 Home Upgrade Program*, CPUC 0118.01.
[38] *California Heating, Ventilation, and Air Conditioning (HVAC) Quality Installation/Quality Maintenance Customer Decision-Making (CDM) Study*, EMI Consulting, 5/4/2015, # CPU0374.01.
[39] *California HVAC Contractor & Technician Behavior Study*, EMI Consulting, 5/6/2015, Study SCE0375.01.
[40] *California HVAC Contractor & Technician Behavior Study*, EMI Consulting, 9/14/2012, Study SCE0323.01.
[41] California LED workpaper update study by Navigant.
[42] Lighting Savings Overlap Estimates for 2014 IOU Home Energy Report Programs.
[43] *Appliance Recycling Program Impact Evaluation*, DNV-GL # CPU0092.02, 10/29/2014.
[44] Impact Evaluation Report, Business and Consumer Electronics Program (WO34).

C. Market Barriers

The residential sector has multiple market barriers associated with each of is sub-segments that limit the adoption of EE. These barriers are a result of customer behavior and market conditions that influence the market actor's behavior and choices through a variety of and strategies and tactics.

The following are market barriers identified through the Business Plan development process that will need to be addressed to drive deeper EE adoption and influence market actor behaviors. The market barriers are a breakdown of problem statements into their respective components so that the intervention strategies needed can be better recognized. To align with the market characterization, the barriers are broken down into the categories shown in Table 4, following:

Table 4. Barriers Affecting Decision Makers

Decision-Maker	Residential Barriers	
Homeowners, Renters, & Consumers	**Hassle or transaction costs:**[45, 46, 47]	High implementation cost of energy upgrades and assessments; limited affordability of these projects
		Lack of awareness associated with non-energy benefits of projects
	Performance uncertainties	Performance uncertainty of EE benefits (financing limitations, realized savings)[48]
		Lack of EE awareness by contractors[49, 50]
		High transactional cost for retailers to administer downstream rebates to consumers for plug loads and appliances[51]
		Lack of retail sales staff and knowledge about EE products may not drive selection of high-efficiency plug load products
		Lack of customer understanding of high quality products for lighting products
	Asymmetric information and opportunism	Limited skilled workforce able to provide whole home solutions outside of their area of expertise [57, 58]
	Misplaced or split incentives	Residential property owners lack the financial incentive to make improvements to a tenant occupied property.

[45] *Baseline Characterization Market Effects Study of Investor-Owned Utility Whole House Retrofit Programs in California*, DNV-GL, 7/18/2014, Report ID: CPU0073.01.

[46] *Whole House Retrofit Impact Evaluation of Energy Upgrade California Programs Work Order 46*, DNV-GL, 10/31/2014, CPU0093.01.

[47] *Focused Impact Evaluation of the 2013-2014 Home Upgrade Program*, CALMAC Study ID CPU0118.01.

[48] Ibid.

[49] *A Comprehensive Strategic Market Transformation (SMT) Plan for a Home Upgrade Program SMT Initiative Report on Working Group Activities from April 2014 through March 2015*, Navigant Consulting, 6/15/2016 Report ID: SDG0293.01.

[50] *Baseline Characterization Market Effects Study of Investor-Owned Utility Whole House Retrofit Programs in California*, by DNV-GL Date: 7/18/2014 Report ID: CPU0073.01.

[51] *Impact Evaluation Report Business and Consumer Electronics Program (WO34)*, DNV-GL CPU0060.01.

Decision-Maker	Residential Barriers	
Multifamily Building Owner; Facilities Manager[52]	**Hassle and search cost**	Multifamily segment is fragmented and diverse requiring alignment in approach to the sector's market actors
	Misplaced or split incentives	Building owners are responsible for investing in energy efficiency improvements, while tenants reap the benefits via lower energy bills.
	Performance uncertainty of EE benefits	Prior to investing, it is hard for building owners to predict the full return on energy efficiency investments which limits adoption of energy efficiency measures by facility owners and managers
	Lack of knowledge and low energy efficiency priority	Energy efficiency is a relatively low priority for multifamily building owners who, like all businesses, have many demands on their resources.
Builders and Developers[53]	**Performance uncertainty of EE benefits**	Incremental cost (to builders): Incremental cost reduces the number of builders that deliver ZNE-type homes through programs.
		Lack of Consumer Demand: Lack of homebuyer demand for ZNE-type homes.
	Lack of knowledge	Education and Training needs
		Building official training needs, to allow for permitting high performance homes without delay.

III. SCE's Approach to Achieve Sector Goals

SCE's approach to the diverse nature of the residential sector will require SCE and third parties to concentrate on delivering solutions to an identified market actor, whether they are a homeowner or renter, in the single-family or multifamily market. In order to assist these customers, a suite of offerings will guide customers to meet their immediate energy needs and provide a means for continuous engagement, education and expertise to help drive deeper energy solutions.

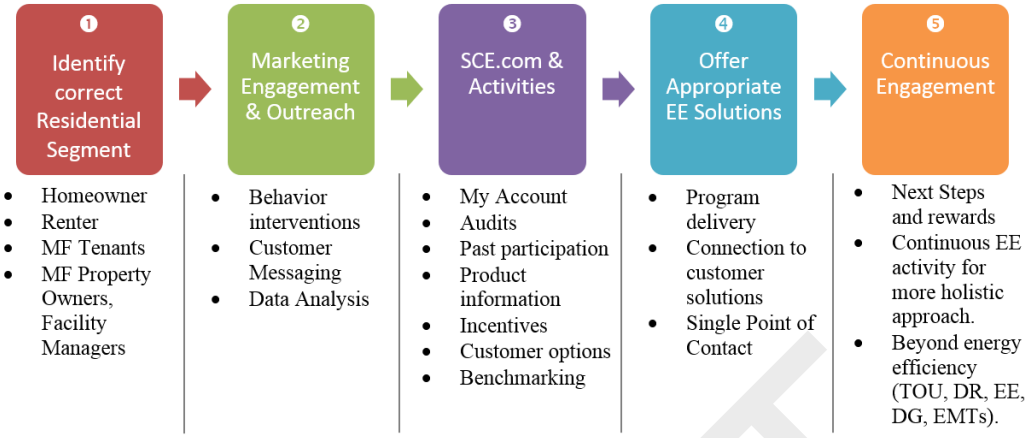
To do this cost-effectively, SCE will deploy new tools, enable the market and streamline offerings. The type of approach will need to be tailored to the specific market actors through the strategies laid out in the sections below.

