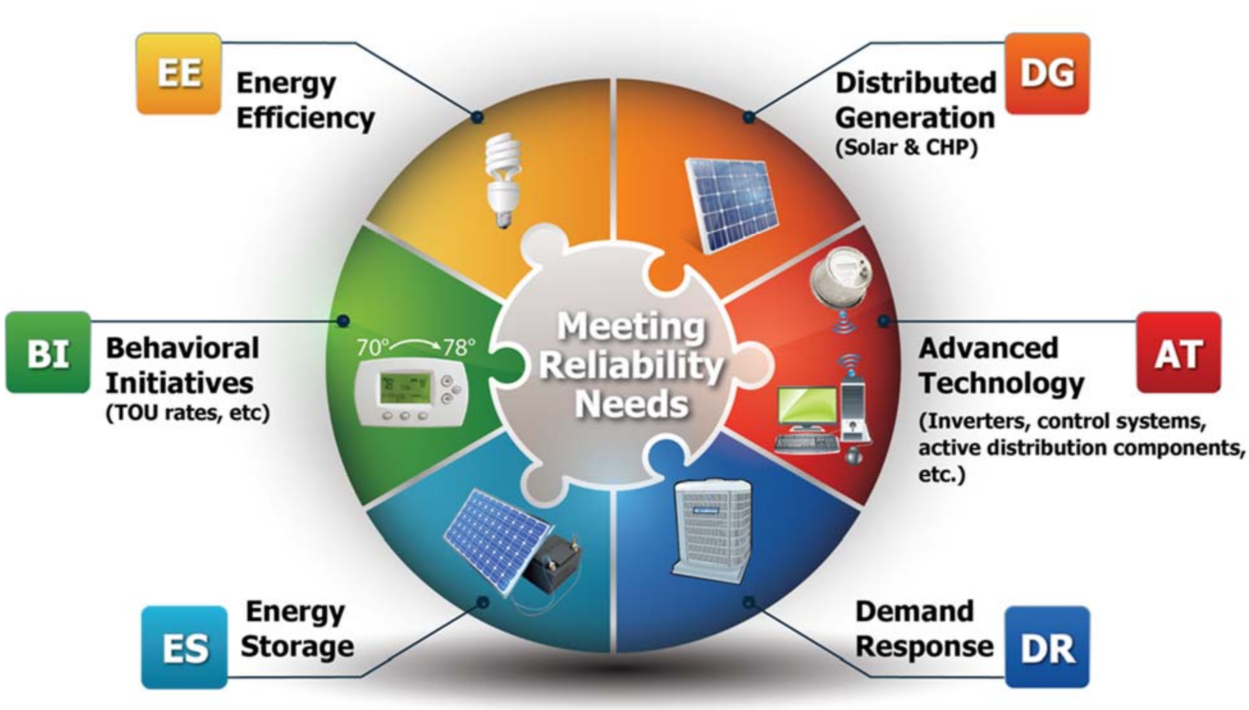

Southern California Edison

Preferred Resources Pilot

Portfolio Design Report

Revision 0

October 31, 2014

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1. Executive Summary

As a result of the closure of the San Onofre Nuclear Generating Station (SONGS) and the impending retirement of nearby once-through cooling (OTC) power plants, SCE must find replacement power for the transmission-constrained Southern Orange County area served by the Johanna and Santiago (J-S) substations. SCE is therefore faced with the unique opportunity to explore, for the first time, whether a transmission constraint can be solved at the local or distribution level with clean resources and without the use of gas-fired conventional generation. To take advantage of this opportunity, SCE is pioneering a Preferred Resources Pilot (PRP).

The PRP represents an innovative approach for three reasons. First, its goal to manage load growth in the PRP region to net zero solely with clean resources is unprecedented for SCE. Second, it departs from SCE's past practice of procuring clean resources simply to meet state energy-policy goals and adds a component to solve for a local reliability issue. Third, it represents an additional departure from SCE's current practice of conducting top-down, system-wide, integrated, resource planning, to a bottom-up planning approach that forecasts customer load growth using local specific data and market potential of preferred resources based on customer meter data.

This portfolio design report provides guidance on the acquisition of preferred resources in the PRP region to meet the expected load growth – more than 300 MW through 2022. To determine the best mix of clean resources to meet that need, SCE conducted a bottom-up analysis to identify portfolio options to serve the growth. The portfolio options first accounted for resources that can contribute over multiple hours, such as energy efficiency and distributed renewable generation, then layered the use of energy storage and demand response to meet the peak.

The analysis demonstrated a minimum of three possible portfolio options that could meet the forecasted need – (1) a recommended approach that reflects what SCE reasonably believes the market can deliver to the PRP region; (2) a high approach in which the market delivers more customer demand side resources than historical trends predict, relying on existing programs; and (3) a low approach in which the market delivers less than the expected customer demand side resources. The portfolio options serve as a starting point for implementing SCE's existing demand-side management and resource-procurement programs and identifying the need for targeted solicitations or bilateral contract negotiations.

The design process will go through several iterations and will account for updates to the distribution forecast, improved understanding of the market potentials, refinements in the design process based on lessons learned, and policy revisions. The iterative implementation of the portfolio design process will help ensure the acquisition of the right resources at the right time.

2. Purpose

This document describes the analysis and results associated with the PRP portfolio design process. The objective of this process is to provide guidance regarding the type and quantity of preferred resources to be acquired to manage load growth to net-zero in the PRP area, the basis of which is described in the "Background" section below. The results consider the operational constraints — availability, duration, and intermittency — of the preferred resources.

For purposes of the PRP portfolio design, preferred resources include the following:

- Energy efficiency (EE) and demand response (DR) resources that are expected to deliver a measurable impact at a customer's meter during peak hours as monitored by the PRP measurement process.
- Eligible Renewable Resources (ERR), including Behind-the-Meter (BTM) renewable resources that are expected to reduce a customer's load and deliver excess energy to the distribution grid, and In-Front-of-the Meter (IFTM) renewable resources that can either help meet load growth or provide resource adequacy benefits.
- Energy Storage (ES) resources that can either help meet load growth or provide resource adequacy. Energy storage behind the meter is viewed the same as DR.
- CHP and FC resources may be acquired to support the PRP objectives.

3. Background

a. Genesis of the Preferred Resources Pilot (PRP) Program

The retirement of SONGS and the potential closure of the region's OTC generating plants by 2020 may create capacity replacement needs that, if not met, may challenge transmission reliability in the southern Orange County area served by SCE's J-S substations.

SCE is implementing the PRP to determine if preferred resources[1] can meet local capacity requirements (LCR) in the area served by J-S. The current system capacity is sufficient to serve the current J-S load, but the load is expected to grow by ~30 MW per year, creating a need for more capacity by 2022.

b. Johanna and Santiago Substation Areas

Table 3.1 and Figure 3.1 provide a general description and map of the J-S substations and supporting B-Banks, respectively. Figure 3.2 is a representation of SCE's transmission system in the area.

Table 3.1: General Description of Johanna and Santiago Substations

	Johanna		Santiago	
2014 Peak Demand*	432 MW		770 MW	
Customer Characterization	Primarily commercial		Mix of commercial and residential	
Supporting 66/12 B-Banks (# of Circuits)	Cabrillo (19)	Camden (7)	Borrego (8)	Crown (10)
	Chestnut (14)	Fairview (12)	Estrella (14)	Irvine (8)
	Johanna (9)		MacArthur (10)	Morro (5)
			Moulton (13)	Niguel (7)
			Santiago (17)	

* Peak demand value obtained from SCE Distribution Engineering Team

[1] Preferred resources are defined in the State's Energy Action Plan II, at 2, as follows: "The loading order identifies energy efficiency and demand response as the State's preferred means of meeting growing energy needs. After cost-effective efficiency and demand response, we rely on renewable sources of power and distributed generation, such as combined heat and power (CHP) applications. To the extent efficiency, demand response, renewable resources, and distributed generation are unable to satisfy increasing energy and capacity needs, we support clean and efficient fossil-fired generation." Energy storage is a potential enabling technology, but is not a Preferred Resource because it stores power regardless of how that power is produced. However, in this document, similar to the CPUC decision, the PRP also includes energy storage in the category of preferred resources for ease of use unless otherwise noted. Additionally, distributed generation includes and is referred to throughout this document as renewables and CHP at the distribution grid level, such as solar in-front-of-the meter and behind-the-meter.

Figure 3.1: Map of J-S in Southern Orange County

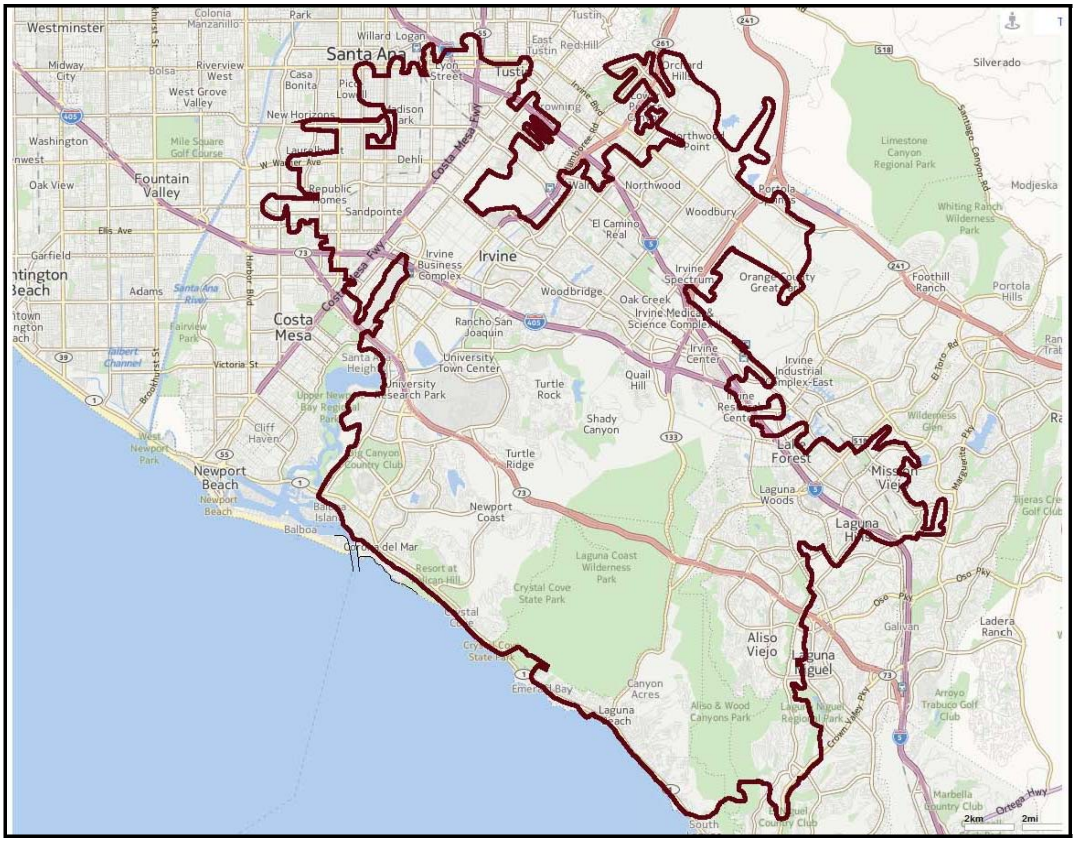
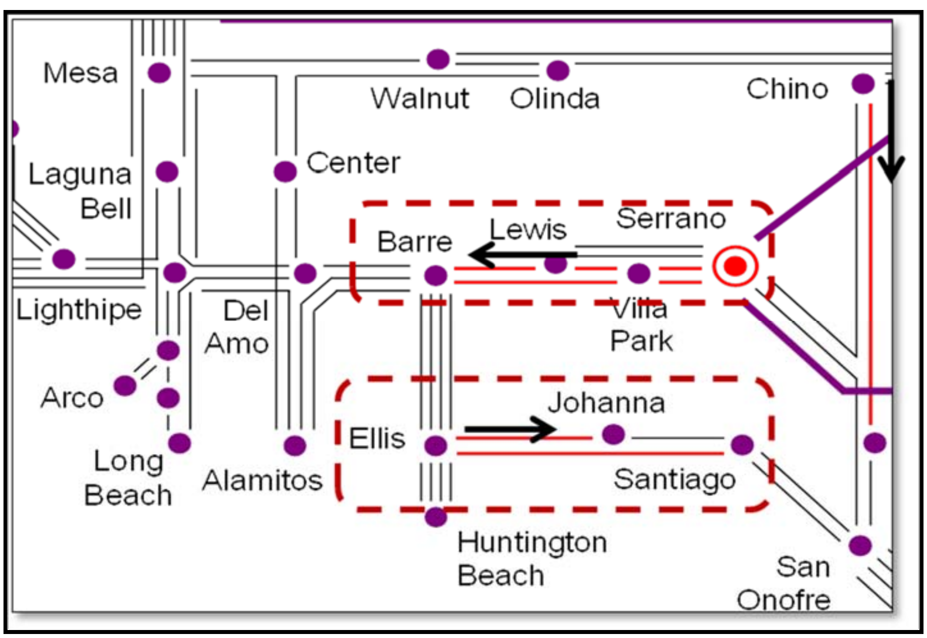


Figure 3.2: SCE's Transmission Map for Southern Orange County



c. PRP Objectives

The PRP's objectives are to:

- Measure the local grid impact of preferred resources
- Implement a preferred resources portfolio to address local peak needs — an innovative approach not previously attempted
- Demonstrate that preferred resources can be used to meet local capacity requirements
- Minimize or eliminate the need for gas-fired generation at these locations, and
- Identify lessons learned for application to other grid areas.

The expected outcome from implementing a preferred resources portfolio to address local peak needs and meet local capacity requirements is that load-growth will be managed to net zero. Load in the J-S area is expected to grow by ~30 MW/year through 2022. As preferred resources are added to the system, the PRP grid-level measurement of their performance will quantify the ability of preferred resources to manage load growth to net-zero.

d. PRP Project Workstream Components

Through workstreams, the PRP will meet its objectives of measuring, implementing, and demonstrating PR in the J-S region. While focusing on their general scopes of work, the workstreams will also cooperate with and provide feedback to each other in support of the project's overall objectives. The workstreams are Stakeholder Engagement, Design & Acquisition, Portfolio Implementation, and Measurement & Verification.

1. **Stakeholder Engagement:** The goal of this workstream is to engage in a two-way learning discussion to obtain increased customer participation and to share status, challenges, insight, and results through clear, consistent, and open communications with affected SCE customers and key stakeholders.

2. **Portfolio Design and Acquisition:** The goal of this workstream is to define and acquire the mix of preferred resources to meet the forecasted needs for the PRP target area through 2022. The portfolio mix of resources will be based on MW, location, time of day, duration, frequency, and season. These are collectively referred to as the **resource attribute needs**. Resources will be acquired through existing solicitation processes, as part of the Demand Side Management (DSM) program planning process, and possibly through unique PRP solicitations as well. In establishing the PRP DSM targets, focus will be placed on those programs that produce dependable and persistent grid level savings.

3. **Implementation:** The goal of this workstream is to ensure that the acquired Preferred Resources are fully deployed and performing in the PRP target area. Improving customer adoption is critical to meeting the PRP DSM targets. Additionally, this workstream will explore interconnection improvement opportunities for generation-type preferred resources.

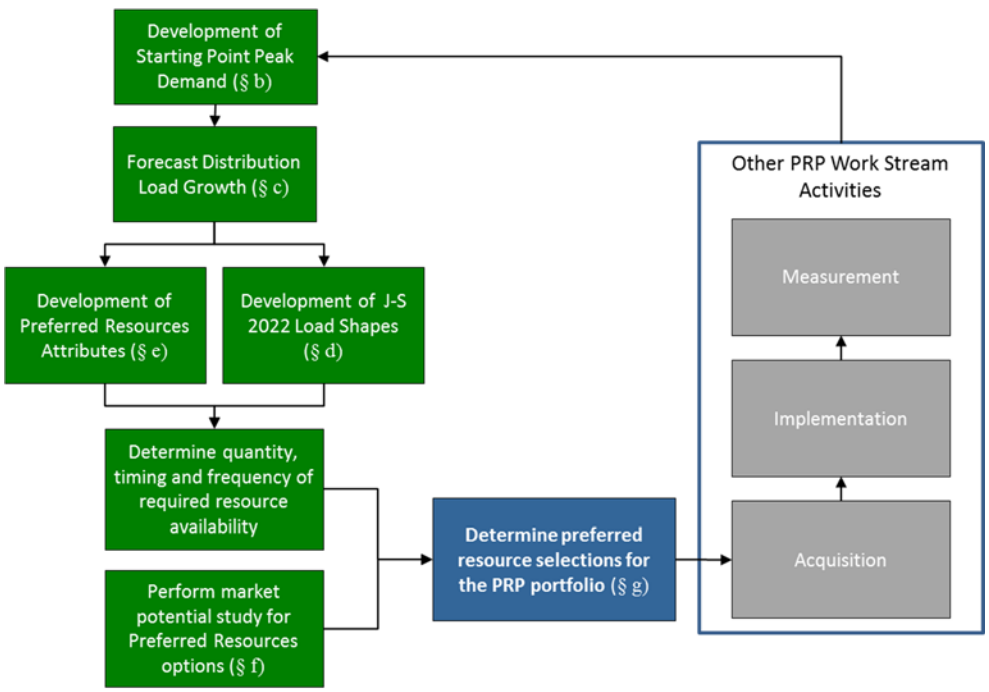
4. **Measurement and Verification:** The goal of this workstream is to measure the grid impacts of preferred resources in the PRP area. Use of raw Advance Metering Infrastructure (AMI) data, Supervisory Control and Data Acquisition (SCADA), and other metered data will enable analysis of the performance of the preferred resources in the PRP area.

4. PRP Portfolio Design Process

a. Overall Process Definition and Components

The objective of this process is to provide guidance regarding the type and quantity of preferred resources that will best meet the forecasted load needs in the PRP area within the operational constraints of preferred resources (availability, duration, and intermittency). The steps involved in the portfolio design process are outlined in Figure 4.1 and described in more detail throughout this report. This design process is intended to be iterative. The addition of preferred resources contracts and programs and the development of new forecasts can both trigger re-evaluation of the portfolio. Periodic re-evaluation of the entire process will be necessary to incorporate updates based on actual measurements.

Figure 4.1: Preferred Resources Portfolio Design Process



b. Development of Starting Point Peak Load

Development of the starting point peak (SPP) load is an annual process conducted by SCE as part of its distribution planning purposes. The process calculates projected load figures which are used to determine if the distribution system has adequate capacity to meet future demand requirements. The SPP data was necessary for the development of a summer peak baseline for the PRP. SPPs can be described as normalized peak demand values, where adjustments are made to recorded peaks based on the temperature, day of the year, abnormal conditions, generation, and other preferred resources (such as EE and DR) operating on peak. The annual analysis leading to the development of SPPs for Johanna and Santiago was based on the following inputs and assumptions.