Overall, the approach will assist the state with its goals of driving down GHG emissions, reaching energy savings targets, and support customer needs. SCE will work with the residential sector customers and market actors to drive greater and deeper EE retrofits over time. The flow chart below outlines a potential path for DSM adoption in the residential sector.

[52] Examples of ACEEE multifamily reports: *ACEE Research Report A122, Engaging as Partners in Energy Efficiency: Multifamily Housing and Utilities*, by Anne McKibbin and Anne Evens (CNT Energy) and Steven Nadel and Eric Mackres (ACEEE), January 26, 2012, available at **http://www.aceee.org/research-report/a122.**

[53] ***Residential ZNE Market Characterization***, TRC, CALMAC Study ID PGE0351.01.

Figure 18. Potential Path for DSM Adoption in the Residential Sector



A. Sector Vision

The residential sector requires a coordinated approach to guide residential customers from education about EE opportunities through the purchase and installation of equipment and/or through behavioral change. To meet the requirements of the residential market while maintaining a cost-effective portfolio and achieving the directives of the State and Commission, SCE must balance and align its resource acquisition goals and market transformational activities.

SCE's vision for the residential sector is to increase customer adoption of energy efficiency improvements, enhance customers' abilities to self-serve and target market actors to maintain cost-effectiveness. SCE will empower customers to realize and value EE through simplified offerings that connect appropriate products, services or solutions customized for their needs and enable continuous energy management. In order to drive forward the changes needed in the residential sector, SCE will utilize these overarching strategies to enhance the current portfolio:

Strategy 1. Enable third parties to promote cost-effective solutions.

- Support and encourage Third-Party program proposal, design and delivery
- Develop RFOs for third-party solicitation based on market and portfolio needs, and
- Enable market based solutions through access to customer energy consumption data while preserving customer privacy.

Strategy 2. Simplify offerings by increasing the utilization of up/mid-stream or self-service delivery channels and reducing the number of customer touch points.

- Consolidate customer touch-points to simplify DSM adoption process
- Simplify offerings for customers, contractors and other market actors
- Reduce and/or eliminate non-cost-effective programs

- Statewide Administration of mid/upstream programs
- Shift from downstream to alternative delivery channel paths, and
- Connect customers to products and authorized contractors (delivery channels).

Strategy 3. Expand customer engagement through access to their energy use.

- Customize outreach to customers for deeper, more relevant recommendations
- Drive consumers to self-service channels, and
- Utilize Benchmarking services.

Strategy 4. Expand behavioral interventions to enable deeper adoption of energy efficiency.

- Utilize energy management technologies
- Influence customers through more traditional behavioral interventions, and
- Continuous energy management and engagement.

Strategy 5. Leverage alternative cross cutting portfolio resources to enable market transformational activities across the residential sector.

- Utilize WE&T to provide training and education for market actors.
- Demonstrate market ready solutions and pathways for emerging technologies and practices, and
- Coordinate with Codes & Standards to deliver mature market intervention solutions.

B. Sector Goals

1. Residential Sector Goals

CPUC Decision (D.) 16-08-019 states that "Future energy efficiency goals analysis should be done in coordination with the CEC, through the JASC and the DAWG, and should incorporate cumulative goals in addition to the annual goals in time for the beginning of 2018."[54] For this reason, near-term, mid-term, and long-term energy savings goals will simply be estimates and will be revised upon completion of the energy efficiency goals analysis.

Table 5. Metrics

Metric	Near Term 2018-2020[55]	Mid Term 2020-2024	Long Term 2024-2027
GWh	**TBD**	**TBD**	**TBD**
MW	**TBD**	**TBD**	**TBD**

[54] CPUC Decision (D.) 16-08-019.
[55] Will be updated with updated Potential and Goal Study.

2. Existing Products and Services

SCE's existing products and services utilize various intervention strategies to reach current EE targets, CLTEESP goals, and support market transformation. As current policy, regulatory, and market drivers affect the portfolio SCE's approach and coordination will and has required significant adjustments. Subsequently, the following programs are changing, being expanded or administered through a single statewide administrator or Third-Party implementers.

- **Energy Advisor Program:** The Energy Advisor subprogram will utilize interactive tools designed to engage customers and encourage participation in innovative initiatives. These initiatives are designed to help customers understand and empower them to manage their energy use, and will guide them, where appropriate, towards advancing whole-house energy solutions.
- **Plug Load and Appliances:** The Plug Load and Appliances subprogram merged the previous Home Energy Efficiency Rebate (HEER), Business Consumer Electronics (BCE) and Appliance Recycling subprograms. BCE and Appliance Recycling have since been discontinued. This subprogram will develop and build upon existing retailer relationships and continue to modify its approach and product mix to improve cost-effectiveness and goal achievement**.**
- **Multifamily Energy Efficiency Rebate Program:** The MFEER subprogram is a continuing subprogram. This subprogram will promote EE by providing equipment rebates to owners and tenants of MF properties, including common areas of residential apartment buildings, condominium complexes, and mobile home parks. It will be coordinated with the Energy Savings Assistance (ESA) program authorized in a separate proceeding and designed to assist low-income tenants in SF and MF properties.
- **Comprehensive Manufactured Homes:** The target customers may include a wide range of people who are typically of moderate or fixed income, elderly, retired, and disabled individuals. The Program is designed to enhance the EE knowledge and program participation of this segment of customers.
- **Primary Lighting Program:** The Primary Lighting Program engages lighting manufacturers who enroll in the program and supply retailers with energy efficient lighting products. These products are then sold to customers at a reduced price. An incentive reimbursement is paid to the manufacturer who, at its own expense, facilitated the discounted rate. One hundred percent of the incentive is passed on to the customer, making the Residential Lighting Incentive Program a "pass-through" of incentives, which is one form of an Upstream Program.

- **Lighting Market Transformation:**[56] The LMT sub-program established the process through which the IOUs developed and tested market transformation strategies for emerging lighting technologies.
- **Lighting Innovation:**[57] The LI sub-program identified lighting measures that could potentially progress into the Primary Lighting sub-program.
- **Residential New Construction Program:**[58] The RNC subprogram served as a statewide program that consists of the California Advanced Homes Program (CAHP) and, in Southern California, the program was designed to help guide builders to produce efficient homes in a cost-effective manner and will be changing to examine methodologies for supporting the Strategic Plan target of residential ZNE by 2020.
- **Energy Upgrade California Home Upgrade:** The EUC sub-program is designed to build customer and contractor awareness of the house-as-a-system approach to residential retrofits and the many benefits of improving the comfort, safety, and energy savings potential of the house. The EUC approach promotes both Basic and Advanced Paths to retrofitting; these complementary paths will be presented to customers as one comprehensive offering.
- **Residential HVAC Program:**[59] The Residential HVAC subprogram's primary objective was to drive high quality levels in California's HVAC market for technology, equipment, installation, and maintenance. An additional objective was to increase customer awareness of the value of HVAC installation and maintenance practices toward driving energy efficiency and peak load reduction.
- **2017 Launch Residential Direct Install:**[60] Residential Direct Install is a direct install program aimed to provide comprehensive EE measures to targeted residential customers. The program aims to enhance the EE knowledge and program participation of the residential market segment in an effort to drive customers to undertake deeper EE activities and retrofits.