Inputs

- Raw Peak: Raw trend data for 2013 summer peaks, obtained from the SCADA systems installed at Johanna and Santiago.
- Temperature Adjusted:
  - Peak day temperature data and historical temperature data is used to normalize raw peak day data to a 20+ year mean temperature.
- Transfer/Abnormal Adjusted: Data from transfers or abnormal events (such as outages) experienced during the 2013 summer peak season.
- Date Adjusted: A date/calendar normalization routine prorating load growth to adjust to the regular calendar year, based on the date the peak occurred in 2013 versus Sept. 15 (a constant date used to represent the end of summer for tool modeling and calculations).
- Generation Adjusted: Where telemetry is available, actual output data from generators is used. For smaller installations (typically less than 1MW), an expected output is calculated.
- DR Adjusted: DR load reduction during the 2013 summer peak season, based on values provided by SCE's DSM-DR programs (see Appendix B).

Assumptions

- To ensure a conservative approach, the forecast assumes SCE will need to supply the "non-dependable" portion of solar PV generation.[2]

Methodology

The SPP development process began by identifying a number of "raw" peaks from the SCADA system information. The peak values were then adjusted to what would be expected if the temperature for the selected day was at the 20+ year mean temperature. The peaks were then corrected for the effects of transfers and abnormal events, and also date-normalized, which prorated load growth based on the date the peaks occurred versus Sept. 15th. Next, a peak day was selected on which the adjusted peak demand best represented the typical peak demand of the corresponding substation.

[2] The "non-dependable" and "dependable" solar PV generation values were calculated by the Distribution Engineering team for solar PV generators sized 1 MW or smaller. These calculations were based on a comprehensive solar PV generation study which the team conducted across the SCE service territory to assess solar PV system output and intermittency (see Appendix A for graphic representations of the results). The portion of the solar PV generation used as "dependable" is dependent on the timing of the peak demand at each circuit or substation. On average, Distribution Engineering has found that approximately 17% of solar PV nameplate generation capacity can be considered "dependable" in SCE's service territory. The amount of PV counted as "dependable" might actually increase pending PRP measurement results. The "non-dependable" generation is the difference between the maximum output as a function of nameplate capacity and the "dependable" portion (minimum). For solar PV generators sized larger than 1 MW, the Distribution Engineering team imputed the actual generation value based on generator telemetry data. Since all 1 MW or greater generators are required to install telemetry, the system output can be measured. In situations where telemetry data is not available, the engineers may impute the information based on the same solar PV study previously mentioned.

Once the SPP day was selected, adjustments were made for actual conditions on the J-S system.

Findings

Based on the methodology described above, the Starting Point Peak Load for the Johanna substation was determined to be 432 MW and for the Santiago substation was 770 MW (rounded up from 769.5).

c. Forecasting of the Distribution Load Growth

The next steps in the design process were forecasting load growth for the Johanna and Santiago substation areas and developing projected area peak loads through 2022. Forecasting of load growth across SCE's service territory is an annual process conducted by SCE for distribution system planning purposes. The load growth forecasting and subsequent load projection process is a "bottom-up" process that aggregates expected load growth up from the circuit level to B and A substations:

Inputs

- Base growth, based on expected new load sources (that is, new residential, commercial, or industrial developments).
- "Dependable" solar PV generation based on expected PV penetration nameplate data per circuit and projected dependable output at the time of the circuit peak.
- Electric Vehicle (EV) impact based on expected EV penetration per circuit and projected demand curves for each year in the forecast at the time of the circuit peak.
- Energy efficiency impact (based only on lighting[3] and SmartConnect programs), and
- Expected permanent load transfers. This input occurs after load growth forecasts are completed and is used to develop projected peak loads.

Assumptions

- Only "dependable" solar PV generation can be reliably counted on for load growth projections.
- Lighting-related EE savings were proportionally allocated to circuits based on an assumption of 95% residential and 5% commercial energy use for 2014. The SmartConnect EE savings figures were proportionally allocated to circuits based on an assumption of residential energy use only.
- A 1-in-5-year heat storm adjustment was used for A substation peak forecasting.

Methodology

In order to develop load growth forecasts, a detailed assessment was conducted of all potential sources of load growth in the Johanna and Santiago substations through the year 2022, starting at the circuit and substation levels. This effort provided an estimate of the

[3] The lighting component of EE impact is based on AB 1109, Huffman. Energy resources: lighting efficiency: hazardous waste, at http://www.leginfo.ca.gov/pub/07-08/bill/asm/ab_1101-1150/ab_1109_bill_20071012_chaptered.pdf

expected additional load SCE will likely need to serve. These incremental new loads can come from expected new residential, commercial, and industrial developments and projects. Historical growth trends in the area were also considered and adjustments made to the load growth number to reflect their impact. The outcome of this process is considered the "base" growth.

Subsequently, the forecasted "dependable" solar PV generation and energy efficiency MW were subtracted from the base growth, while the incremental increase in demand due to increasing penetration of EVs was added to the base growth. The net result of this step yielded the growth forecast for Johanna and Santiago areas.

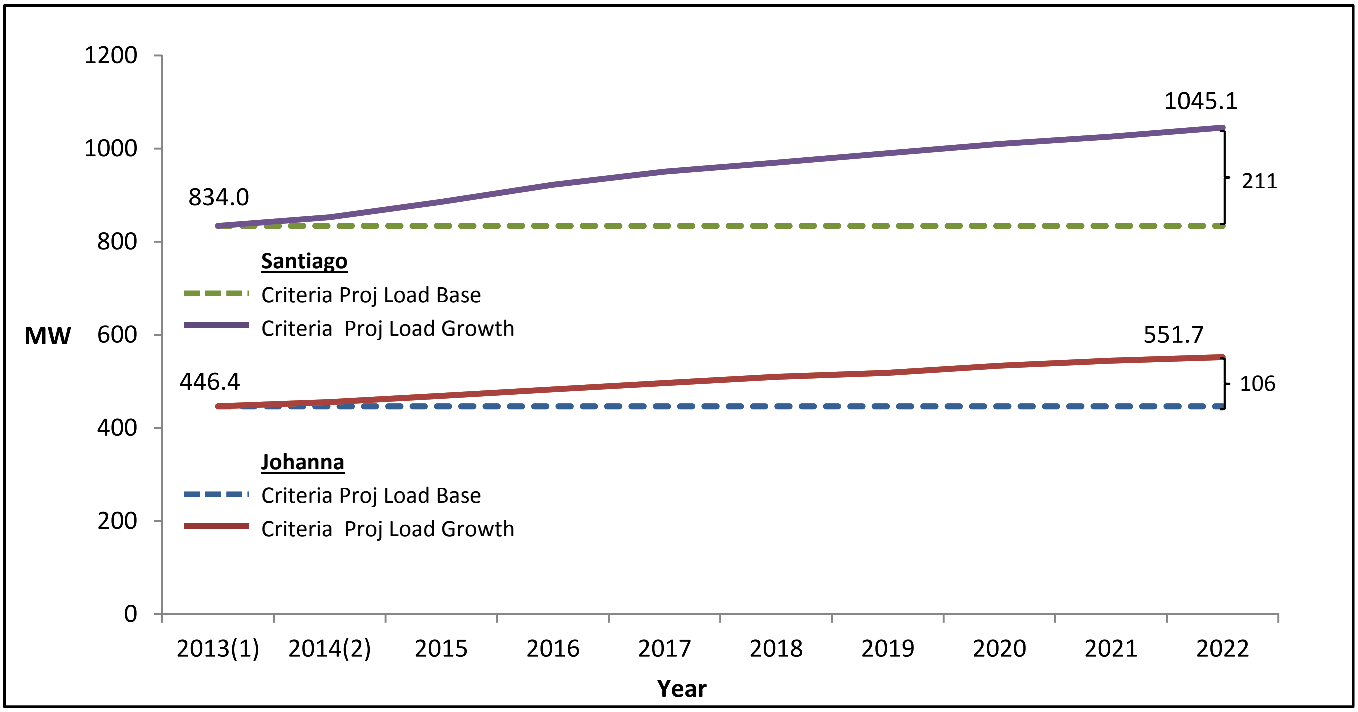
The next step in the process was to use the growth forecast values to develop projected loads for Johanna and Santiago through 2022. This was achieved by adding the growth forecast to the starting point peaks to develop the total projected loads. However, before finalizing the projected loads, two more adjustments were necessary:

- One adjustment involved accounting for any expected permanent load transfers by incorporating the impact of any such transfers into the projected loads.
- The other was to incorporate the 1-in-5-year heat storm adjustment to develop the final design criteria, based on the projected load forecasts for Johanna and Santiago. It should be noted that the 1-in-5-year heat storm adjustment may create a more conservative forecast.

Findings

Figure 4.2 provides a graphical representation of load growth in the Johanna and Santiago substation areas. These values show an approximate annual average load growth of ~30 MW for the two substation areas.

Figure 4.2: Forecasted Criteria Projected Load Growth — Johanna-Santiago Substation Area



d. Development of Johanna and Santiago Substations 2022 Load Shapes

In order to define the types of preferred resources required, it was necessary to understand the forecasted load shapes for Johanna and Santiago substation areas in 2022. These load shapes would enable the identification of the needs that could be met with PRs.

Inputs

- Distribution peak load (A-bank) forecasts for Johanna and Santiago areas through 2022.
- Historical substation-level hourly load data (average and peak) for Johanna and Santiago, based on SCADA system information for the period 2008-2013.

Assumptions

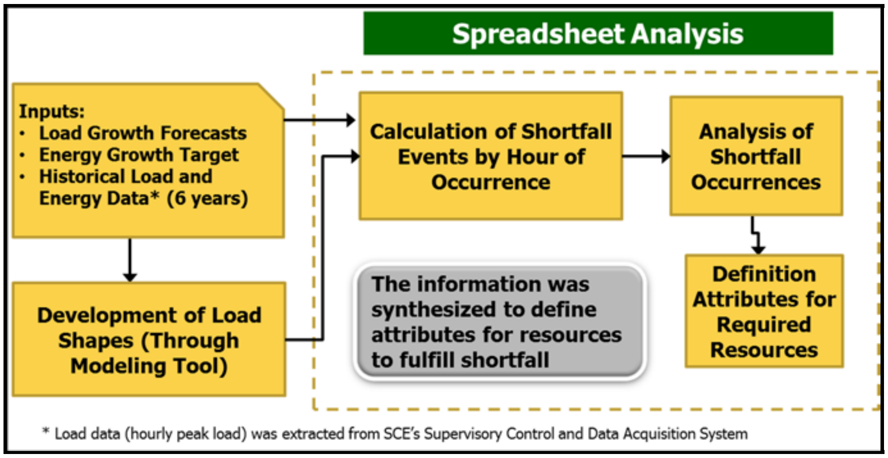
- Sufficient resources exist to meet the Johanna and Santiago loads up to their respective historical peaks. Resources assumed included imports as well as local J-S supply and demand resources.
- Historical usage patterns and load shapes were used as the basis for developing forecasted future load shapes. However, this process may not capture the possible future impacts of several factors, such as EV usage patterns, which are not sufficiently understood at this point.

- To account for potential changes in future load shapes and patterns a "conservative" historical shape was used. The conservative shape was characterized as having the most events demonstrating resource need.
- Separate load shapes for Johanna and Santiago were developed (rather than a single "aggregated" J-S load shape), since at present there is limited ability to re-distribute load between the two substations. Using an aggregated load shape could result in misleading need and resource attribute information, due to the limited capability of the physical system to redirect load and to share supply resources effectively. For example, in a hypothetical situation where Johanna has a need and Santiago has a surplus, aggregated analysis would show no combined J-S need, while in reality, there would be an unmet need at Johanna.

Methodology

The input data was processed using the Plexos modeling tool to escalate the historical hourly loads to 2022 peak forecast levels. The energy usage growth rate (a.k.a.: energy growth target) was derived based on the historical Johanna and Santiago loads. These factors were used to develop the hourly 2022 load shapes. Using an energy growth target in addition to peak load targets ensured that the forecast load shapes did not overestimate the total (yearly) energy. An evaluation of the resulting Johanna and Santiago load shapes resulted in the selection of the profile based on the 2008 historical shape, which was the most conservative since it resulted in the most events demonstrating a resource need. The entire process of defining forecasted load shapes and development of required attributes (described in the next section) can be seen in Figure 4.3.

Figure 4.3: Process Used for Development of Load Shapes and Resource Attributes



Findings

The work performed in this step created the forecasted 2022 load shapes for Johanna and Santiago, shown in Figures 4.4 and 4.5 below. These load shapes were necessary to enable the next step in the process, which involved defining the expected 2022 needs and identifying the preferred resource attributes required to meet these needs.

Figure 4.4: 2022 Forecasted Load Shape for Johanna Area

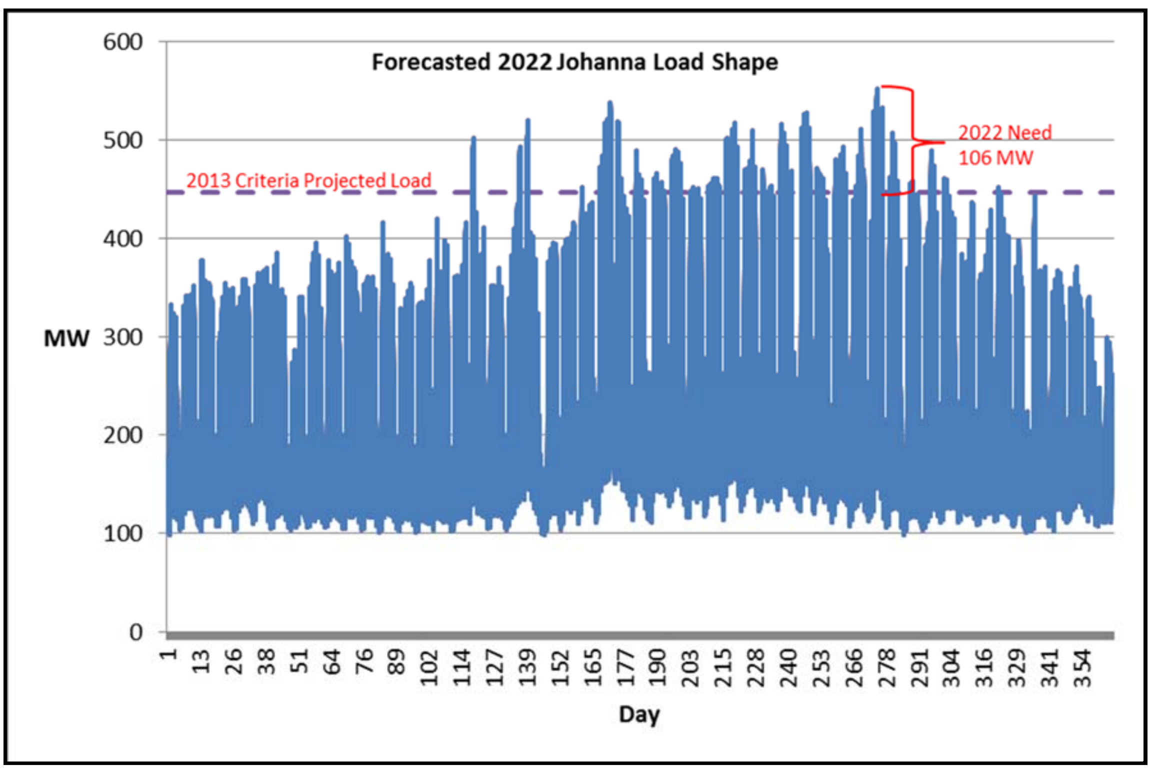
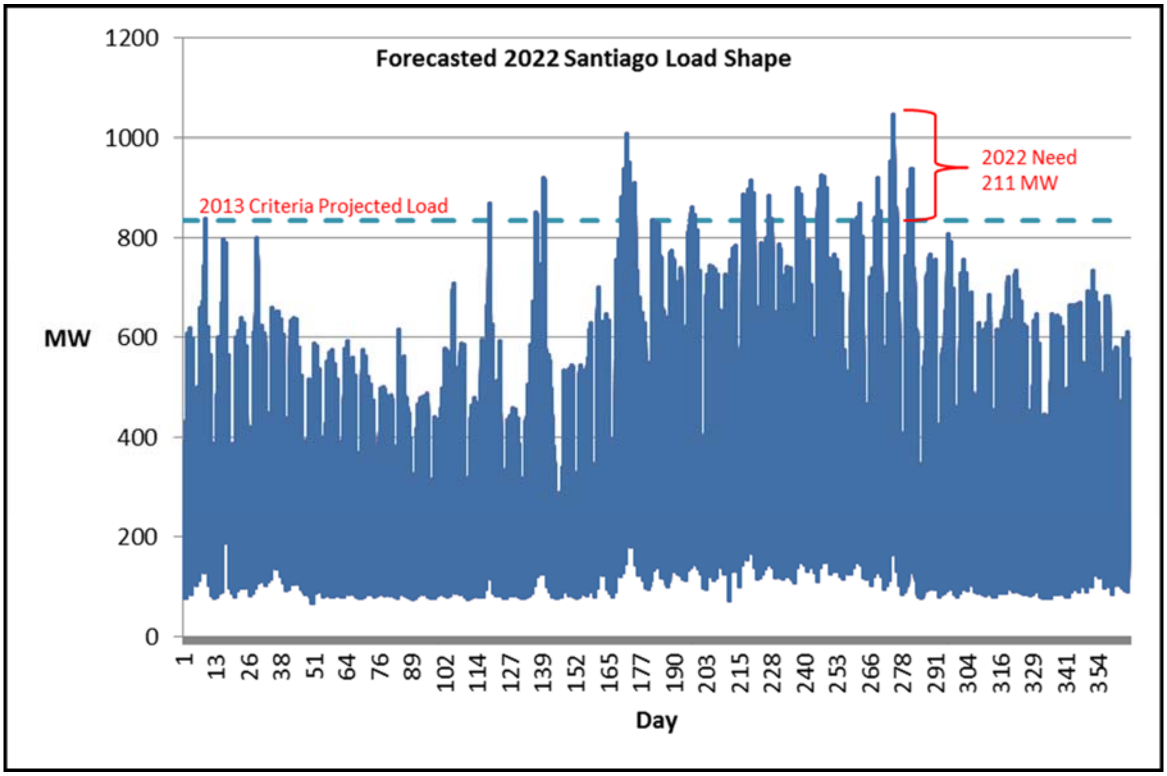


Figure 4.5: 2022 Forecasted Load Shape for Santiago Area



e. Development of Preferred Resources Attributes

Once the 2022 forecasted load shapes for Johanna and Santiago were developed, the team began identifying the likely resource needs and/or shortfalls in 2022 and determining the resource attributes (quantity, duration, frequency, timeframe / season, and time of day) required to meet those locational needs.

<u>Inputs</u>

- 2022 forecasted load shapes for Johanna and Santiago.
- 2013 forecasted load.

<u>Assumptions</u>

- Sufficient resources exist to meet the Johanna and Santiago loads up to their respective historical peaks. This includes imports as well as local J-S supply and demand resources.
- Historical usage patterns and load shapes were used as the basis for developing forecasted load shapes. However, this process may not capture the possible future impacts of several factors, such as EV usage patterns, which are not sufficiently understood at this point.
- To account for potential changes in future load shapes and patterns, and the limitations in using only six years of historical data, the historical shape causing the most shortfall events was used.

- Separate resource attributes for Johanna and Santiago were developed (rather than a single aggregated J-S set of attributes), since at the time of the analysis there was limited ability to re-distribute load between the two substations. Using an aggregated load shape could result in misleading need and resource attribute information due to the limited capability of the physical system to redirect load and to share supply resources effectively, as mentioned in Section 4.d, above.