3. Intervention Strategies

Implementation plans will utilize the intervention strategies described below to tailor programs for the various segments and sub-segments of the Residential sector. The following list provides an overview of the strategies that will be employed in future programs to overcome the market barriers and achieve SCE's 10-year vision for the residential sector.

[56] Changes pending 2017 Advice Letter Filing 3465-E.
[57] Ibid.
[58] Ibid.
[59] Ibid.
[60] Changes pending 2017 Advice Letter Filing 3465-E.

Table 6. Intervention Strategies

Interventions	Overview
Customer Incentives	Payments designed to encourage customers to adopt and install EE measures. Customer incentives will continue to be available to customers.
Delivery Channel	Identify and target specific delivery channels for EE products to reach specific hard-to-reach audiences and minimize free-ridership
Demonstrations	Demonstrate best practices and disseminate technical expertise in order to overcome knowledge gaps for market actors or industry.
Direct Install	Access to direct install or turnkey programs allows customers to benefit because these programs remove technical and search burden by providing vendors that have already been vetted and can be leveraged for customer touch points.
Financing	Designed to assist customers in acquiring the capital necessary to procure and install EE measures.
Intelligent Outreach	A targeted marketing approach using analytic tools to deliver specific messages to specific customer groups in order to increase energy efficiency adoption
Midstream Incentives	Financial incentives directly to vendors or distributors to decrease cost and increase the sales of energy-efficient products.
Partnering	Identification and recruitment of key partners and market actors needed to support and reach various customer groups and drive adoption of EE
Quality Assurance	Working with key market actors in order to improve EE products and services to meet industry specification and practices
Single Point of Contact	Streamline program offerings for market actors to reduce burden to participate in program offerings.
Upstream Incentives	Financial incentives directly to manufacturers to decrease cost and increase the sales of efficient products and reducing hassle for managing high volume products.

a. Existing Building Retrofits: Homeowner / Renter / Consumer

SCE will utilize its approach outlined in Section III to guide homeowners and renters to improve the efficiency of their homes and manage their energy use. SCE will leverage multiple offerings to meet customers at their level of interest or financial capability to keep them engaged to drive persistent and continuous energy management. Changes to current offerings and new approaches will enable third-party market actors to provide solutions for residential customers. A high-level overview of the implementation of these strategies will need to provide a comprehensive suite of offerings to all residential customers. By utilizing behavioral interventions or access to their enegy use history and patterns, customers can be further engaged in managing their energy use and drive customers to pursue additional energy efficiency savings.

The Graphic below can help provide an overview of a customer's potential path towards continuous energy management recognizing that customers will have different needs and routes to greater EE adoption. Customers will need to be provided access to EE through coordination with ESA offerings and

provide self-service channels to provide residential customers a balanced approach. To drive EE adoption, interventions will need to deliver high-volume products to a mass market, drive market transformation, and help enable customers to manage their energy use. For more extensive changes to properties, SF homeowners and MF facility owners will need to be guided towards continuous DSM adoption and best fit solutions for meaningful efficiency savigns. Table 7 provides an overview of proposed delivery streams for existing buildings for homeowners and renters. Coordination with Statewide administrators and third parties will be critical to achieve policy direction and encourage innovation. New and Modified tactics are called out below and will be discussed further in implementation plans or in conjunction with third-party solicitations.

Figure 19. Overview of Customer Potential Path Towards Continuous Energy Management

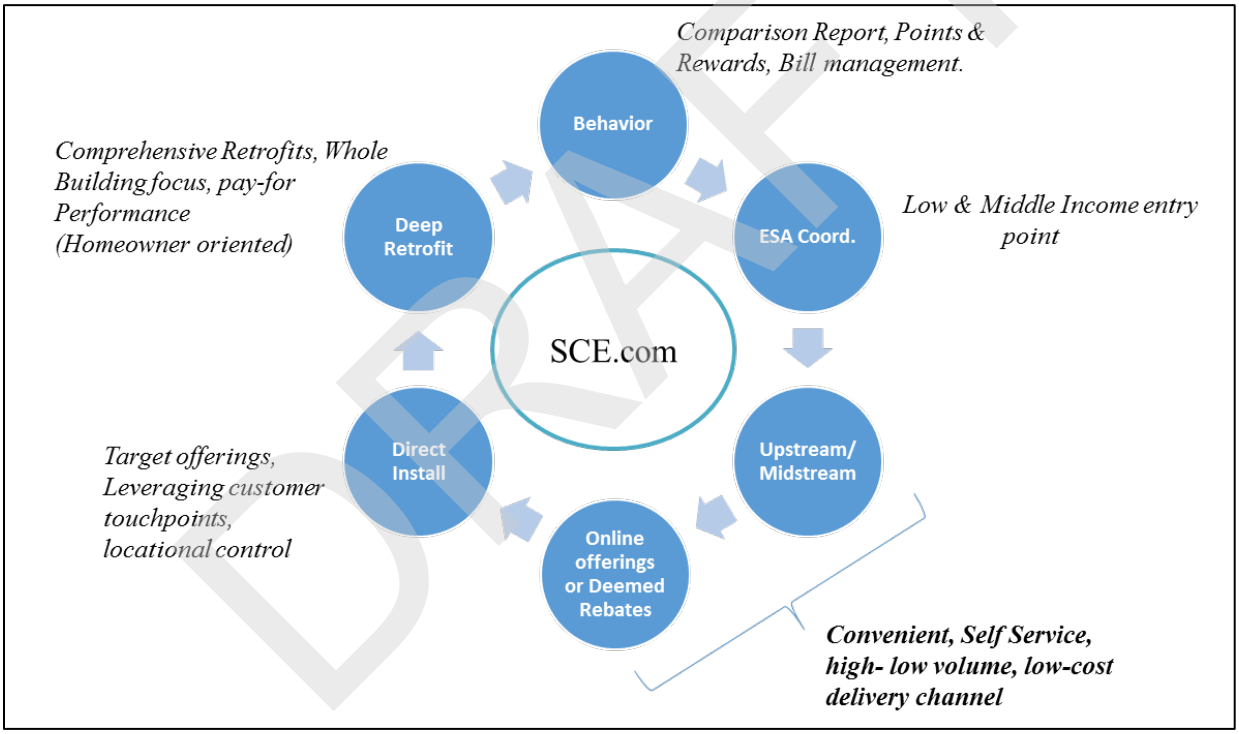


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Table 7. Existing Building Retrofit – Homeowners, Renters and Consumers