Methodology

The analysis began with the 2022 forecasted load shapes for Johanna and Santiago, and subtracted the 2013 forecasted peak loads for each respective substation. This process enabled isolation of that portion of each load shape that was above the substation's 2013 projected peak load. This portion of each load shape represented the gap that needed to be offset and/or managed through the addition of preferred resources. The process and the 2013 Criteria Projected Load line are depicted in Figures 4.4 and 4.5, above.

Once the need portions of the load shapes were identified, the primary attributes were deduced from these "isolated" portions of the graphs, including the following:

- Quantity: number of MWs of preferred resources required
- Duration: 2 hours, 4 hours, 6 hours, or 8 hours of preferred resources required
- Frequency: number of times or days resources are required
- Timeframe/season: preferred resources requirements in different months and/or seasons of the year, and
- Time of Day: specific times.

This analysis provided "indicative" results which have an inherent degree of uncertainty because the analysis was based on inputs that include 9-year-forward peak forecasts and a limited volume of historical load shapes, with the assumption that these are representative of future loads. However, with each reiteration, the resulting set of attributes will become more accurate.

Findings

Some of the key findings of the attribute analysis step have been summarized below:

- Overall, the estimated value of the Johanna substation area need was found to be 106 MW of preferred resources by 2022, while the estimated value of the Santiago area need was found to be 211 MW (as depicted in Figures 4.4 and 4.5, above).
- Table 4.4A identifies the MW necessary to meet all forecasted need for 2022. Built from the bottom up, the MW required correlate to the duration of need, first for any need greater than 6 hours, then 4-6 hours, then 2-4 hours, and finally between 0-2 hours. A portfolio of preferred resources designed to meet the MWs required on Table 4.4A will also meet the expected load growth.
- Table 4.4B depicts the amount of MW required to meet any need in 2022 above the 2013 baseline — in other words, the expected load growth. SCE forecasts that in the year 2022 there will be 81 days with a need of greater than -0- MW, 11 days with a need

greater than 70 MW, 3 days with a need greater than 85 MW, and one day where the need is greater than 100 MW.

- Table 4.4C divides the total number of days with need into exclusive groupings by duration. This can be interpreted as saying that there are only 7 days with a need lasting between -0- and 2 hours. All days with durations of more than (>) 2 hours are not included in the 0-2 hour category; instead, they are only counted in their respective grouping.
- Each table cannot be directly related to the others. For example, Table 4.4A should not be associated with Table 4.4C, as it would be incorrect to state that there are 39 days where we expect to need 70 MW for > 6 Hours. Instead 70 MW of > 6-hour need can be considered the most extreme event to have occurred.
- Figures 4.7 and 4.8 depict the 2022 hourly MW need for the forecasted peak day by respective substation.

Table 4.4A: 2022 Forecasted Peak Resource Attributes

MW Required to Meet Peak		
Duration	Johanna	Santiago
	MWs Required	MWs Required
0-2 Hours	5 MW	10 MW
2-4 Hours	15 MW	50 MW
4-6 Hours	15 MW	50 MW
> 6 Hours	70 MW	100 MW

Table 4.4B: Forecasted MWs Required to Meet Any Need in 2022

Annual MW Requirements			
Johanna		Santiago	
MWs Required	Days	MWs Required	Days
> 100 MW	1	> 200 MW	1
> 85 MW	3	> 150 MW	2
> 70 MW	11	> 100 MW	6
> 0 MW	81	> 0 MW	36

Table 4.4C: Estimated Resource Attributes for Johanna and Santiago Substation Areas

Annual Duration Requirements		
	Johanna	Santiago
Duration	Days	Days
0-2 Hours	7	5
2-4 Hours	16	5
4-6 Hours	19	12
> 6 Hours	39	14

Figure 4.7: Johanna Substation Hour-Ending Forecasted MW Need

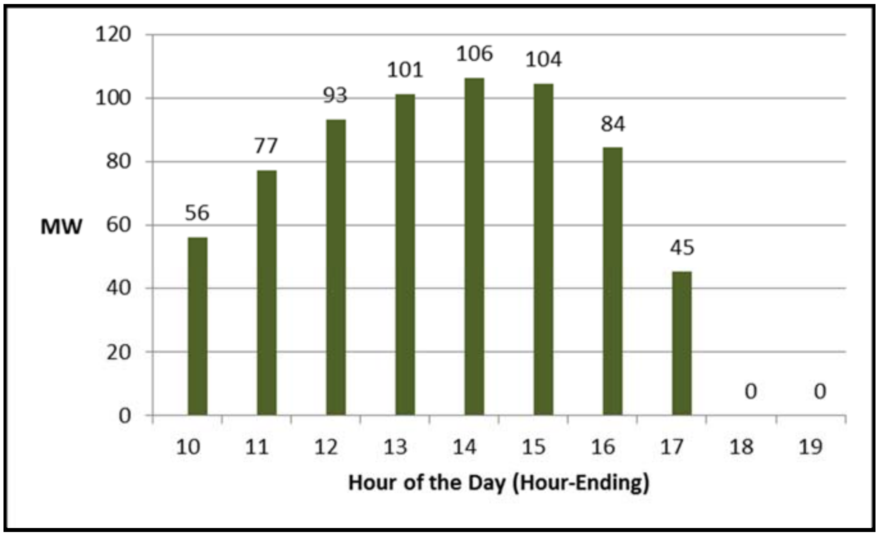
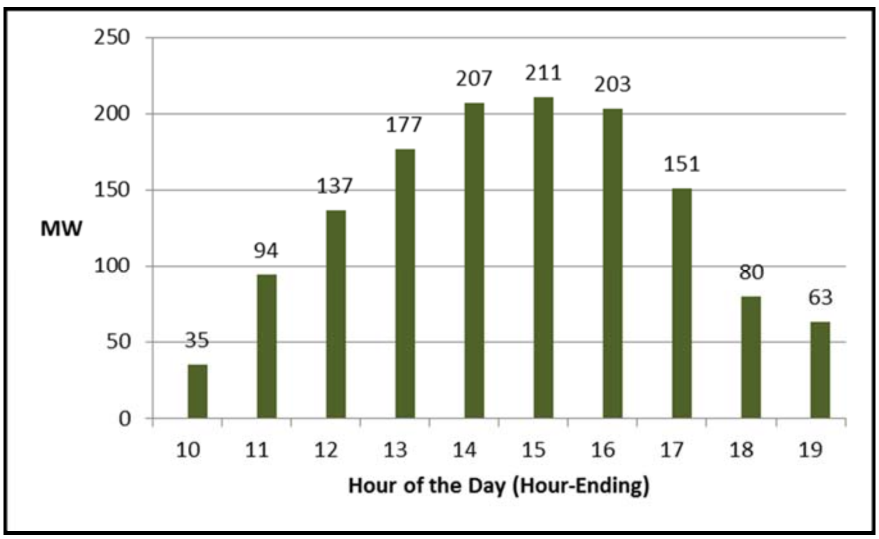


Figure 4.8: Santiago Substation Hour-Ending Forecasted MW Need



f. Identification of the Preferred Resources DSM Market Potential

After determining the preferred resource attributes, it was necessary to study the market potential for DSM preferred resources in the J-S area. The market potential for Demand Response (DR) and Energy Efficiency (EE) are discussed separately in this sub-section due to differences in approach. The DSM Market Potential details are included in Appendix C.

However, while various studies explore solar PV generation potential, these studies tend to focus on surface area and not on viability for development in the J-S region. Additionally, the market potential for any type of combined heat and power or fuel cell (CHP- or FC-powered from gas or renewable sources) has yet to be determined in sufficient detail. As a result, this version of the PRP Portfolio Design Report does **not** include data on solar, CHP, or FC.

The DR and EE market potential study results provided in this report address the period 2014 to 2017. The PRP DSM Potential and Targeting Analysis provided additional information on the process to develop the market potential for each component of DSM.

Demand Response (DR) Market Potential

Inputs

- Detailed customer usage and load data obtained from SCE's AMI system.
- Customer rates.
- System peak.
- Historical DR participation records for J-S.
- 2012 DR load impact results.

Assumptions

- Focus of the DR potential estimate was on the segments and customers that contribute most to peak load.
- Market potential is based on M&V measures. True value actual measurement may be different.

Methodology

The approach used began with the development of a set of targeting criteria to identify customer segments and individual customers that contribute the most to peak load, as well as segments with end uses that were weather-sensitive. This step involved selection of factors that were relevant to DR and could be used to quantify characteristics of segments, customer profile, and customer usage. The four selected factors were the following:

- J-S coincident peak factor.
- DR eligible load.
- Aggregate J-S coincident peak load.
- Average J-S coincident peak load.

Weights were assigned to these factors, based on their perceived level of importance, and the customer segments then received a composite score based on these factor weights. Once scored, the segments could be ranked and the team could focus on the highest-ranked segments to identify the customers offering the largest DR potential. Finally, the average 2012 DR load impact results for similar customers and customer segments were applied to the high-potential customers to determine the DR potential for each customer and each sector. Summing the DR potentials for these top target customers provided the aggregate DR potential for J-S.

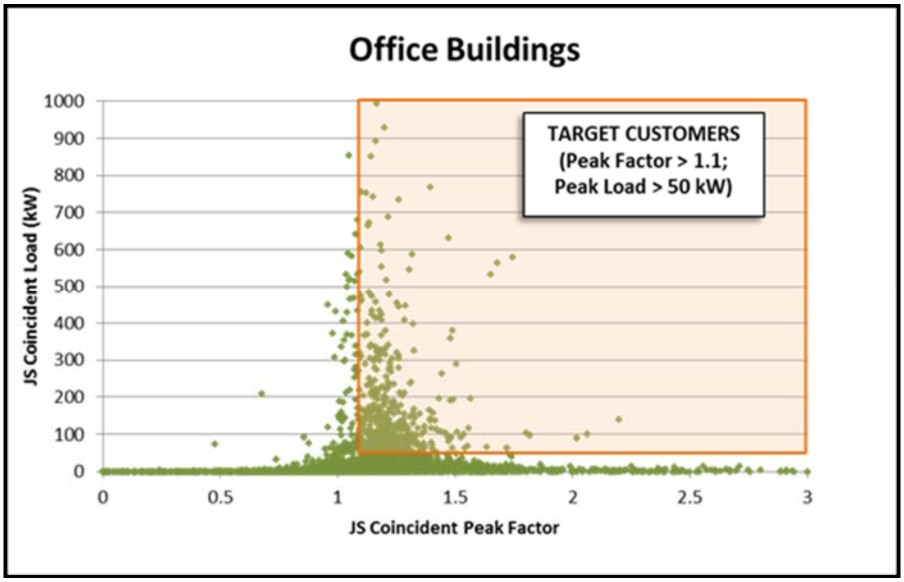
It should be noted that customer willingness or ability to participate was not factored into the DR potential analysis. As a result, the estimates provided represent the "technical" DR potential. Future refinements to include a criterion for estimating likelihood of customer participation would improve the accuracy of the DR potential estimate.

Table 4.5 below shows the top 10 DR priority segments, while Figure 4.9 provides an example of the methodology used to identify the top target customers within each segment.

Table 4.5: Top 10 Target Segments Based on DR Potential in J-S

Top 10 Target Segments for DR	
Segment	**Rank**
Office Buildings / Large & Small	1
Residential - Single Family	2
All Other Commercial	3
Hotels & Motels	4
Water Agencies	5
Food Stores / Refrigerated Warehouses	6
Retail Stores / Large & Small	7
Schools	8
Other Warehouses	9
Colleges & Universities	10

Figure 4.9: Example of Methodology Used to Identify Target Customers



Findings

The key findings from the DR potential study are summarized as follows:

- 81 MW in technical potential DR peak load reduction is estimated, based on 1,202 customers identified as "good candidate" DR participants.
- Many large commercial and industrial customers already participate in SCE's Base Interruptible Program (BIP).
- Targeting DR efforts on the top-ranked commercial and industrial segments is likely to be a cost-effective way to meet PRP goals, given that a relatively small number of these non-residential customers drive J-S peaks.
- Additional work is required to refine the DR potential by incorporating "propensity to participate" into the analysis.

EE Market Potential

Inputs

- 2013 California Energy Efficiency Potential and Goals Study.
- 2009 California Residential Appliance Saturation Study.
- Numbers and types of commercial customers in J-S, and.
- 2010-12 Commercial Saturation Survey / Commercial Market Share Tracking Survey (CSS/CMST).

Assumptions

- Only rooftop Heating, Ventilation, and Air Conditioning units (HVAC RTUs) were included in the EE potential study because they comprise the largest share of the commercial HVAC market, thus representing the commercial HVAC measure with the highest achievable potential in the target market

- Other measures selected for inclusion in the EE potential analysis, based on end-use saturation and EE potential, include commercial lighting, residential pool pumps, and residential HVAC, and
- Seasonality, EE potential, and average summer on-peak load were chosen as the most relevant factors for selecting top-priority customer segments for EE.

Methodology

The methodology used to derive the EE market potential was very similar to that described above for DR, involving identification of high-value target customer segments and end uses for peak demand reduction, selection of top weather-sensitive non-residential segments, and development of EE potential estimates based on target end uses and segments. This relied on information obtained from the studies and reports listed under "Inputs," above. In determining the EE potential for commercial HVAC and residential pool pump measures, the studies identified in the "Inputs" section were used to estimate the number of commercial RTUs and pool pumps in the target area and the estimated efficiency level of equipment stock. Market potential was developed by estimating the savings that would result from replacing less efficient HVAC and pool pump equipment with more efficient equipment. For commercial lighting, the results from the 2013 EE Potential and Goal study was used for Climate Zones 6 and 8. Table 4.6 below shows the top 10 EE segments.

Table 4.6: Top 10 Target Segments Based on EE Potential

Tier 1 - Top Target Segments for EE	
Segment	**Rank**
Office Buildings / Large & Small	1
Retail Stores / Large & Small	2
Restaurants	3
Schools	4
Other Warehouses	5
Hospitals / Medical Facilities	6
Colleges & Universities	7
Food Stores / Refrigerated Warehouses	8
Residential – Single-Family	9
Residential – Multifamily	10

Findings

The following conclusions were drawn from the EE potential study:

- 65 MW in technical potential EE peak demand reduction can be achieved through the identified top segments.
- Primary focus should be on commercial HVAC and lighting loads for each sector, since these represent the highest-value target measures.
- Roughly 15-20% of J-S commercial customers participated in EE programs between 2010 and 2013. However, most of these customers installed lighting measures, indicating potential for HVAC EE retrofits.

- The commercial sector is the most promising area for EE to impact peak load:
  - Commercial HVAC is the end-use with greatest potential
  - SCE's HVAC Early Replacement program targets this sector and end-use
  - Commercial lighting also remains a viable end-use for load reduction. In addition, SCE's Direct Install EE program plans on targeting large commercial customers in J-S for lighting retrofits during 2014 and 2015.
- Residential pool pumps represent another viable end-use for peak load reduction.
- Residential HVAC is not a high-value target due to uncertainty of usage and the potentially high cost of reaching the large and diffuse customer base.

g. Determination of the Preferred Resources Selection for the PRP Portfolio

The final step in the portfolio design process involves a "best fit" selection of preferred resources. This step relied on the work performed up to this point to forecast load growth in J-S, define the required resource attributes, and estimate availability of at least some preferred resources through the market potential studies.

The findings described below represent the starting point for the acquisition of preferred resources. As preferred resources are added to the PRP region J-S substations and to our tracking and measurement process, the ability to acquire the resources, the delivery performance results, and the cost of the resource will inform future acquisitions.

The preferred resource portfolio is aligned with the Loading Order[4] and also supports the reduction of greenhouse gases. Since there is limited distributed generation in the PRP region, it may be difficult to acquire generation resources that will not contribute to greenhouse gas generation (GHG) when deployed. Initial preference is given to preferred resources that do not rely on natural gas (EE, DR, all PV, ES, R-CHP, R-FC), but other resources such as CHP and FC resources may be acquired to support the PRP objectives. Three alternative scenarios or "Cases" were developed on this final step: Recommended, Low EE and DR, and High EE and DR

<u>Inputs</u>

- Required preferred resources by hour associated with the forecasted highest peak day in 2022.
- Market potential for various resources.

<u>Assumptions</u>

- Energy efficiency is assumed to have a flat load shape to simplify analysis. The Low Case assumes that market barriers limit the ability to acquire the EE market potential. The 65 MW market potential reflects selected EE programs specifically measured in the PRP. The contributions from the remaining EE programs are embedded into the load growth slope.

[4] See Footnote 1, above.

- DR is deployed in four-hour blocks and is used to reduce the peak. Based on the frequency of calls indicated by the attributes analysis, the DR product is expected to meet all of the 0-4 hour needs in the Recommended Case. All Cases assume sufficient program changes to cause increased customer participation over the current stable DR program estimate of 32 MW.
- BTM PV is based on CSI trends and a Low Case was assumed due to the planned incentives reduction.
- IFTM PV and Energy Storage are assumed to fill the MW gap. IFTM PV addresses 75% of the need based on current maturity of the technology. However, over time this percentage may change.
- Solar load shape for BTM and IFTM was developed by using a production profile based on actual solar PV output measured for June, 2014 (from 6/4/14 to 6/30/14) in the PRP. This will be updated as more data becomes available. A higher level of PV procurement is assumed to account for PV's capacity factor, and the actual expected energy delivered to the grid rather than the nameplate capacity.
- Energy Storage assumes a 4-hour storage product that is not all used in the same continuous 4-hour block and has the potential of daily dispatchability. Energy storage is used to reducethe peak when DR is not available or used to fill small gaps.
- CHP and FC are not included in this initial preferred resource but will be considered in future iterations.
- Since the reliability need is in 2022, it will be recommended to acquire these resources over time. The first acquisition recommendation will be for the combined J-S region, and any constraints that require more resources in one substation over another are assumed to be minimal to non-existent.
- Three preferred resources availability scenarios were developed to determine potential portfolio options. The assumptions are summarized in Table 4.7.

Table 4.7: Preferred Resource Availability Scenarios

Resource Type	Low Case	Recommended	High Case
EE – 65 MW Market potential	50%	100%	150%
DR – 81 MW Market Potential	75%	100%	125%
BTM Solar – 45 MW Residential regional trend (Nameplate)	125%	150%	175%
IFTM Solar	Amount needed to fill greater than 2 hour blocks		
Energy Storage	Amount needed to reduce the peak when DR is not available or used to fill small gaps		
CHP	*Next portfolio iteration – April 2015*		
FC	*Next portfolio iteration – April 2015*		

Methodology

The selection of best-fit preferred resources for the PRP portfolio was conducted by matching the required preferred resources by hour associated with the forecasted highest peak day in 2022. The selections for the three scenarios (Cases) were developed based on the assumption.

Findings

- All three scenarios summarized in Table 4.8 and depicted in Figures 4.10-4.12, below, result in a diverse portfolio of preferred resources that can meet expected load growth.
- The High EE and DR Case requires about half of the IFTM PV and Energy Storage resources when compared to the Low EE and DR Case.
- In terms of GHG, the Low EE and DR Case could result in the greatest GHG increase, given the increased reliance on Energy Storage (90 MW).
- The Recommended Case as a starting point for building a PRP portfolio has a moderate reliance on IFTM PV and Energy Storage. The MW portfolio size assumes nameplate capacity for generation resources and since output is less than nameplate, more MW are required.

Table 4.8: PRP Portfolio Options for Meeting the 2022 Forecasted Peak Load

Resource Type	Low Case	Recommended	High Case
EE	33 MW	65 MW	98 MW
DR	61 MW	81 MW	101 MW
BTM PV	56 MW	68 MW	79 MW
IFTM PV	175 MW	150 MW	70 MW
Energy Storage	90 MW	55 MW	45 MW

Figure 4.10: Recommended PRP Portfolio

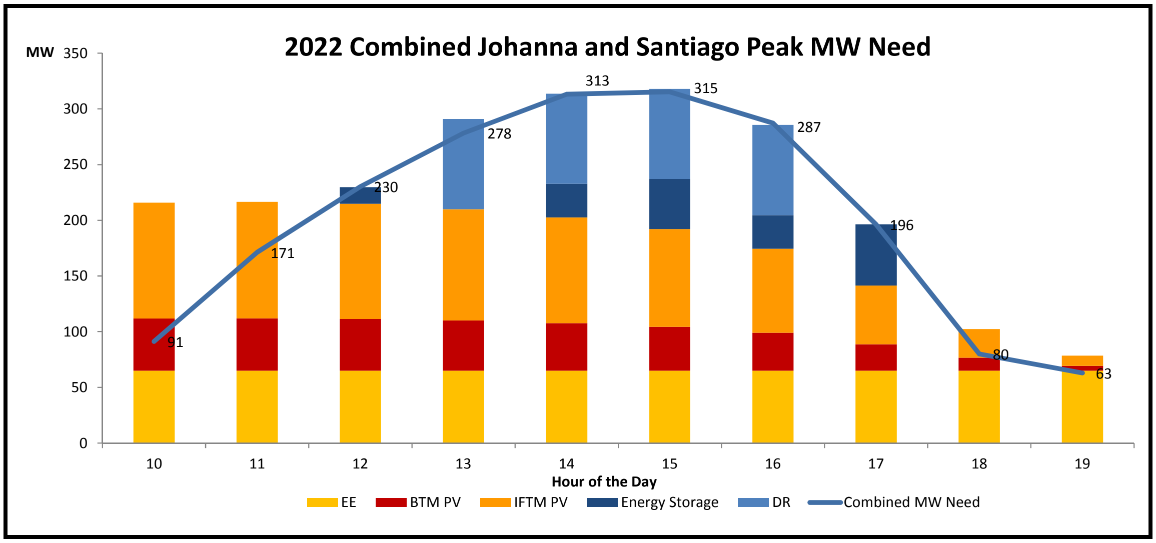


Figure 4.11: Low DSM Delivery Case PRP Portfolio

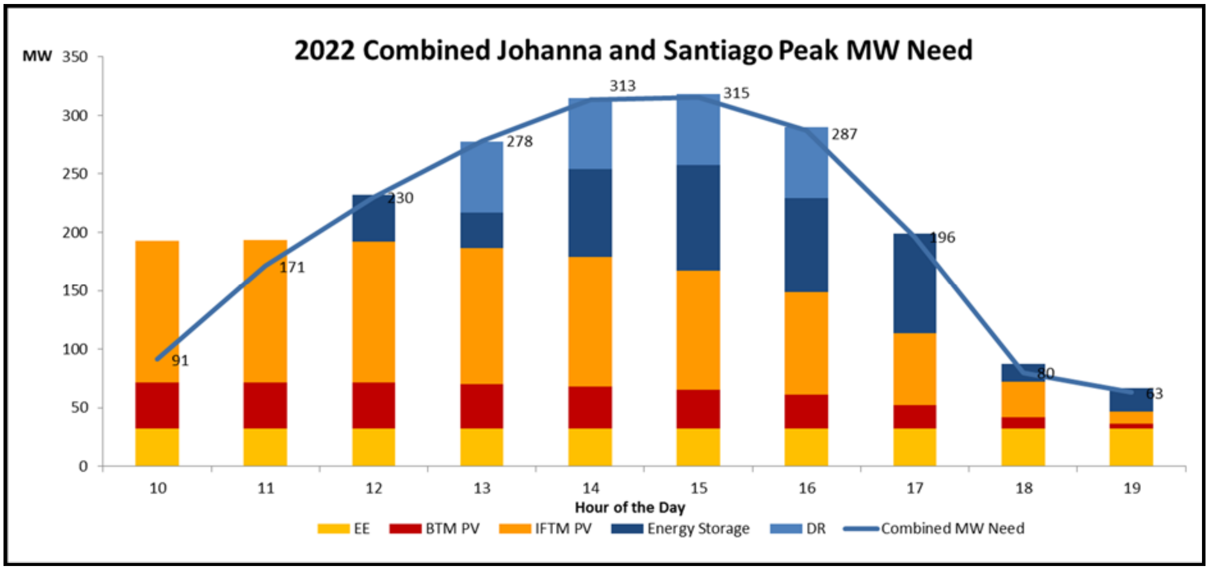
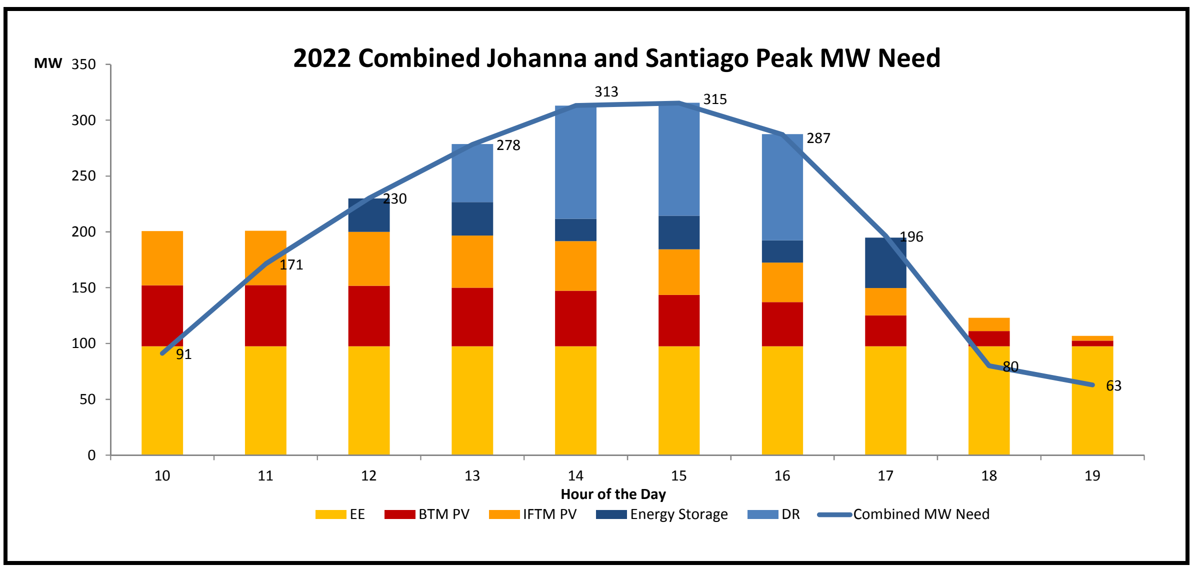


Figure 4.12: High DSM Delivery Case PRP Portfolio



A staged acquisition approach will help fill gaps at the right time with the right resources while leveraging lessons learned from ongoing acquisition activities. Moreover, a concerted effort should be made to acquire sufficient amounts (up to ~39% of the expected need) of preferred resources early to support the PRP's 2017 milestone, which includes two key components, acquisition and measurement:

> **Demonstrate the ability to acquire a mix of preferred resources that meets the 2022 forecasted local needs and measure those resource's capabilities in support of deferral of, or elimination of the need for, new, gas-fired generation in the PRP region.**

Acquiring up to 125 MW (~39% of the expected load growth) by 2017 would serve as an indication of SCE's progress toward meeting the region's 2022 load growth. In terms of the specific resource breakdown to test the ability to acquire resources, there is a greater need to demonstrate distributed generation, demand response, and energy storage can be delivered into the PRP region. In terms of measurement, energy efficiency and energy storage are the two resources with the greatest need for measurement based on limited grid-level impact data available to date. The minimum amounts of each resource type will be highlighted in the PRP's Acquisition Plan.

For acquisition of preferred resources, the following is a recommended staged acquisition approach for the duration of the PRP program based on expected load growth:

	Procurement Periods		
	2014-2016	**2017-2019**	**2020–2022**
Expected Load Growth	125 MW	103 MW	89 MW
	(39% of Need)	(33% of Need)	(28% of Need)

5. Conclusion

The portfolio design processes and methodologies summarized in this report, including consideration of the operational constraints of the Preferred Resources (availability, duration, and intermittency), provide a sound approach for analyzing the type and quantity of Preferred Resources to be acquired to best meet the forecasted increase in J-S area local demand needs.

The forecasted load growth in the PRP area is approximately 317 MW. A portfolio of about 393 MW – 419 MW, depending on the actual deployment of DSM resources, is needed to manage load growth to net zero by 2022. The MW portfolio size assumes nameplate capacity for generation resources and since output is less than nameplate, more MWs are required.

- No single preferred resource can meet all local needs; however, energy efficiency and demand response should be pursued initially consistent with the State's preferred loading order.
- Implementing the achievable DSM potential leaves a resources gap in meeting the PRP's goal of managing load to zero net growth. This resource gap could be met by DG and energy storage.
- The forecast indicates there is one day where the peak need is 317 MW and three days where the resource need is expected to be greater than or equal to 235 MW, in such cases, the existing DR programs should be capable of shaving off the peak, assuming all other preferred resources contribute toward meeting the MW peak.
- Acquiring less than the expected DSM market potential may result in an increase in GHG emissions from the PRP portfolio of preferred resources because more energy storage is assumed to fill the resource need. In the development of the recommended mix of preferred resources, energy storage was shaped to meet the peak need and demand response was assumed to shave off the peak.

Given that this is the first time this approach will be implemented, that the distribution forecast is updated annually, that policies are under review for revision, that the measurement portion of the PRP work will provide data on the dependability of the resources, and that the market is dynamic by nature, this process will be implemented periodically to ensure that PRP resource acquisitions will be appropriately focused. Periodic implementation should also improve the process and could serve as the foundation for local planning in other regions.

6. References

2013 California Energy Efficiency Potential and Goals Study – Revised Draft. California Public Utilities Commission, November 26, 2013.

2009 California Residential Appliance Saturation Study. California Energy Commission, October 2010.

Commercial Saturation Survey. California Public Utilities Commission, August 2014.

Commercial Market Share Tracking Survey (CSS/CMST). California Public Utilities Commission, July 20144

PRP DSM Potential and Targeting Analysis. Southern California Edison, March 5, 2014.

7. Appendices

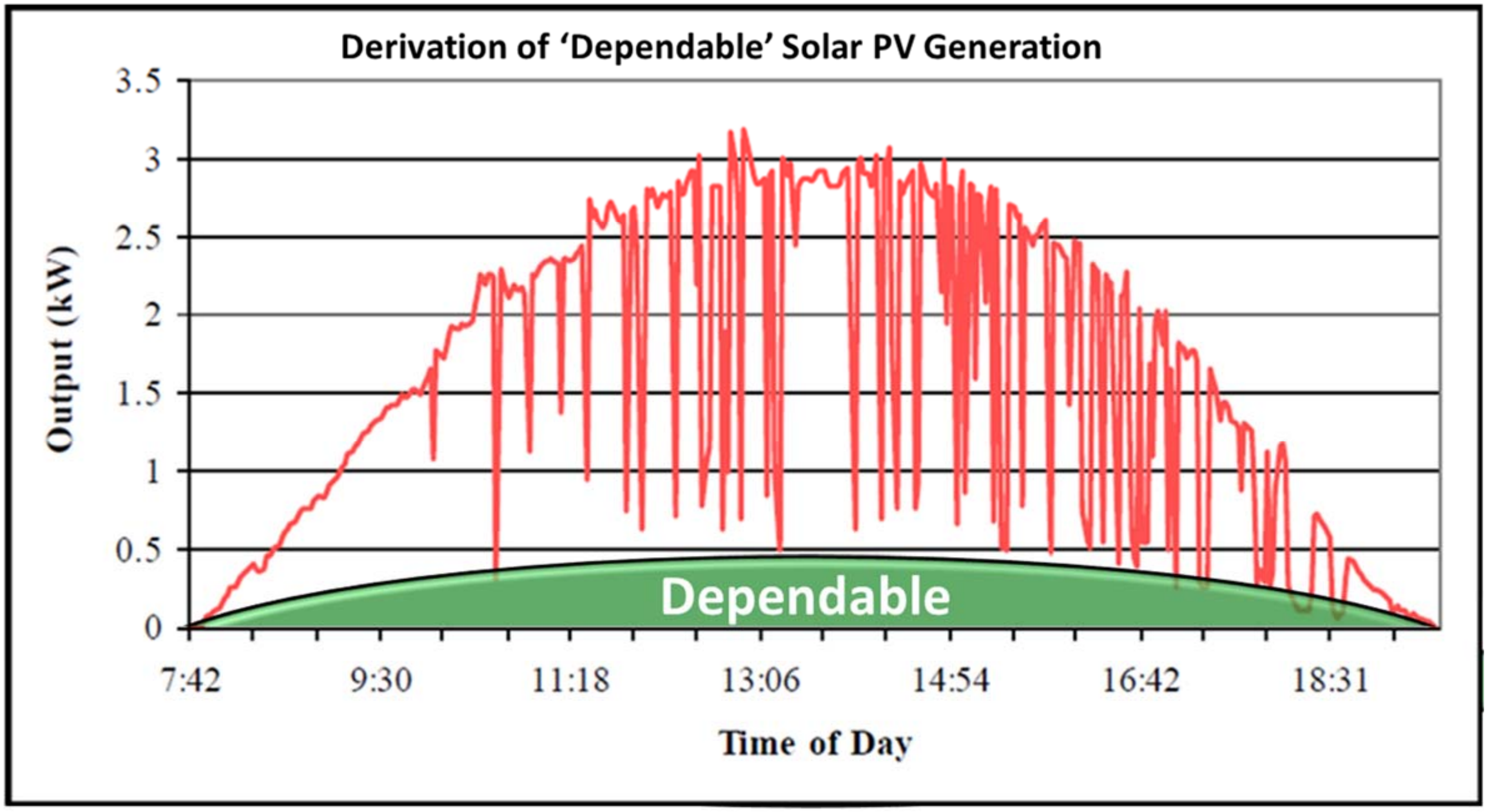
Appendix A. Results of SCE Distribution Engineering PV Study

Appendix B. Estimated Available DR Load Reduction Capacity

Appendix C. PRP DSM Potential and Targeting Analysis

Appendix A

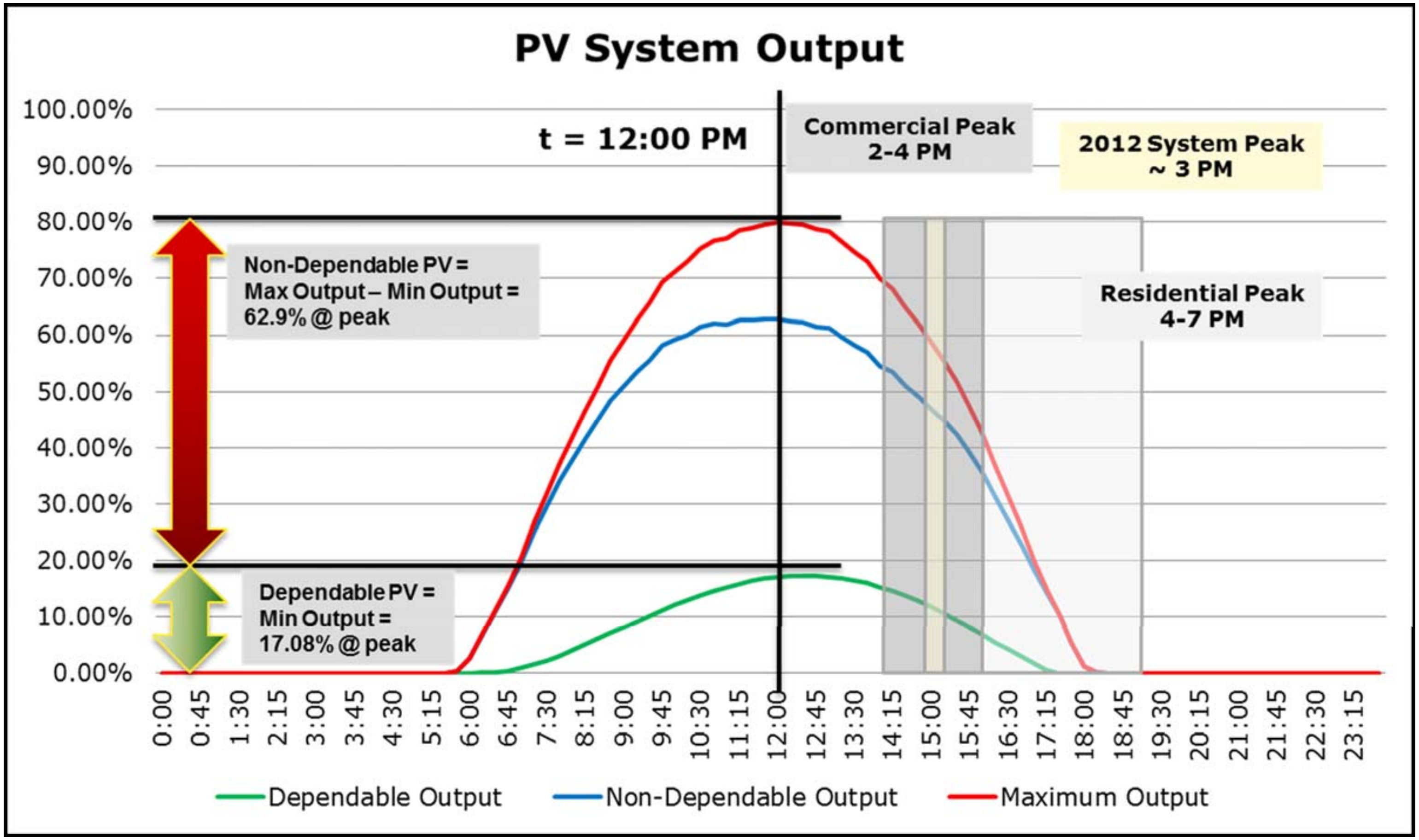
Results of SCE Distribution Engineering PV Study (continued on next page)



Source: CPUC California Solar Initiative 2009 Impact Evaluation

Appendix A

Results of SCE Distribution Engineering PV Study – (continued from previous page)



Appendix B

Estimated Available DR Load Reduction Capacity

Program	Commercial	Industrial	Residential	Agricultural	JOHANNA (MW) Total
Aggregator Managed Program	0.0	0.0	-	0.0	0.0
Agricultural and Pumping Interruptible	-	-	-	0.4	0.4
Base Interruptible Program	3.0	6.2	-	-	9.1
Capacity Bidding Program	0.0	-	-	0.0	0.0
Critical Peak Pricing	0.3	0.1	-	0.0	0.4
Demand Bidding Program	0.6	0.1	-	0.0	0.7
Real-Time Pricing	0.0	0.0	-	0.0	0.0
Summer Discount Plan - Commercial	0.9	0.1	-	-	1.0
Summer Discount Plan - Residential	-	-	1.0	-	1.0
					12.7

Program	Commercial	Industrial	Residential	Agricultural	SANTIAGO (MW) Total
Aggregator Managed Program	0.0	0.0	-	0.0	0.0
Agricultural and Pumping Interruptible	-	-	-	0.2	0.2
Base Interruptible Program	4.6	8.0	-	0.2	12.8
Capacity Bidding Program	0.0	-	-	0.0	0.0
Critical Peak Pricing	0.5	0.1	-	0.0	0.6
Demand Bidding Program	0.5	0.1	-	0.0	0.6
Real-Time Pricing	0.0	0.0	-	0.0	0.0
Summer Discount Plan - Commercial	0.8	0.0	-	-	0.9
Summer Discount Plan - Residential	-	-	4.6	-	4.6
					19.7

Values are in MW and based on Program Year 2012 Load Impact results filed on April 1, 2013.