Strategies	Timing	New, Modified, or Existing	Sample Strategy: Description and Tactics	Legislative and Policy Drivers
Partnering	Short-term	E – SCE Strategy 5	Homeowner/Industry: Train market actors about the requirements and benefits of quality HVAC installation to support code compliance.	EBEE: High-Performance Workforce, Education, and Training (WE&T): 3.3 (3.3.5, 3.3.2)
	Short-term	E	Homeowner: Support home buyers through realtor and appraiser education to better understand the value of EE.	
	Short-term	E	Lighting: Encourage development and exploration of new high quality, cost-effective, products to support lighting innovation and efficacy.	
Quality Assurance	Short-term	E	Homeowner: Educate consumers on the benefits of HVAC Quality Installations as a part of a whole house approach.	
	Short-term	E	Lighting: Continue to support the development of higher quality, more efficient products and technologies through ongoing influence with manufactures, retailers, and industry stakeholders.	
Customer Incentives	Short-term	E	Homeowner: Provide downstream incentives to customers to adopt whole home solutions.	CLTEESP 2-1, Deploy full-scale Whole house programs.
	Short-term	E	Plug Loads: Pursue customer and contractor adoption of efficiency measures by incentivizing market actors to reduce the cost of stocking high efficiency products and generating customer demand for targeted and high impact measures.	• CLTEESP 3-3 - Create demand for high-efficiency Plug-Load • EBEE 1.6.5 Plug-Load Management Programs
	Short-term	N – SCE Strategy 3,4	Behavioral/Advisor: Incorporate EMTs to help consumers manage their energy use where cost-effective.	CLTEESP 2-3- new/advanced cost-effective innovations to reduce energy use in existing homes

Strategies	Timing	New, Modified, or Existing	Sample Strategy: Description and Tactics	Legislative and Policy Drivers
Customer Incentives	Short-term	N - SCE Strategy 3,4	Plug Loads: Provide downstream incentives to customers for products for targeted or low volume products for emerging, market transformational and energy management technologies to enable customer control and information.	CLTEESP 3-3 - Create demand for high-efficiency Plug-Load
	Short-term	N - SCE Strategy 1	Homeowner/Renter: Co-Pay option for customers to adopt additional improvements to leverage direct install touch-point and provide customer choice.	CLTEESP 2-3- new & advanced cost-effective innovations to reduce energy use in existing homes
	Short-Term, Mid-Term, Long Term	N, M - SCE Strategy 1	P4P: Shift whole home solutions towards pay for performance and align customer incentives and contractor incentives to drive participation in high performing energy retrofits.	• CLTEESP 2-3- new & advanced cost-effective innovations to reduce energy use in existing homes • EBEE: Sustainable and Effective Program Delivery:3.1.1 • EBEE: Performance-Driven Value: 3.2 (3.2.1,3.2.2)
Midstream Incentives	Short-term	N - SCE Strategy 2	Plug Loads: Pursue midstream energy savings by incentivizing retailers and manufactures to reduce the cost of stocking high efficiency appliance products for consumers.	• CLTEESP 3-3 - Create demand for high-efficiency Plug-Load • EBEE 1.6.4 -1.6.5 Plug-Load Management Programs
Upstream Incentives	Short-term, Mid-term	E - SCE Strategy 2	Lighting: Manufactures and retailers will pass 100% of the SCE customer incentive to end-users in the form of reduced prices. The program will encourage manufacturers and retailers to provide additional price reductions of their own.	
Delivery Channel	Short-term	E	Lighting: Targeted delivery and support of high efficacy lighting to focus on stocking products in more stores and those where free-ridership is lower.	
Intelligent Outreach	Short-term	N - SCE Strategy 1,2,3	Homeowner/Renter: Augment/deploy a targeted customer outreach to high potential customers.	CLTEESP 2-2- Promote effective decision making

Strategies	Timing	New, Modified, or Existing	Sample Strategy: Description and Tactics	Legislative and Policy Drivers
Intelligent Outreach (continued)	Short-term	E	Outreach to drive contractor participation in providing whole home solution to customers.	
	Short-term, Mid term Long term	N - SCE Strategy 2,3	Behavioral/Advisory: Provide meaningful energy feedback tools and/or recommendations to customers to better manage their energy use such as social behavioral interventions or "Framing" based on customer attributes.	EBEE Plug-load efficiency (S1.6)
	Short-term, Mid-term, Long term	M - SCE Strategy 2	Behavioral/Advisory: Simplified on-line customer engagement and access to enable a streamlined customer experience and drive participation in self-service options.	EBEE Data For Improved Decisions: 2.1.2, 2.1.3
	Short-term, Mid-term	E, M - SCE Strategy 4	Behavioral: Engage customers through behavioral offerings to drive EE adoption and conservation.	EBEE Plug-load efficiency (S1.6)
	Short-term, Mid term	N - SCE Strategy 3,4	Behavioral/Advisory: Provide customer rewards to drive persistent customer engagement.	
	Short-term, Mid term	N - SCE Strategy 2	Behavioral/Advisory: Provide a consumer knowledgebase online tool to support customer adoption and information about EE products such as EMTs, MELs and other customer offerings.	• CLTEESP 3-2 Public awareness of and demand • EBEE 1.6.5 Plug-Load Management Programs
Direct Install	Short-term	N - SCE Strategy 1	Homeowner/Renter: Provide no cost measures for SF residents to overcome upfront cost barriers for EE adoption and support all occupants.	• CLTEESP 2-2 - Promote effective decision making • EBEE: 3.1.1 Sustainable and Effective Program Delivery:
Single Point of Contact	Short-term	N, M - SCE Strategy 1,2	SPOC: Provide single point of contact for multi-utility offerings to deliver water, gas, and electric customer offerings	CLTEESP 2-1, Deploy full-scale Whole House programs. Water-Energy Nexus
Financing	Short-term	M	Homeowner: Expand/promote financial offerings to overcome up-front cost, performance uncertainties and preserve ratepayer dollars.	

b. Existing Building Retrofit: Multifamily Facility Managers / Owners

Since 2014 SCE has been simplifying its program delivery approaches. In 2015 SCE provided an extensive proposal to integrate program design and delivery for MF property owners and low-income ESA Program participants through the pending low income proceeding and Application 14-11-007. These efforts were created to address a multitude of program offerings available to the MF segment with varying qualifications, which is often a source of confusion for MF property owners and managers, as well as individual tenants. Feedback from stakeholders and EM&V, as identified in the market barriers in Section II. C., indicated the desire for a single-point-of-contact to help MF property owners and managers to navigate the program landscape to access the appropriate programs and resources to meet their needs.