Source: SCE DSM Forecasting & Cost Effectiveness

Appendix C

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PRP DSM Potential and Targeting Analysis

Analysis completed January 31, 2014

PRP DSM Potential and Targeting Analysis

Objective

- To estimate the potential for demand-side management (DSM) resources to provide peak demand reduction in the areas served by the Johanna and Santiago substations

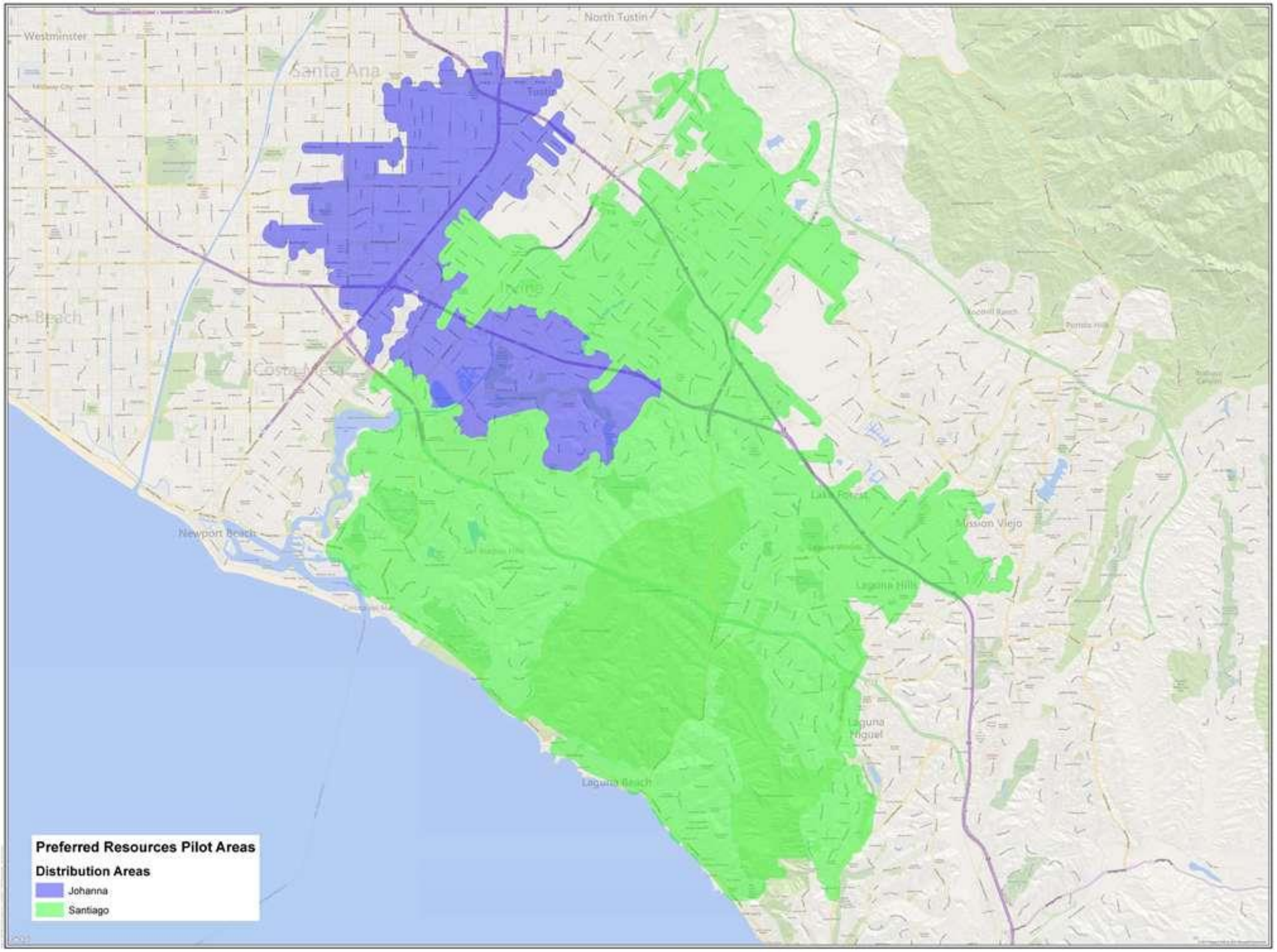
- This analysis provides
  - Identification of key customer segments that contribute to area peak demand
  - Identification of end uses that contribute most to area peaks
  - Targeting of customer segments and individual customers based on criteria set
  - Estimates of energy efficiency and demand response potential of targeted customers

PRP DSM Potential and Targeting Analysis

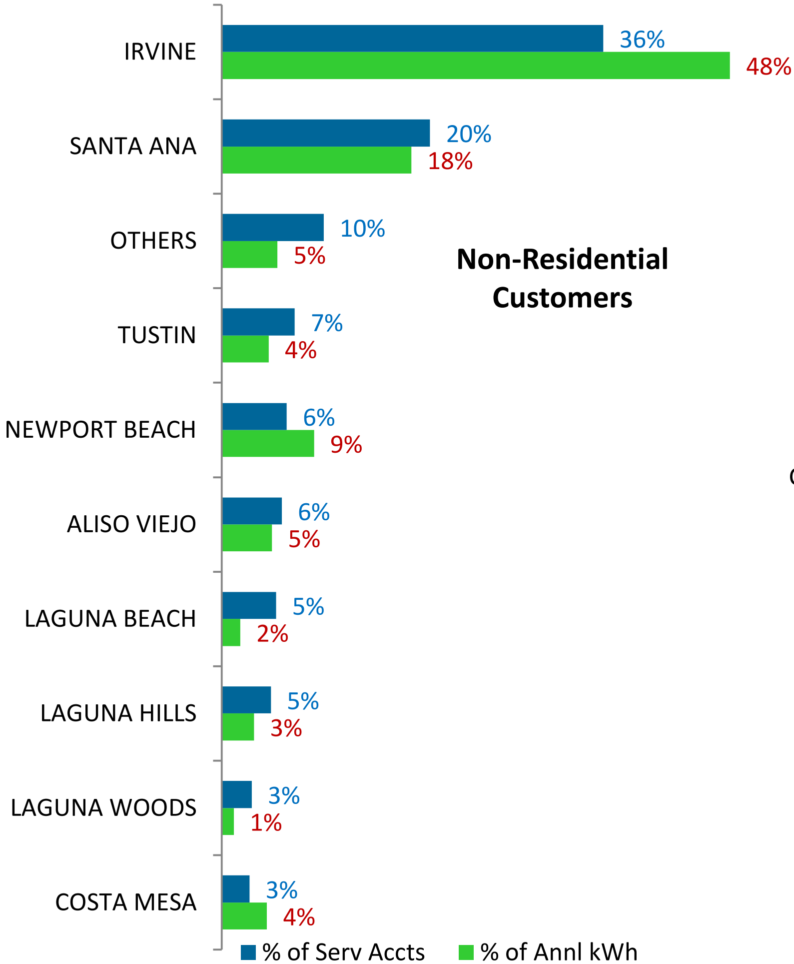
Conclusions and Summary of results

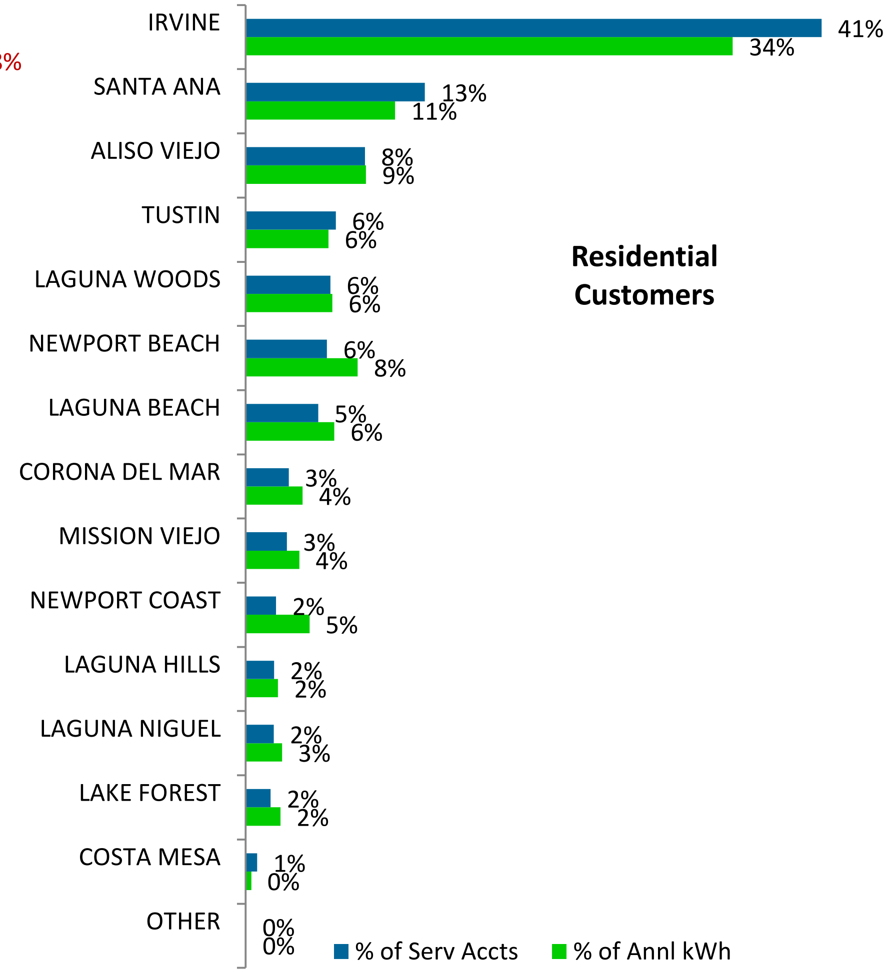
- **65 MW** in potential grid-level EE peak demand reduction can be achieved through target sectors
  - Focus on commercial HVAC and lighting loads for each sector as highest value target measures
- **81 MW** in potential peak demand reduction with **1,202** customers identified as "good candidate" DR participants
  - This 81 MW of potential represents an estimate of DR load reduction that is *technically feasible* if all targeted customers enrolled and participated in DR programs
- Identified top 10 customer segments with highest EE and DR peak demand reduction potential
  - Identified through analysis of customer segments along several criteria including that capture J-S coincident peak contribution, relative seasonal load, and sector EE potential
- **6,000** income-qualified customers identified for potential ESA participation

Target Area: Johanna and Santiago



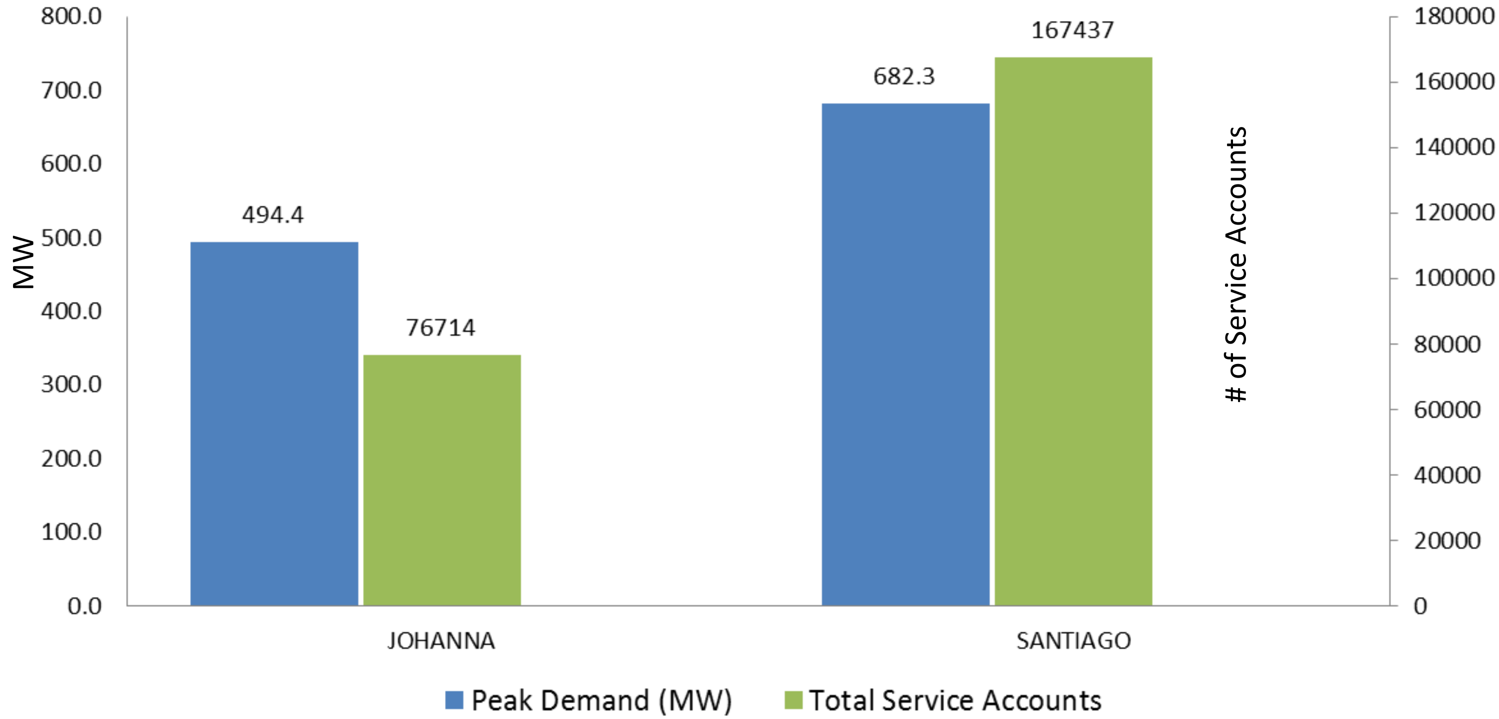
Distribution of Energy Usage & Customer Accounts by City





Customer Composition in J-S Area

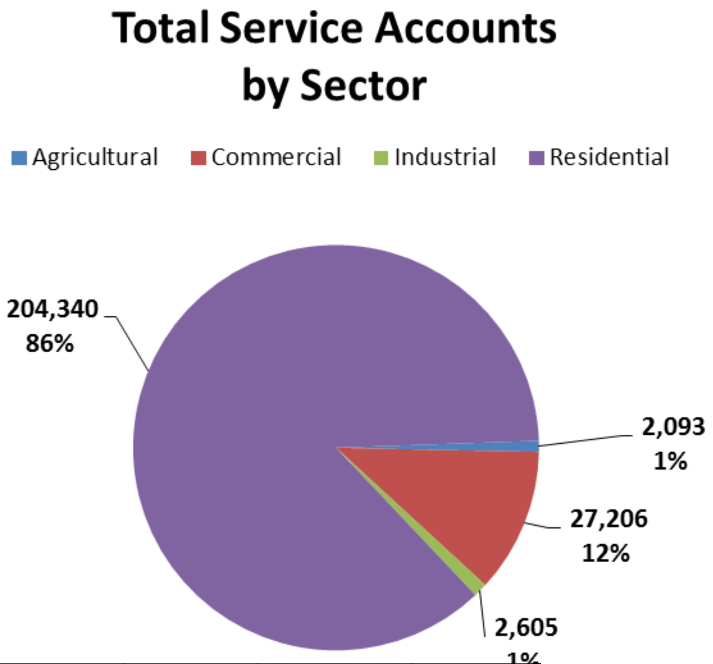
Total Accounts and Coincident Peak MW by A Bank

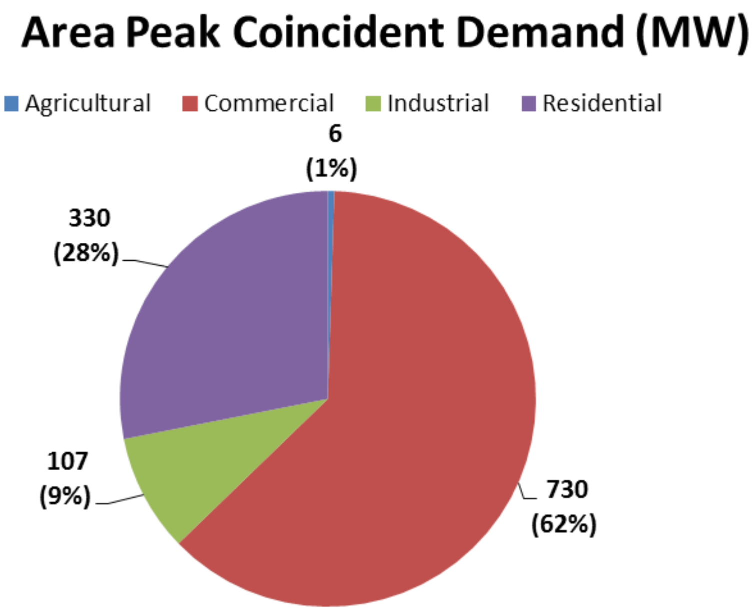


- Greatest number of customers and peak load served by Santiago A-bank

*SmartConnect data not available for 7% of area customers

Customer Composition in J-S Area





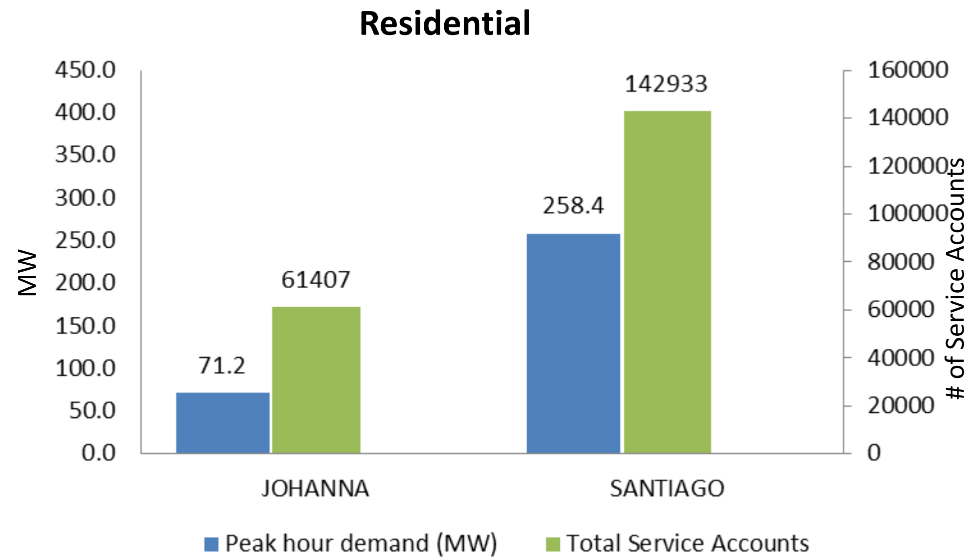
Customer Sectors	Number of Service Accounts	Area Peak Coincident Demand (MW)	Energy Usage (GWh)
Agricultural	2,093	6	78
Commercial	27,206	730	2,740
Industrial	2,605	107	469
Residential	204,340	330	1,146
Total	**236,244**	**1,173**	**4,433**