One barrier for MF building owners and managers is knowing how to prioritize one EE investment relative to another or other capital expenses. For the near and mid-term, SCE is proposing the program strategies listed in Table 8, following, and an overall approach to assist MF building owners and managers to prioritize investments in EE. Below is a depiction of how SCE's Residential Strategies will help engage multifamily property owners and assist in prioritizing their investment to meet their need and deliver a pathway for ongoing customer engagement and continuous improvements. New and Modified tactics are called out below and will be discussed further in implementation plans or in conjunction with third-party solicitations.

Figure 20. MF Support Path

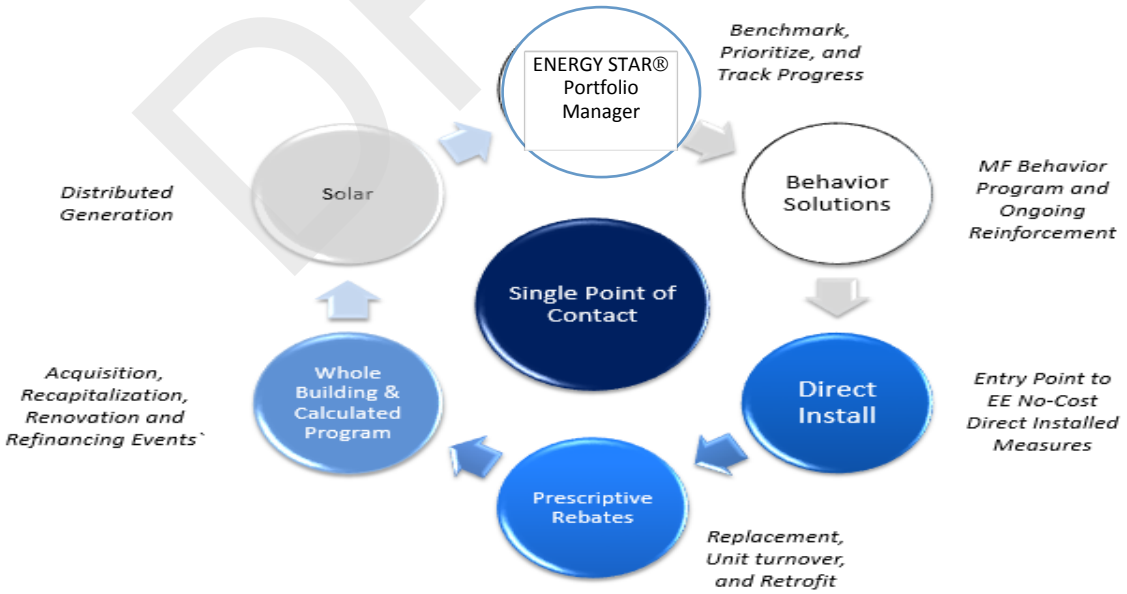

Table 8. Existing Building Retrofit – Multifamily Property Owners and Facility Managers

Strategies	Timing	New, Modified of Existing	Sample Strategy Description and Tactics	Legislative & Policy Drivers
Intelligent Outreach	Short-term, Mid-Term	M - SCE Strategy 2	Integrate program delivery with ESA to holistically serve low income properties and improve program participation.	CLTEESP LIEE 2.4: Identifying segmented concentrations
	Short-term, Mid-term, Long term	N - SCE Strategy 3	Foster ongoing relationships with facility managers and owners about energy use to enable investment prioritization through benchmarking.	• AB 802 - Benchmarking EBEE Data For Improved Decisions 2.1 • EBEE Strategic Energy Planning: 2.2.5
Single Point of Contact	Short-term, Mid term, Long Term	M - SCE Strategy 2	Simplify owner engagement to reduce multiple customer touchpoints.	CLTEESP LIEE 1.3: Improve program delivery
	Short-term	M - SCE Strategy 2	Simplify program delivery by having a single set of qualified contractors implement various programs across diverse market needs.	CLTEESP LIEE 1.3: Improve program delivery
Financing	Short-term	E	Expand and promote financial offerings to overcome up-front cost and performance uncertainties and preserve ratepayer dollars.	
Customer Incentives	Short-term	E	Provide incentives to property owners to adopt EE solutions. (Offerings for tenants listed above.)	CLTEESP 2-1, Deploy full-scale Whole house programs.
Direct Install	Short-term	E	Provide no cost measures for MF residents to overcome upfront cost barriers for EE adoption to support all occupants and leverage customer touchpoint	• CLTEESP 2-2 – Promote effective decision making • EBEE: 3.1.1 Sustainable and Effective Program Delivery:
Partnering	Short-term	E	Education and outreach to trade organizations, local governments and portfolio operators to increase awareness and drive program participation.	

c. New Construction: Builders and Developers

The Residential New Construction market has been impacted by the adoption of the 2016 Title 24 code that will become effective on January 1, 2017. ZNE is not common place in the market; however, with recent code adoptions the cost of achieving energy savings beyond the 2016 code are higher for incremental savings. It is vital to transition the program to a more sustainable format to continue supporting ZNE development. SCE will continue to pay CAHP incentives for previously committed projects though 2019 while Codes and Standards aims to deliver a ZNE code for 2020 if proven cost-effective by the CEC's standards.

Additionally, with the elimination of non-cost-effective CAHP resource activities, SCE recognizes the ongoing need to support and develop residential 2020 ZNE goals as well as and commercial ZNE 2030 goals. SCE will work with stakeholders to develop a mechanism to support comprehensive ZNE efforts through an alternative program, pilot or demonstration.

Table 9, below, identifies proposed SCE strategies and supporting functions to help achieve statewide residential ZNE goals in the residential sector.