3% of accounts not categorized

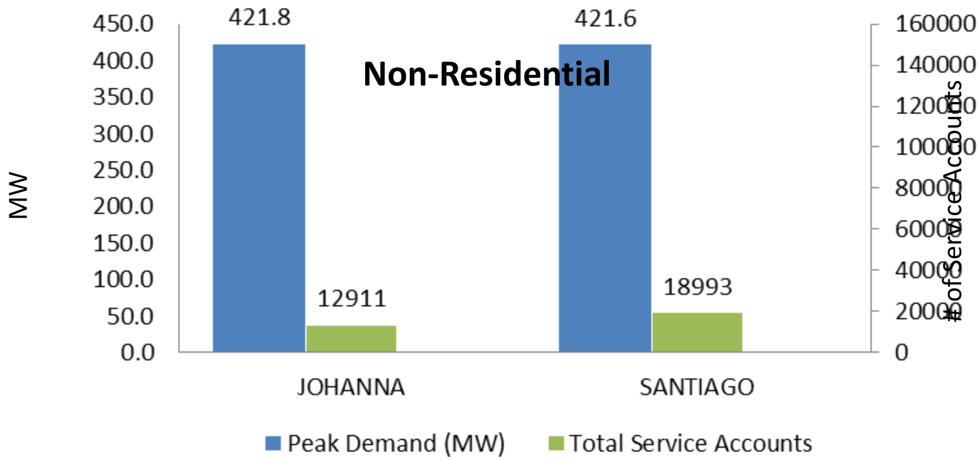
- Primarily comprised of residential customers, though commercial customers drive peak demand in the area
  - Residential sector: 86% of customers and account for 28% of load
  - Commercial sector: 12% of customers, but accounts for 62% of peak demand

Customer Composition in J-S Area

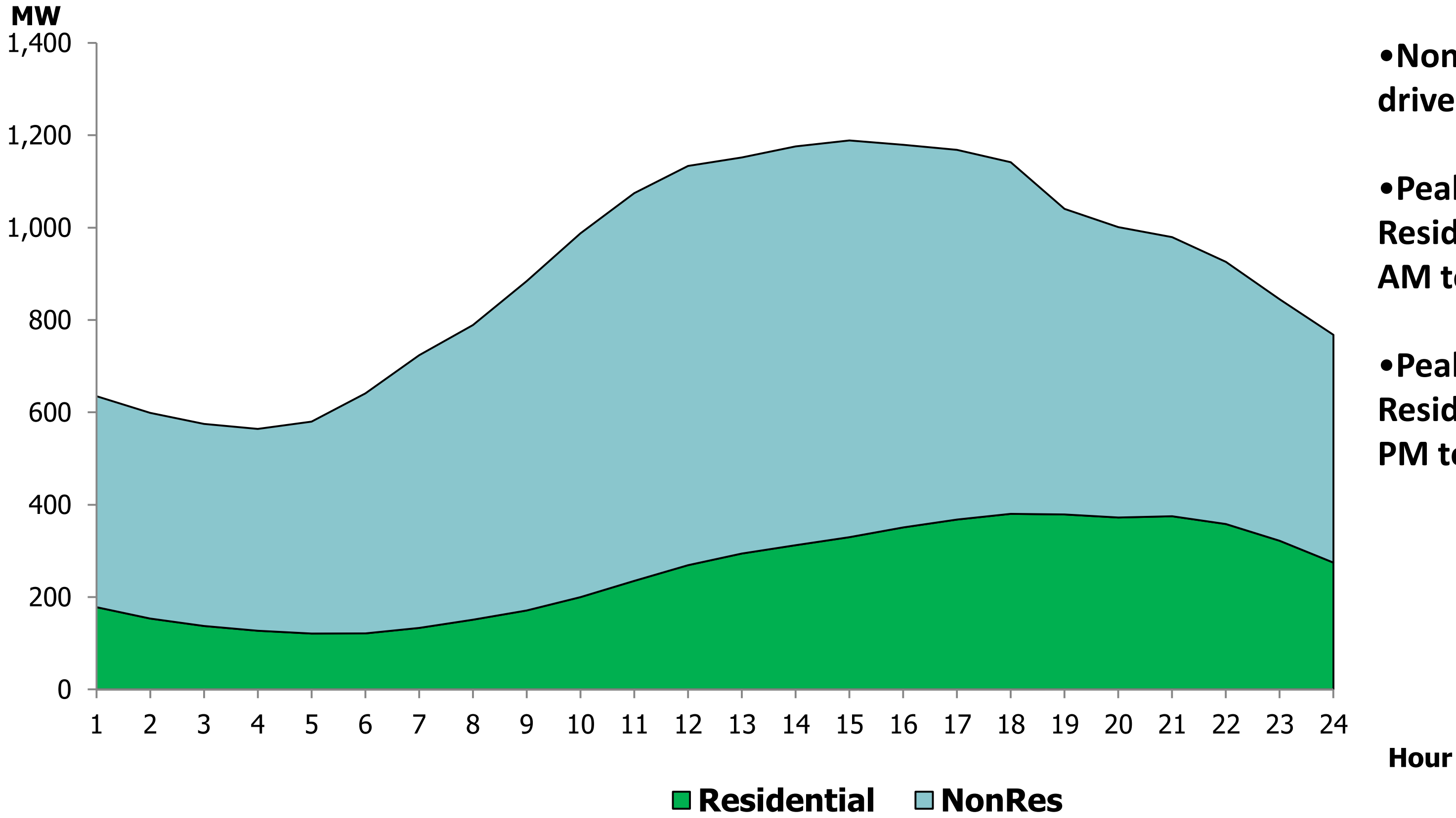
- 70% of area residential customers served by Santiago



- Peak non-residential load similar at both A-banks
  - Larger non-residential customers drive peak load at Johanna

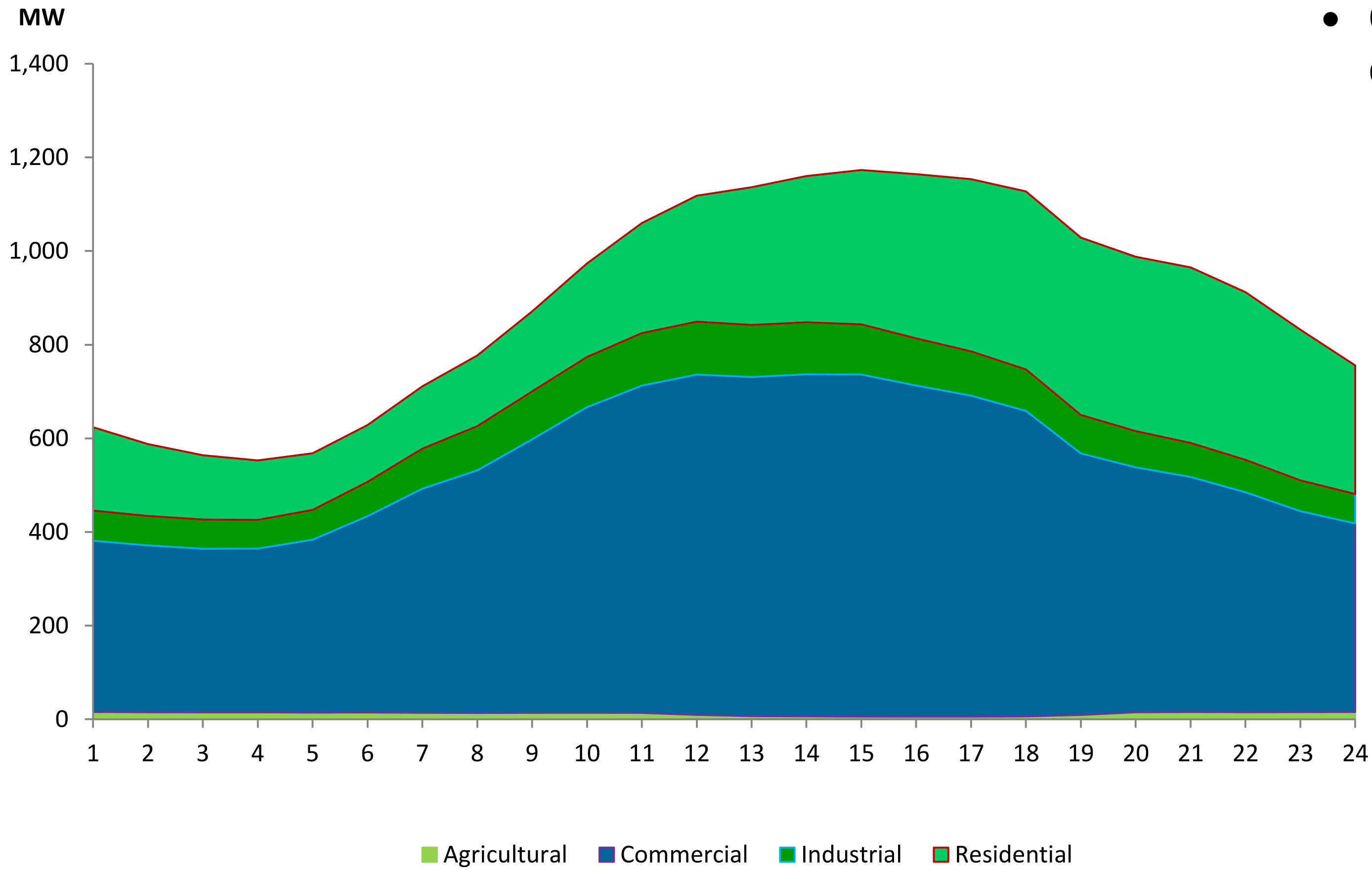


Combined J-S Peak Day Load Profile (bottoms up) August 31, 2013



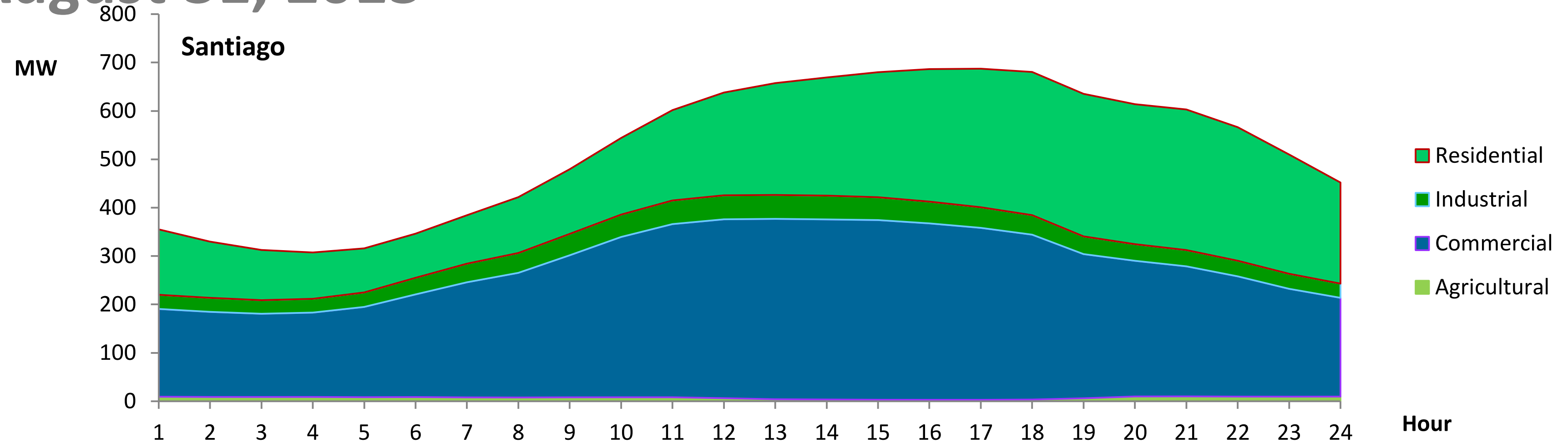
- Non Residential sector drives peak load
- Peak hours for Non Residential are from 11 AM to 3 PM
- Peak hours for Residential are from 6 PM to 9 PM

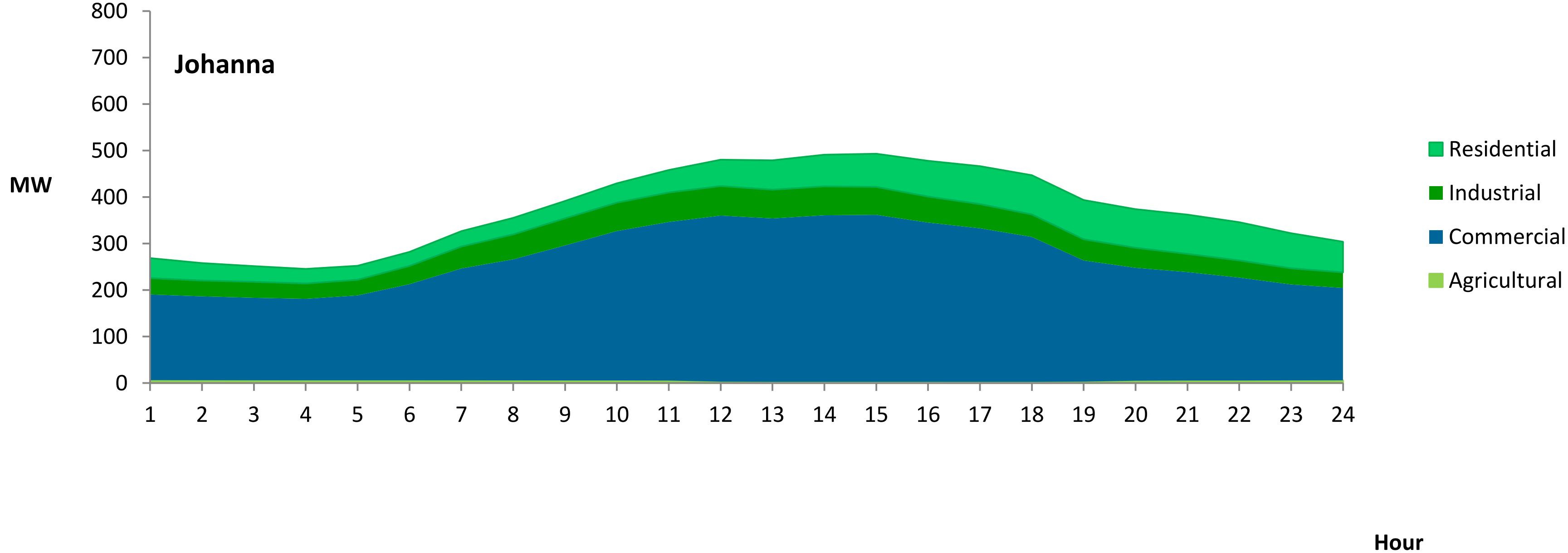
Combined J-S Peak Day Load Profile – by Sector August 31, 2013



- Commercial Sector drives area peak
  - 62% Commercial
  - 28% Residential
  - 9% Industrial
  - 1% Agricultural

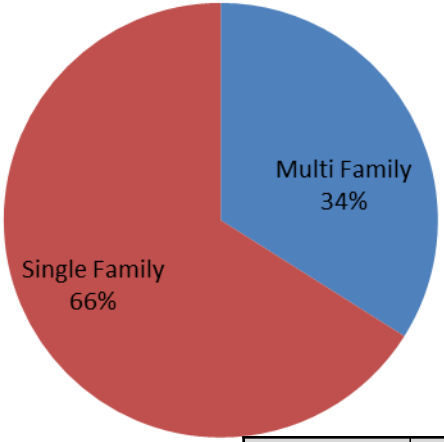
Peak Day Load Profile – by A-bank and Sector August 31, 2013



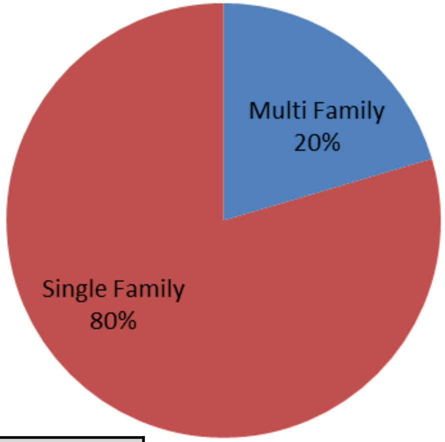


Residential Customer Accounts and Contributions to J-S Peak

Residential Customers by Segment in J-S

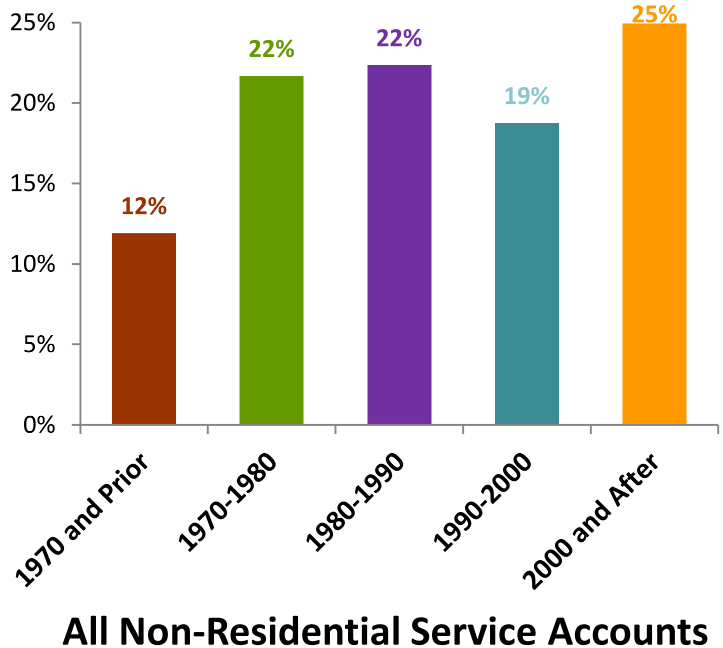


Residential Segment Contributions to J-S Peak

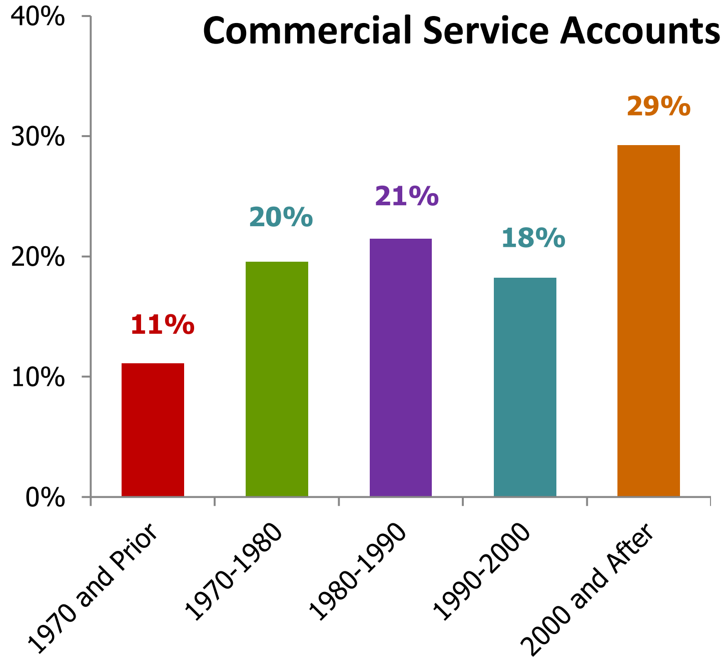


Residential Sectors	Area coincident peak kW	% of peak kW	Number of Customer Accounts	% of all residential customers
Multi Family	67,022	20%	70,230	34%
Single Family	261,223	80%	136,559	66%
Total	328,245	100%	206,789	100%