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Table 9. New Construction – Builders and Developers

Strategies	Timing	New, Modified or Existing	Sample Strategy: Description and Tactics	Legislative & Policy Drivers
Intelligent Outreach	Short-term	E - SCE Strategy 5	Disseminate best practices of CAHP projects and programs using ZNE as a reference point and evaluate CAHP database to assess ZNE rating. Through industry partners.	CLTEESP 1-1 Drive continual advances
Demonstration	Short-term	E - SCE Strategy 5	**ET:** Deliver Single-family and Multifamily demonstration projects of near ZNE or ZNE homes for industry awareness and dissemination of best practices.	CLTEESP 1-1 Drive continual advances
	Short-term	E - SCE Strategy 5	**ET:** Deliver demonstration of community based approach for meeting ZNE requirements.	CLTEESP 1-1 Drive continual advances
Partnering	Short-term	M - SCE Strategy 5	**Codes and Standards** to provide enhanced subprogram activities: • Provide technical expertise and training for energy modeling software to achieve code compliance. (CBECC Res software) • Support Reach Codes for Local Governments to pursue above code savings. (supporting ZNE) • Building code advocacy for 2019 Title 24 which aims to develop a ZNE code for homes by working with the builders, CEC and stakeholders. **WE&T** activities also listed in cross-cutting chapter	CLTEESP • 1-2 Continual coordination • 1-3 Support "Reach standards, • 2-5 Increase Title 24 compliance • 3-1
Integration	Short-term, Mid-term	N - SCE Strategy 5	Explore new program component/pilot/demonstration to further support ZNE efforts.	

C. Budget and Metrics

The following table highlights SCE's planned budget for the residential sector over the next 10 years. As stated above, budgets will be estimated and will be revised upon completion of the EE goals analysis by the CPUC. The 2017 budget shown below is the filed budget for the existing residential sector programs. The majority of the change in budget between 2017 and 2018 is associated with the decrease in primary lighting due to the changes in code.

Table 10. Residential Sector Budget 2018- 2024[61]

Sector	2017	2018	2019	2020	2021	2022	2023	2024
Residential	**$94m**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**	**TBD**

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Table 11. Energy Efficiency Business Plan: Sector Metrics

	Residential Sector						Target		
	Problem Statement	**Desired Market Effects**	**Intervention Strategies**	**Market Effect Metrics**	**Baseline**	**Metric Source**	**Short**	**Mid**	**Long**
Homeowners & Renters	As currently designed, low UES and high transactional cost are reducing the value of traditional downstream approaches for mass market/mainstream technologies for market transformation activities.	Increase adoption of EE appliances, measures and management technologies in the residential sector.	• Partnering • Intelligent Outreach • Customer Incentives • Midstream Incentives	Increased number of participants in PA programs	Program Tracking Data	2015 Participation Levels	5%	15%	25%
	Increasing codes and standards for residential lighting products will impact savings opportunities and require market support to avoid recidivism.	Adopt high efficiency lighting products.	• Partnering • Quality Assurance • Upstream Incentives • Delivery Channel	Increasing use of high-efficiency lighting.	Saturation Studies, Shelf-Studies	2012 Saturation Levels	5%	15%	25%
	Deep, holistic and quality home retrofits have high cost relative to expected energy savings making the current design challenging for customers and unattractive for ratepayers.	Drive targeted adoption of whole home energy efficiency improvements.	• Partnering • Intelligent Outreach • Customer Incentives • Direct Install • Financing	Number of participants in deep energy retrofits.	Program Tracking Data	2015 Participation Potential	5%	15%	25%
	Need for engagement tools to drive continuous customer behavior, persistence and program participation.	Increased use of self-service channels for energy efficiency solutions	• Intelligent Outreach	Number of participants using self-service channels.	Program Tracking Data	2015 Participation Potential	5%	15%	25%

	Residential Sector						Target		
	Problem Statement	**Desired Market Effects**	**Intervention Strategies**	**Market Effect Metrics**	**Baseline**	**Metric Source**	**Short**	**Mid**	**Long**
MF Property Owners and Managers	Market actors in the MF sector are fragmented and diverse creating challenges in aligning drivers for increased EE adoption.	Increased adoption of EE solutions by the multifamily sub-sector.	• Partnering • Intelligent Outreach • Customer Incentives • Direct Install • Single Point of Contact • Financing	• Increased number of MF participants in PA programs. • Number of properties participating benchmarking	Program Tracking Data	2015 Participation Levels	5%	15%	25%
New SF/MF Builders	Increasing cost associated with marginal increases in above code savings for new construction is driving reduced savings and increase complexity for market's code compliance.	Increase of efficient, new construction and support for near ZNE and ZNE homes	• Partnering • Intelligent Outreach • Demonstration	Increase number of builders and developer support and % of homes achieving near ZNE or ZNE designation.	TBD	TBD	TBD	TBD	TBD

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D. Coordination with Key Partners and Associated Proceedings

SCE's residential sector requires partnerships with numerous and diverse stakeholders to achieve its EE goals. Below is a list of likely key partners in the sector:

Table 12. Key Partners

Segments	Key Partners	
Single-family: Homeowners & Renters	**Plug Load Partners**	Manufacturers, retailers, contractors, SW PAs, NEEP, NEEA, etc. For nationwide collaboration activities, DOE, EPA EnergyStar
	Whole home and HVAC Partners	Distributors, contractors and raters, SW PA's, CEC, CPUC, trade associations (e.g., IHACI), manufacturers, WE&T support contractor focus on HVAC quality improvements (i.e., compliance with ACCA.), EPA's Energy Star Verified HVAC Install Program
	Engagement Partners	Behavior and energy management solution providers, SW PAs, key stakeholders, and industry advocates
	Lighting Partners	Lighting manufacturers, retailers, State policy makers, lighting trade and associations, SW PA's, EPA, DOE, CEC
Multifamily	Multifamily property owners and operators, multifamily property and facility managers, multifamily renters, multifamily architects and engineers, multifamily housing industry associations, multifamily commercial real estate industry, financial institutions, lenders, and brokers, SW IOUs and Program Administrators, CPUC, CEC	
New Construction	BIASC, CBIA, NAHB, industry, building officials, realtors, appraisers, local governments.	

1. Program and Statewide PA Administration

D.16-08-019 requires all PAs to include proposals in the upcoming Business Plans for statewide administration of upstream, midstream, and market transformation programs (along with piloting select downstream programs). At this time, the following Residential programs have been identified for statewide administration. (Details on the Statewide Administration process can be found in the Portfolio Summary chapter).

Table 13. Program Transition Expectations

Residential Statewide Programs	Transition Expectations
Plug Load and Appliances	Mid-stream applications will transition to the appropriate Statewide lead and SCE will maintain ability to control its budget commitments to ensure the ability to manage a cost-effective portfolio.
Residential New Construction	Program functions will transition to the appropriate Statewide lead and SCE will maintain the ability to control its budget commitments to ensure the ability to manage a cost-effective portfolio.

Residential Statewide Programs	Transition Expectations
Residential Heating, Ventilation, and Air Conditioning (HVAC)	Residential HVAC applications will transition to the appropriate Statewide lead and SCE will maintain the ability to control its budget commitments to ensure the ability to manage a cost-effective portfolio.
Lighting Market Transformation and Lighting Innovation	Elements of these programs will be further explored as part of ET program development.
Primary Lighting	The Upstream approach of a Primary lighting program will transition to SCE as the statewide lead with further details to come

2. Third Party Administration

SCE will utilize a robust procurement strategy and process to achieve the guidance in D.16-08-019 for 60% of a utility's EE Portfolio to be proposed, designed, and delivered by third parties by 2020. The process will enable bidders to submit unique proposals across all sectors and key intervention strategies. Bidders will also be encouraged to submit proposals for intervention strategies that have not been included in the Business Plan. SCE will encourage potential bidders to utilize the Business Plan as a key input into their proposals to ensure that SCE provides a comprehensive suite of offerings for our customers while providing the maximum level of benefits to the grid and our customers for the lowest possible cost. SCE's general EE procurement strategy is described in more detail in the Portfolio Summary chapter.

3. Cross-Cutting Coordination (ETP, C&S, WE&T)

a. Emerging Technologies

In the residential sector, some of the largest opportunities for savings are in mass-market programs that have a low per-intervention cost, specifically behavioral, upstream, and performance-based programs. The statewide Emerging Technology Program (ETP) will continue to support these types of measures in a number of ways.

For behavioral programs, the ETP will continue to explore solutions such as providing customers with detailed information on energy use, developing residential TOU rates, and boosting savings through gamification or the use of apps. All of these solutions mean adopting new technologies that the ETP would be (or has already been) active in evaluating.

To develop more robust upstream programs, the emerging technology subcommittee will work with product developers to integrate energy-saving attributes in the product design phase. Further, the subcommittee points out

that using other beneficial attributes of widgets can be the primary driver of market adoption. This is useful when working upstream, as it means that energy does not need to be the top customer consideration; it can simply be a "bonus" feature of a product that also offers security, comfort, or a boost in productivity.

Also, performance-based programs will become increasingly feasible as new, advanced methods to evaluate savings emerge. These evaluation methods could streamline the EM&V process and make program participation easier for residential customers. Through the M&V process, the statewide ETP has already started to generate data that can support this evolution.

Outside these low-cost interventions, the ETP supports the residential sector in other ways. One notable example is assisting with utility electric vehicle (EV) efforts. Because EVs can use as much power as a home, they pose significant risks to the grid by straining distribution systems in neighborhoods with high adoption rates. By evaluating EV charging technologies, as well as the way in which customers interact with the technology, the ETP is paving the way for large-scale EV adoption to take place in a way that minimizes risk to the grid but also ensures customer satisfaction by offering practical charging options with minimal inconvenience.

Finally, the statewide ETP is monitoring the evolution of connected technologies within the home. AB 793 requires IOUs to offer such technologies to residential customers and ETP has provided support in identifying and analyzing candidate products. As connected appliances continue to proliferate, the ETP will monitor this industry and will look for individual technologies and suites of products that are an appropriate fit for DSM portfolios.

b. Codes & Standards

The Codes and Standards (C&S) program supports the Residential Sector in a number of ways.

- First, the C&S program is actively supporting the CLTEESP goal of delivering ZNE new homes by 2020. The C&S program's role is supporting the California Energy Commission (CEC) in developing the 2019 Title 24 building energy standards that have a goal of requiring all new homes (under 4 stories) to be designed and built as ZNE buildings.
- Second, the C&S program's compliance improvement activities support the replacement of air conditioners, water heaters, and other appliances that are installed in conformance with the Title 24 standards. This is accomplished by supporting the CEC, building

departments, and installation contractors to better understand the applicable Title 24 requirements for each project.

- Finally, the C&S program advocates for cost-effective higher efficiency household appliances (including televisions, general service lamps (light bulbs), computers, battery chargers, etc.) that save energy for all residential customers. The C&S program provides this advocacy to both the CEC as well as the Department of Energy to support their appliance rulemaking process by providing technical, economic, market, and performance data to justify higher efficiency levels than what would otherwise occur.

c. Workforce Education & Training (WE&T)

The Residential sector coordinates with WE&T to incorporate and integrate industry-specific education and training opportunities within the residential sector. As part of this effort, the following are a few cross-cutting strategies on which the sectors will collaborate to develop and deliver within the residential sector:

- Continue to deliver industry-valued standards-based residential HVAC quality installation and maintenance curriculum and pathways to certification.
- Work with current training providers to enhance Residential HVAC technical and soft skills offerings that target the following subjects.
- Develop new curriculum and other educational tools and offerings, targeted to high-potential market actors and decision makers, to enhance knowledge of technological innovations and integrated business strategies that are required to effectively understand, interpret, and meet the ZNE goals.
- Help develop a well-informed support industry including building inspectors, financial and real estate professionals, and other industries central to the advancement of ZNE.

4. Coordination with Associated Demand-Side Management Activities

a. Demand Response

Coordinating EE and demand response provides customers with better tools to understand, manage, and reduce their electricity use. Such coordination will occur in SCE's AB 793 compliance plan to deploy offerings that provide incentives to residential customers who acquire energy management technology for use in their homes. Additional details that support overall Demand Response activities are provided in intervention strategy tables.

i. ME&O

The residential sector will employ targeted marketing efforts to build ME&O awareness and educate residential customers to participate in relevant EE options. As identified in residential sector intervention strategies, intelligent outreach tools will be used to deliver specific messages to specific customer groups to drive participation to key audiences through analytics and research to increase EE adoption.

As an example, 20 percent of current smart thermostat owners do not enroll in DR programs because they need more information. Many consumers believe the products are too complicated to use. SCE will focus on educational content to explain technology products in simple terms and increase customers' awareness and understanding through intelligent outreach methods.

ii. ME&O Marketing Strategy

Below are specific strategies to integrate SW ME&O within the residential sector:

- Integrate and cross-promote with existing marketing campaigns for DSM program participation
- Integrate communications with other programs, such as Time of Use (TOU) rate communications or New Construction, to provide target audiences with holistic view of all available options in the portfolio; promoting energy efficiency products as a way to save energy
- Leverage seasonality: take into account product seasonality trends, with some times of the year being more marketing-intensive than others. For example, the spring and the holiday season are strong sales months for home technology products.
- Leverage local community partners and relationships, CBOs, and 3rd-party strategic alliances, and
- Provide in-language communications for ethnic and hard-to-reach customers.