Non-Residential J-S Service Accounts by Construction Date



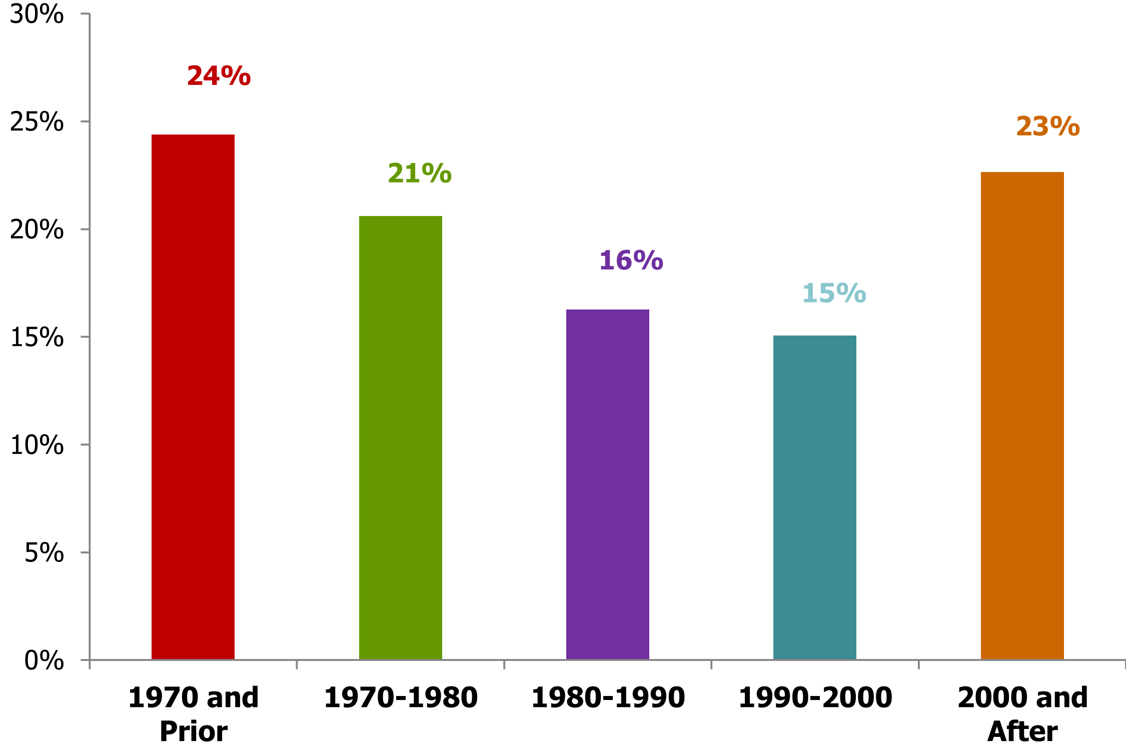
- 56% of all Non-Residential service accounts are in buildings built prior to 1990



- 52% of all Commercial service accounts are in buildings built prior to 1990

Note: Installed service date used as proxy for construction date

Service Accounts by Construction Date – Residential



- **61% of residential accounts are in buildings built prior to 1990**
- **23% of service accounts are in buildings built after 2000.**

Note: Installed service date used as proxy for construction date

J-S Customer Composition: Key Takeaways

- Implications for near term PRP Project Targeting
  - Commercial segment provides the largest target for load reduction in the region
    - Commercial office buildings provides the largest potential for load reduction
  - Residential segment also is a large target, but load reduction is likely more difficult to capture due to large customer base
    - Most J-S residential customers reside in the temperate climate zone 6 making residential HVAC load reductions uncertain

DSM Program Participation, Targeting, and Potential

- ❑ **DR Program Enrollment in J-S**
- ❑ **DR and EE Targeting Schema**
- ❑ **DR Potential**

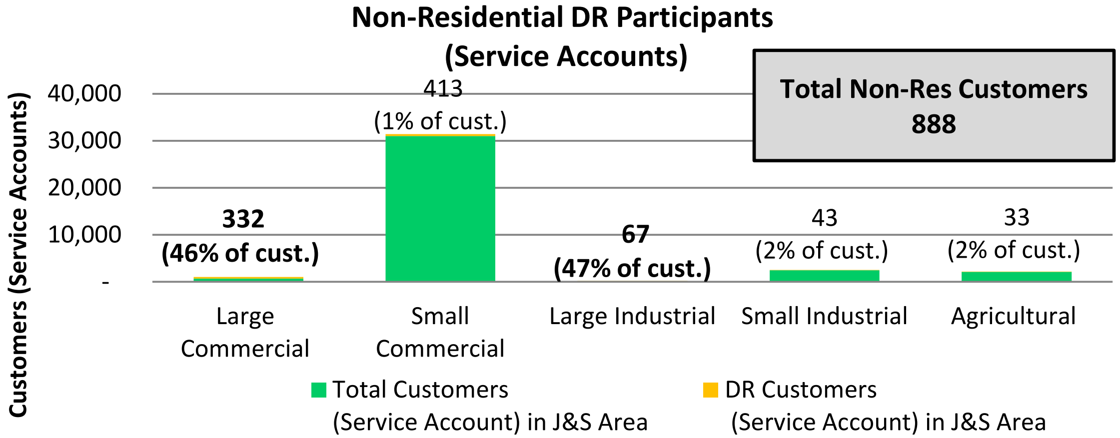
- ❑ **EE Program Participation in J-S**
- ❑ **EE Target Segments**
- ❑ **EE Potential**

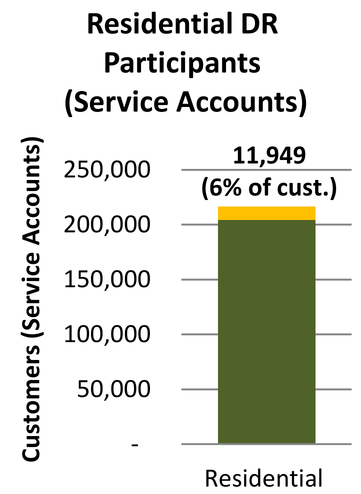
What's been done?

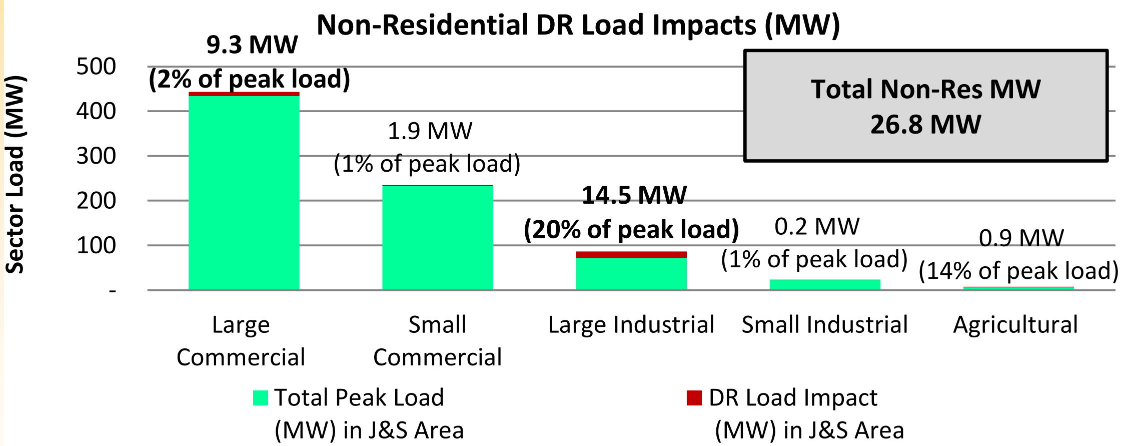
What can we say about what DSM remains?

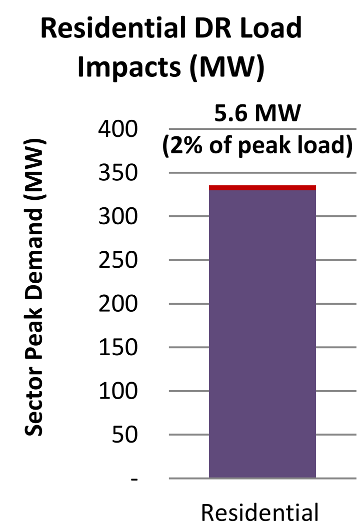
What are the high value targets for peak load reduction?

DR Enrollment and Load Impacts in J-S



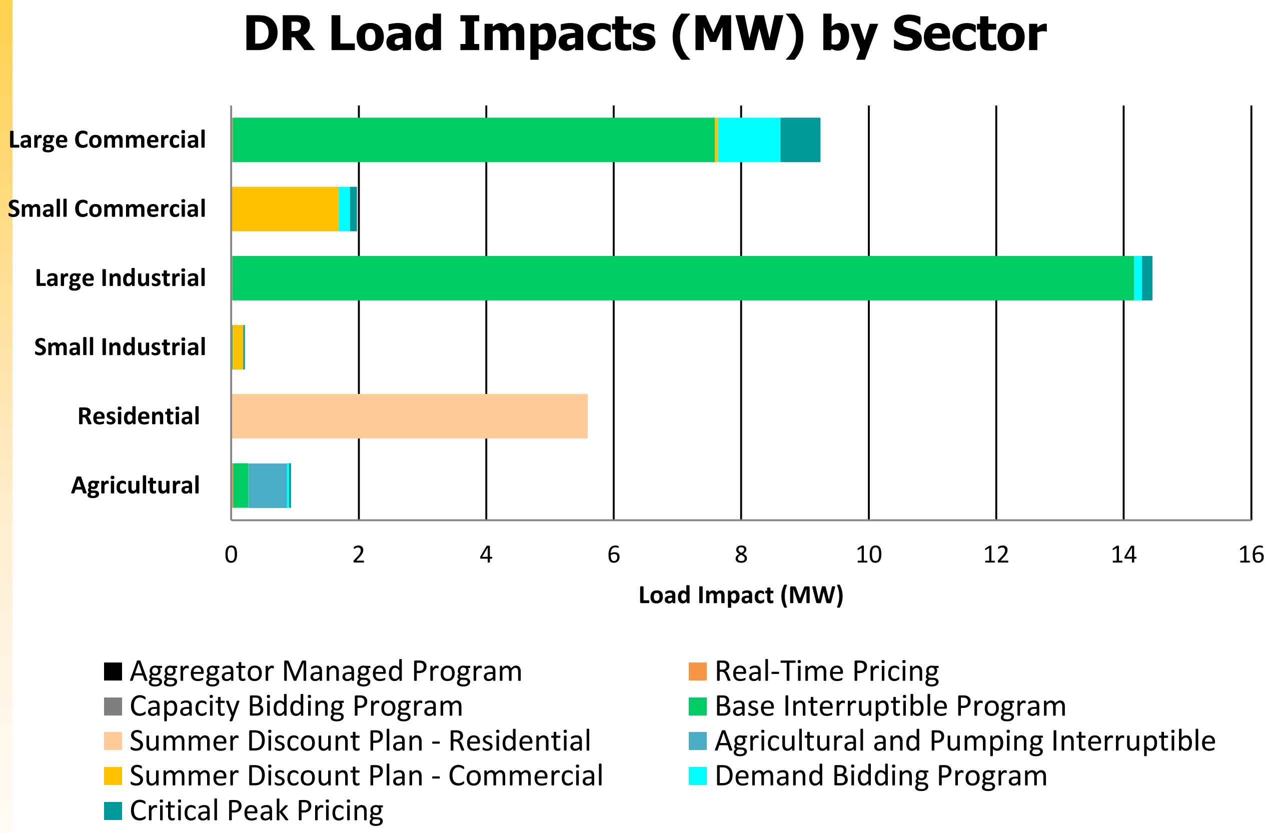






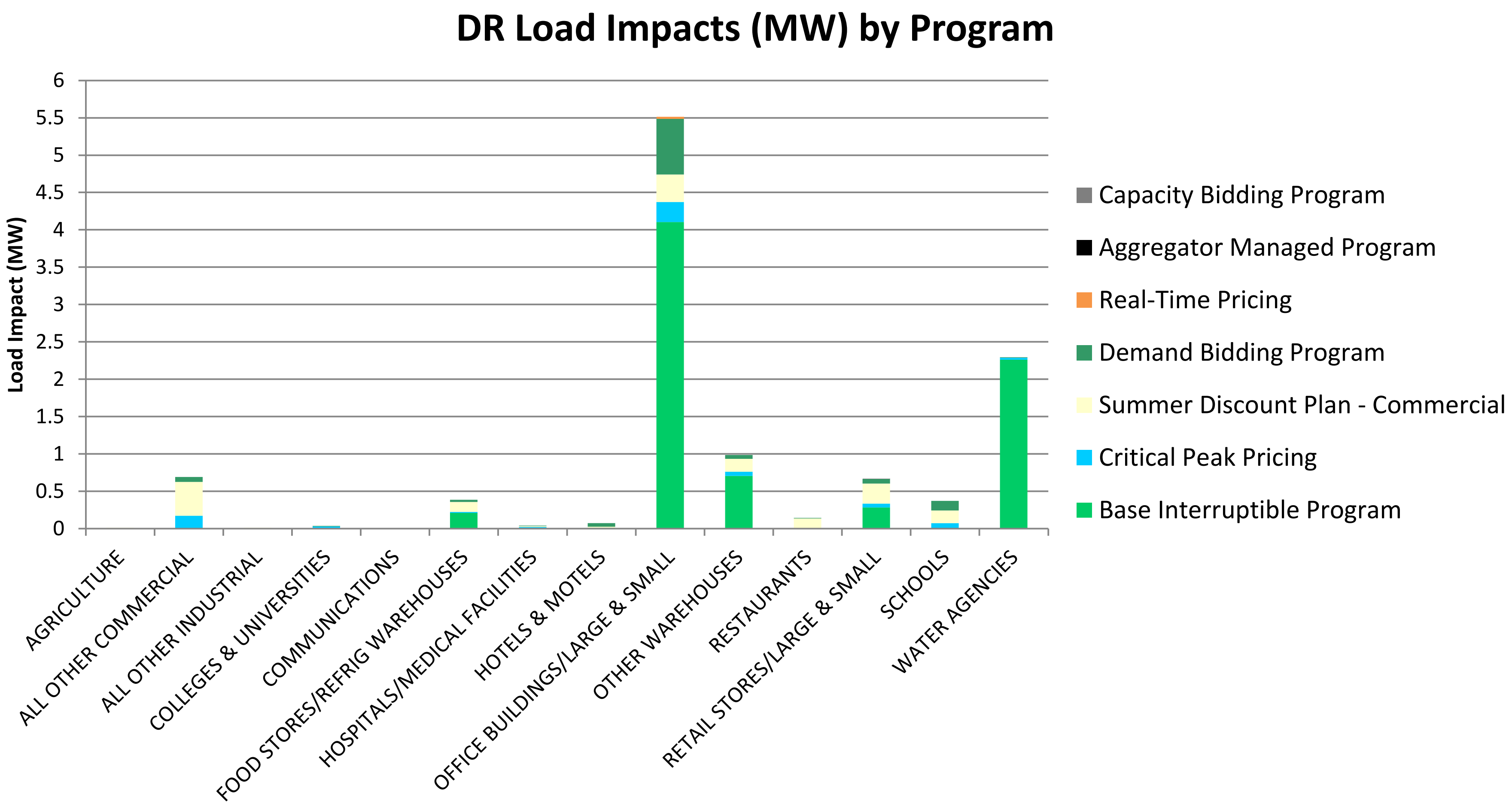
*Large Commercial & Industrial: Rate Categories such as GS3, TOU-GS3, TOU-8
*Small Commercial & Industrial: Rate Categories such as GS1, GS2, TOU-GS1, TOU-GS2

Load Impacts in J-S by Sector and Program – Program Year 2012



DR Program	Load Impacts (MW)
Base Interruptible Program	21.97
Summer Discount Plan - Residential	5.59
Summer Discount Plan - Commercial	1.91
Demand Bidding Program	1.32
Critical Peak Pricing	0.96
Agricultural and Pumping Interruptible	0.60
Real-Time Pricing	0.08
Aggregator Managed Program	0.000006
Capacity Bidding Program	0.000004
Total DR Portfolio	**32.43**

J-S Load Impacts by Commercial Segment



Approach on DR Potential and Targeting

- Focus potential estimates on the segments and customers that contribute most to peak load
- Since peak load reduction is near term need for PRP, resources should be devoted to areas where the largest demand reduction is available
- Targeting criteria were developed to identify customer segments and individual customers that drive peak load as well as segments with end uses that are weather sensitive
- After segments were targeted, demand reduction potential for target sectors estimated using historical load impacts for similar custome
- Refinements to this targeting schema would include a criterion for estimating the willingness or ability to participate in DR

Segment Targeting Approach

Factors
- Identify and select factors relevant to EE and DR
- Factors quantify characteristics of the segment, customer profile, and customer usage

Weights
- Determine weights (relative importance) of selected factors
- Develop a composite score based on factor weights

Ranking
- Rank by composite score to determine top priority segments
- Drill into target segments to identify top target customers

Factors for Segment Selection

Consideration	EE Factor	DR Factor
Weather Sensitivity	Seasonal Factor	JS Coincident Peak Factor
Segment DSM Potential	EE Potential	DR Eligible Load
Segment Contrib. to Peak Load	Summer On-Peak Load (Aggregate)	JS Coincident Peak Load (Aggregate)
Customer Contrib. to Peak Load	Summer On-Peak Load (Average)	JS Coincident Peak Load (Average)