iii. Electric Vehicles

Southern California Edison assists customers with their electric vehicles and will look to coodinate offerings for customers across their DSM options. Energy efficiency can assist costomers with managing their energy consumption but may only be one offering for customers interested in other offerings such as electric vehicles. In addition to managing the homes or MF complex usage, SCE engages the consumer through alterative offerings, such as electric vehicle rates or infrastructure improvements to provide the best fit for customers. EV support includes the following:

- **EV Rate Plans:** Most residential customers are on the Residential Plan (Schedule D). Under this plan, as more electricity is used within any billing period, the cost per kilowatt hour increases as new tiers are reached. Electric vehicles on this rate have other options to consider.
  - The Residential Time-of-Use Plan (TOU-D) offers lower rates every day from 10:00 p.m. to 8:00 a.m., which enables a customer to recharge an EV at a low rate.
  - On the Electric Vehicle Plan (TOU-EV-1), electricity used to charge an EV is billed through a separate meter at a different rate than electricity used by the rest of a home. Lower rates apply during off-peak hours of 9 p.m. to noon. Rates change seasonally, and are higher in summer.
- **Charge Ready** allows multi-unit dwellings to deploy EV charging in three types of locations:
  - **Assigned parking** enables residents to charge their EVs in their own parking spaces, using an unshared charging station. In this case, the building or an individual resident may be named as the customer of record (service account holder) and will be responsible for paying the utility bills related to that service account.
  - **Dedicated parking** allows multiple residents with EVs to access a dedicated, and usually restricted, area to charge their vehicle, even though parking spaces are shared (i.e., not assigned) within this area. This setup prevents non-EVs from using a parking space with a charging station.
  - **Common area parking** allows for on-site EV charging stations located in common areas and shared among residents and guests.

iv. Integrated Demand Side Management

To support the integration of IDSM and EE, the residential sector will continue to collaborate to pursue IDSM activities. Final Business Plans will provide additional detail on IDSM and EE integration.

v. Residential Rate Reform

The IOUs are required to include the residential energy efficiency component of the ME&O plans that will be included in the IOUs Tier 3 Advice Letters.[62] The final IOU ME&O plans are due on November 1, 2016. SCE will include relevant information in its January 2017 Business Plan submittal.

[62] R.12-06-013, Residential Rate Reform Proceeding, December 17, 2015, ALJ Ruling, OP 2.

vi. Energy Savings Assistance

The proposed Residential Direct Install (Res-DI) program seeks to enhance the energy efficiency knowledge and program participation of the residential market segment in an effort to drive them to undertake deeper energy efficiency activities and retrofits.

In 2013-2014, the Commission approved the implementation of the MIDI Pilot as a sub-program to EUC. The MIDI pilot was designed to coordinate with SCE and SoCalGas' Energy Savings Assistance (ESA) Program and offer a sub-set of ESA measures to income qualified customers. The pilot program experienced very low program enrollment for a variety of reasons which include constrained measure offering, inconsistent concentrations of income eligible customers and/or willingness of customers to provide income documentation. The Res-DI Program incorporates these lessons learns resulting a scalable, cost effective program that supports several local and state initiatives.

Multifamily offerings have been working on alignment with ESA offering since 2014. These efforts will continue in the future and the strategies to do so are laid out as a part of this business plan in Section II.

E. Future Needs

1. M&V Anticipated Needs & Internal Performance Analysis

SCE is working with the Energy Division and other program administrators to update the 2017 M&V roadmap.[63] This preliminary M&V study roadmap is posted for public review and comment. A more comprehensive update is planned for Q1 2017 to better reflect the study needs identified in the statewide business planning process.

Generally speaking the following studies are needed to support the residential portfolio of programs:

- Customer characterization and wants/needs study, especially for Energy Management System support
- CLASS Study update
- Performance metric baseline study
- Workpaper updates, and
- Impact and process evaluation studies to support program improvements.

[63] **2013-2016 Energy Division & Program Administrator Energy Efficiency Evaluation, Measurement and Verification Plan, Version 6.**

2. Approved or Proposed Pilots

a. 10-10-10+ Multifamily Behavioral Pilot

This is a Behavior Intervention Pilot, focusing on influencing multifamily complexes to reduce consumption of gas, water, and electricity by 10 or more percent. It includes randomized control trial design with interventions such as competition, feedback, rewards, and commitments. If successful, this top-down approach of MF benchmarking can identify a process and workpaper to support claiming savings for MF complexes that upload data through EPA's ENERGY STAR® Portfolio Manager.

b. Energy Pledge

This pilot is designed to leverage ENERGY STAR® Pledges to motivate energy savings commitment and behavior. This pilot is designed with six bi-monthly mailings to enlist pledge commitments, within a Randomized Controlled Trial (RCT) design. Since no data analytics are required, this may prove to be a low cost behavior program alternative to Home Energy Reports, using comparative energy usage analytics. This pilot will complete its implementation during 2016. The evaluation results will yield insights to implementation cost-effectiveness to different population strata.

c. Points and Rewards

Leverage the Enhanced Energy Audit Tool (EEAT) and the Points and Reward: SCE will initiate a behavior points and rewards in which customers will earn points for taking SCE-selected actions such as completing an audit or enrolling in EE programs. The selected customer can exchange earned points for gift cards. The existing online EEAT platform is designed to provide customers with helpful information, tips, and more to guide them in reducing their energy use. The EEAT and Points and Rewards platform features include:

- Neighborhood comparative energy usage
- Year-to-date usage history
- Billing history
- Information on how much energy appliances consume
- Bill comparison, and
- Customized tips on ways to save energy.

d. Meter-Based Measurement and Verification

SCE is exploring transitioning programs and opportunities utilizing AMI electricity usage for evaluation, measurement and verification to further enable Third Party solutions. Potential approaches can include activities such as CALTRACK and as well as other internal and/or external products.

e. Plug Load and Appliances

Work with Statewide PA administrators to develop and pilot an approach such as RPP, described by PG&E as "a strategic market transformation effort designed to create long lasting, sustainable changes in the functioning of product-specific markets by reducing barriers to the adoption of energy efficient plug-load and appliances."

f. ZNE

SCE recognizes the ongoing need to support and develop residential and commercial ZNE activities to meet their 2020 and 2030 goals, respectively. SCE will explore additional ZNE efforts through an alternative or existing program, pilot or demonstration pathway to coordinate ZNE activities. Please see Codes and Standards and Emerging Technology chapters for additional ZNE touch points. This will be completed through the 2018 BP or a separate Advice Letter filing prior to implementation plans.

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IV. Appendix: EM&V Summaries and References Overview

A. EM&V Summaries and References

Summaries from previous evaluations cycles informed SCE's intervention strategies reflected in the business plan with more specific examples in Section B. 3. 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.