DR Priority Segments

	WEIGHTS					
	30%	30%	20%	20%		
SEGMENT	**JS Coincident Peak Factor**	**DR Eligible Load**	**JS Coincident Peak (Aggregate)**	**JS Coincident Peak (Average)**	**Overall Score**	**RANK**
OFFICE BUILDINGS/LARGE & SMALL	**1.11**	**3.88**	**5.76**	**3.23**	**2.09**	**1**
RESIDENTIAL - SINGLE FAMILY	**1.79**	**3.15**	**5.60**	**0.68**	**1.89**	**2**
ALL OTHER COMMERCIAL	**1.25**	**3.09**	**4.16**	**2.76**	**1.74**	**3**
HOTELS & MOTELS	**1.10**	**2.63**	**3.20**	**4.47**	**1.60**	**4**
WATER AGENCIES	**0.98**	**2.92**	**2.84**	**3.60**	**1.56**	**5**
FOOD STORES/REFRIG WAREHOUSES	**1.17**	**2.38**	**3.13**	**3.76**	**1.49**	**6**
RETAIL STORES/LARGE & SMALL	**1.21**	**2.11**	**4.13**	**3.06**	**1.47**	**7**
SCHOOLS	**1.59**	**1.71**	**3.09**	**4.69**	**1.47**	**8**
OTHER WAREHOUSES	**1.27**	**1.65**	**4.31**	**3.80**	**1.43**	**9**
COLLEGES & UNIVERSITIES	**1.04**	**1.72**	**2.41**	**5.01**	**1.29**	**10**
RESTAURANTS	1.18	1.58	3.68	3.22	1.29	**11**
ALL OTHER INDUSTRIAL	1.21	1.40	3.50	3.34	1.24	**12**
AIRCRAFT/AEROSPACE/ORDNANCE	1.06	1.79	1.85	4.45	1.23	**13**
PRIMARY & FABRICATED METALS	1.06	1.59	2.46	4.46	1.23	**14**
COMMUNICATIONS	1.03	1.61	3.04	2.55	1.16	**15**
PLASTICS	1.06	1.51	1.63	4.49	1.14	**16**
CHEMICALS & ALLIED PRODUCTS	1.19	0.81	2.09	5.30	1.07	**17**
RESIDENTIAL - MULTI FAMILY	1.62	0.90	4.30	0.04	1.07	**18**
FOOD & KINDRED PRODUCTS	1.14	0.61	2.59	5.59	1.06	**19**
HOSPITALS/MEDICAL FACILITIES	1.23	0.37	2.94	4.60	0.99	**20**

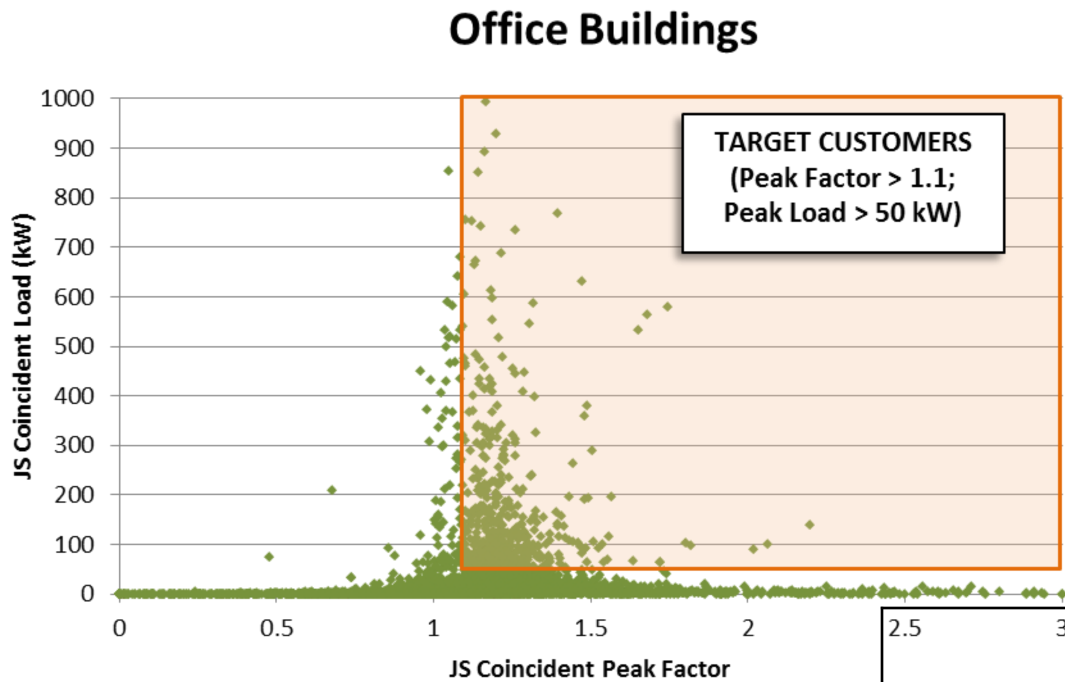
Not all segments depicted.

DR Priority Segments – Top 10

Top 10 Target Segments for DR	
SEGMENT	RANK
OFFICE BUILDINGS/LARGE & SMALL	1
RESIDENTIAL - SINGLE FAMILY	2
ALL OTHER COMMERCIAL	3
HOTELS & MOTELS	4
WATER AGENCIES	5
FOOD STORES/REFRIG WAREHOUSES	6
RETAIL STORES/LARGE & SMALL	7
SCHOOLS	8
OTHER WAREHOUSES	9
COLLEGES & UNIVERSITIES	10

- These segments are the largest contributors to peak load that also are area load drivers during peak days
- Targeting the highest contributors to peak load from all segments results in an expected peak demand reduction of **81MW**
  - This represents the technical potential if all targeted customer enrolled in a DR program
  - Top 6% -- about 1200 customers – represent 53% of DR-eligible peak load
  - Current DR participants were removed from the pool of potential participants
  - **Segment targeting schema does not account for "willingness" or propensity for DR**

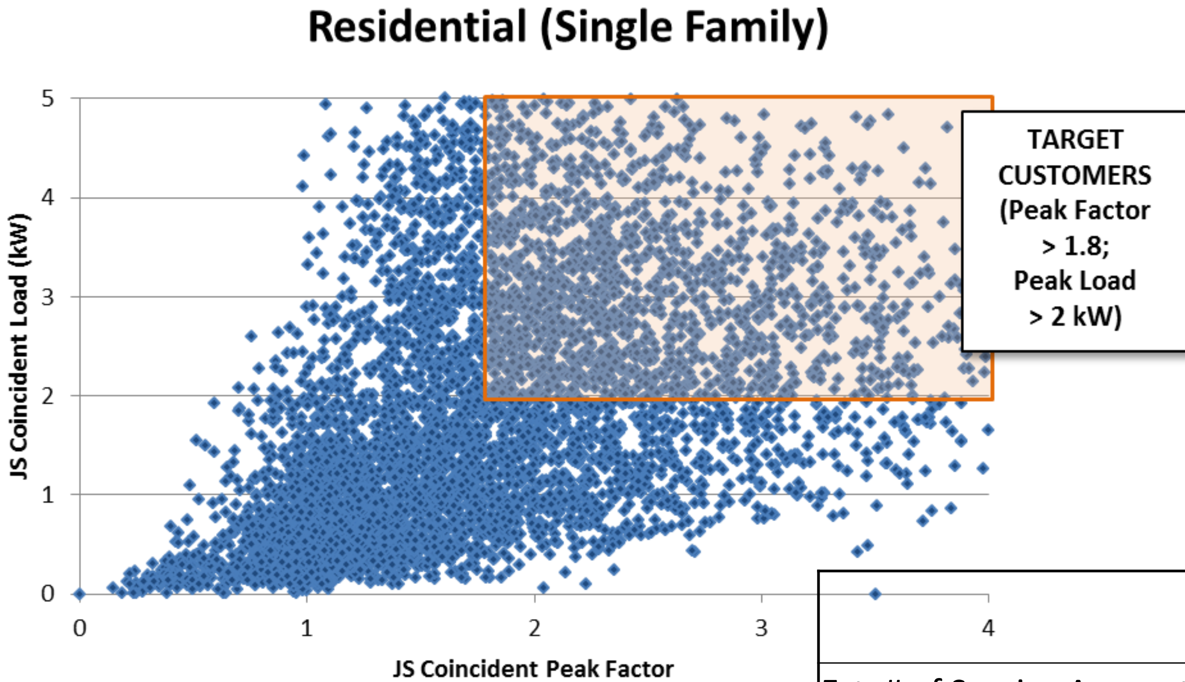
DR Customer Targeting – Office Buildings



- If the 6% of office buildings that contribute most to area peak load participate in DR, **24 MW** of peak load reduction can be expected

	Target Customers	Remainder of Segment
Est. # of Service Accounts	700	12,000
% of Sector	**6%**	94%
Avg. JS Peak Factor	1.2	1.1
Avg. JS Peak Load (kW)	229	13
% of Sector Peak Load	52%	48%
Est. DR Eligible Load (MW)	**24**	23

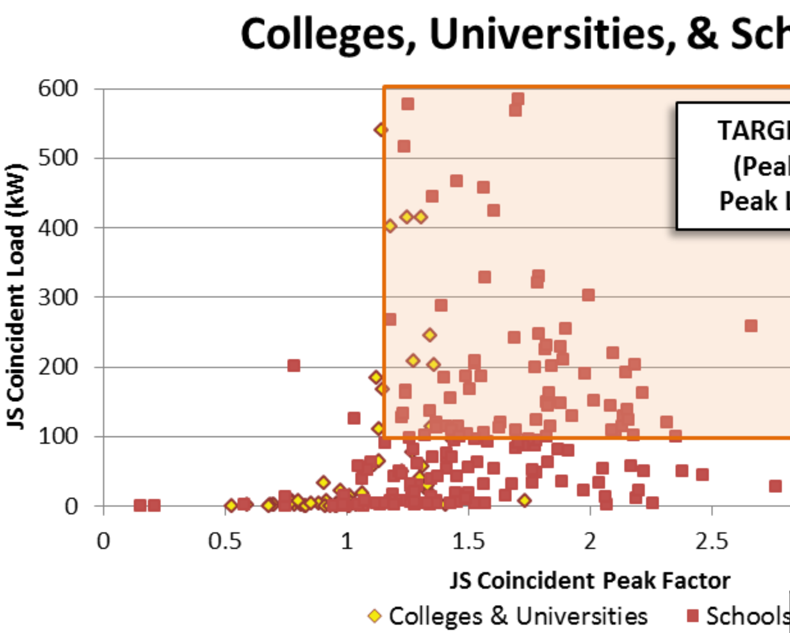
DR Customer Targeting - Residential



	Target Customers	Remainder of Segment
Est. # of Service Accounts	36,500	100,000
% of Sector	**27%**	73%
Avg. JS Peak Factor	2.7	1.5
Avg. JS Peak Load (kW)	3.5	1.4
% of Sector Peak Load	47%	53%
Est. DR Eligible Load (MW)	**10.5**	11.8

- If the 27% of residential homes that contribute most to area peak load participate in DR, **10.5 MW** of peak load reduction can be expected

DR Customer Targeting – Colleges & Schools



- If the 33% of Colleges and Schools that contribute most to area peak load participate in DR, **7 MW** of peak load reduction can be expected

	Target Customers	Remainder of Segment
Est. # of Service Accounts	90	170
% of Sector	**33%**	67%
Avg. JS Peak Factor	1.7	1.3
Avg. JS Peak Load (kW)	282	40
% of Sector Peak Load	78%	22%
Est. DR Eligible Load (MW)	**7**	2

Key Takeaways from DR Potential and Targeting Analysis

- Many large industrial and commercial already participated in BIP

- Targeting DR efforts within the identified segments identified may prove to be a cost-effective way to meet PRP goals
  - Relatively few (non-residential) customers drive J-S peaks

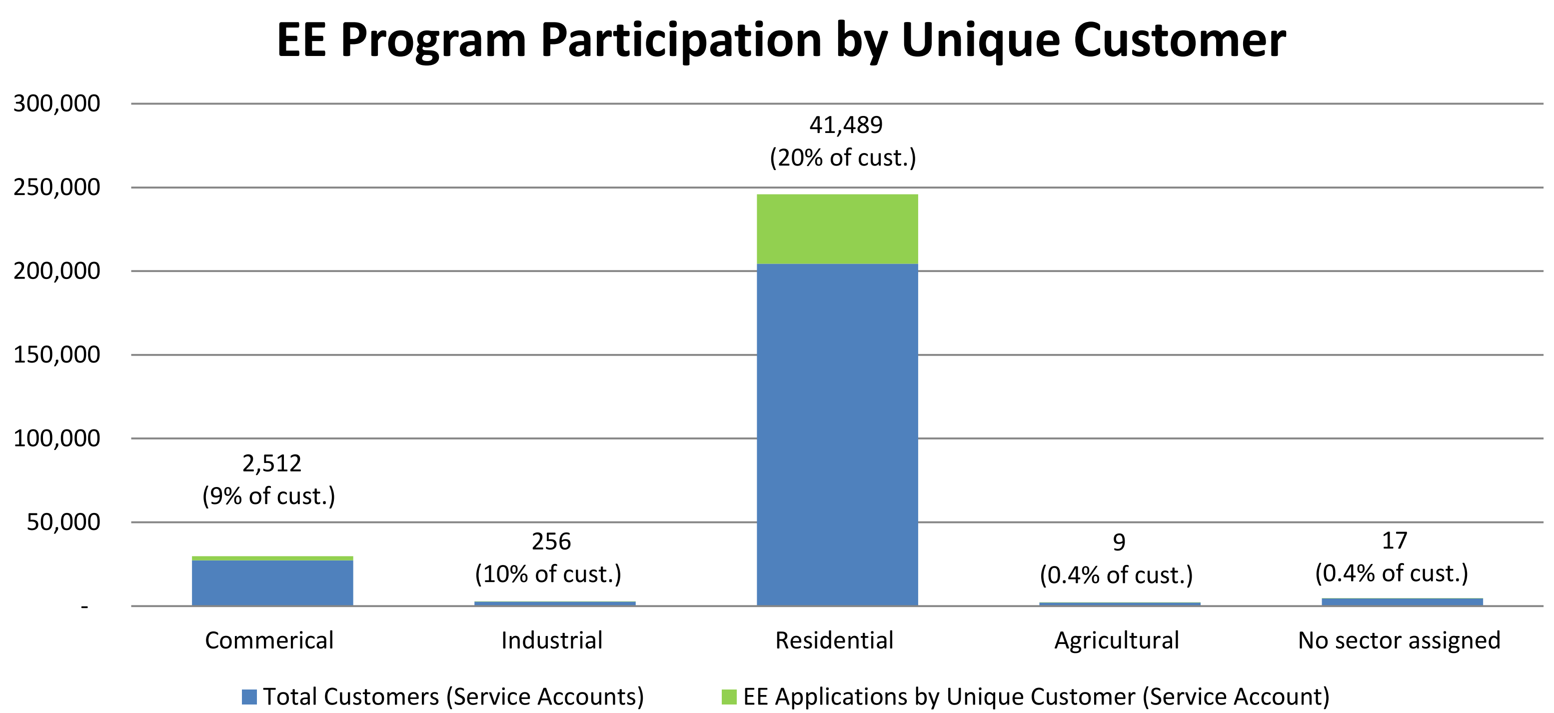
- **Additional work needs to be done to identify customers and customer segments that have high propensity or ability to participate in DR efforts**
  - Analysis team working to identify methods for modeling DR participation propensity

DSM Program Participation, Targeting, and Potential

- ❑ **DR Program Enrollment in J-S**
- ❑ **DR and EE Targeting Schema**
- ❑ **DR Potential**

- ❑ **EE Program Participation in J-S**
- ❑ **EE Target Segments**
- ❑ **EE Potential**

2010-2012 EE Program Participation: J-S Area

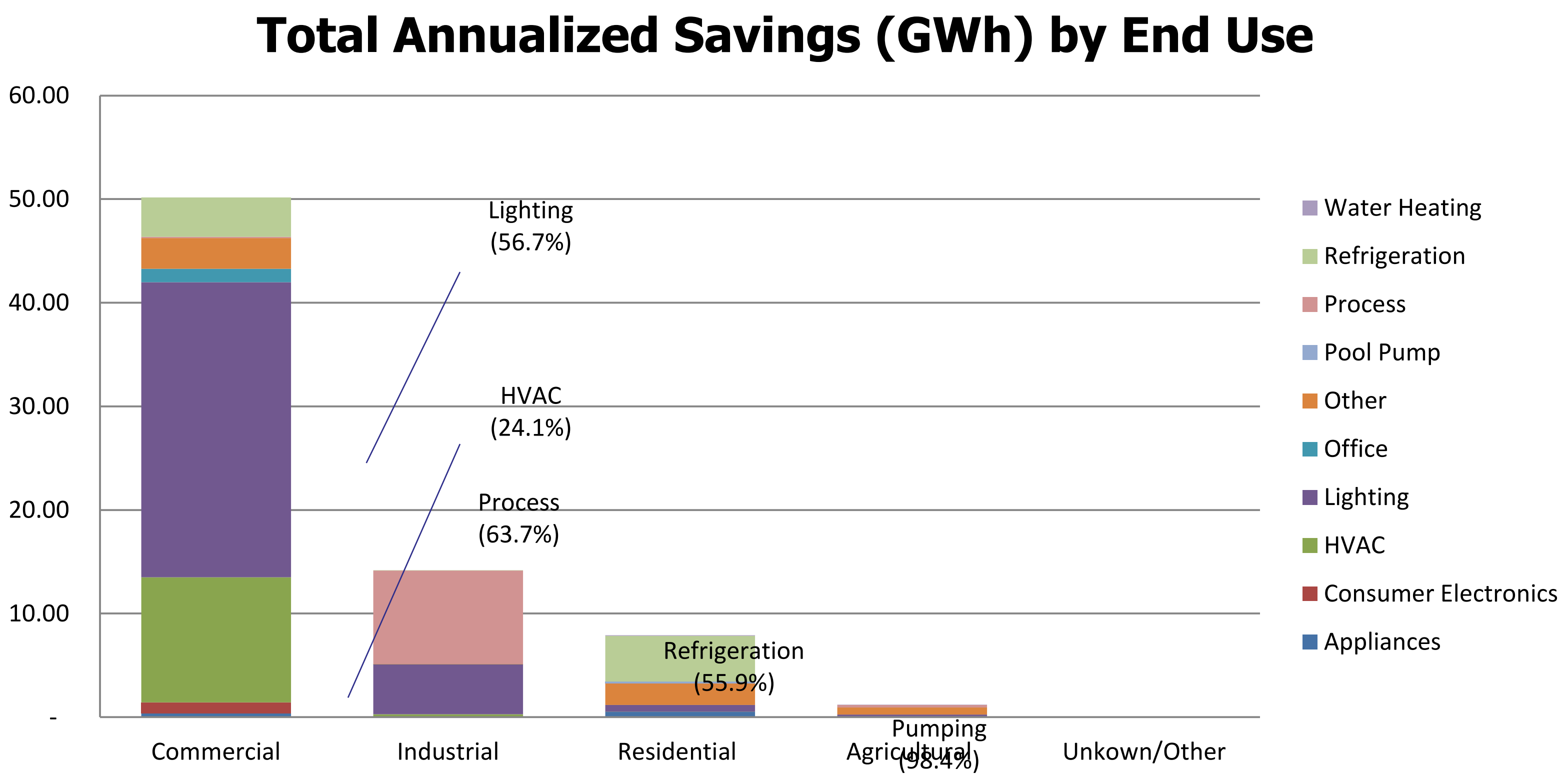


- Identifies program participation during 2010-2012 (all 2013 portfolio data not yet available)
  - Does not reflect all EE program activity – upstream and midstream energy savings are not tied to individual customers, are substantial, but not included in these estimates

2013 SONGS Summer Readiness: Direct Install Program targeted small commercial lighting
- **Preliminary estimates**: **1027** J-S customer sites participated, **4,385** lighting measures installed, **1.7 MW peak demand reduction**

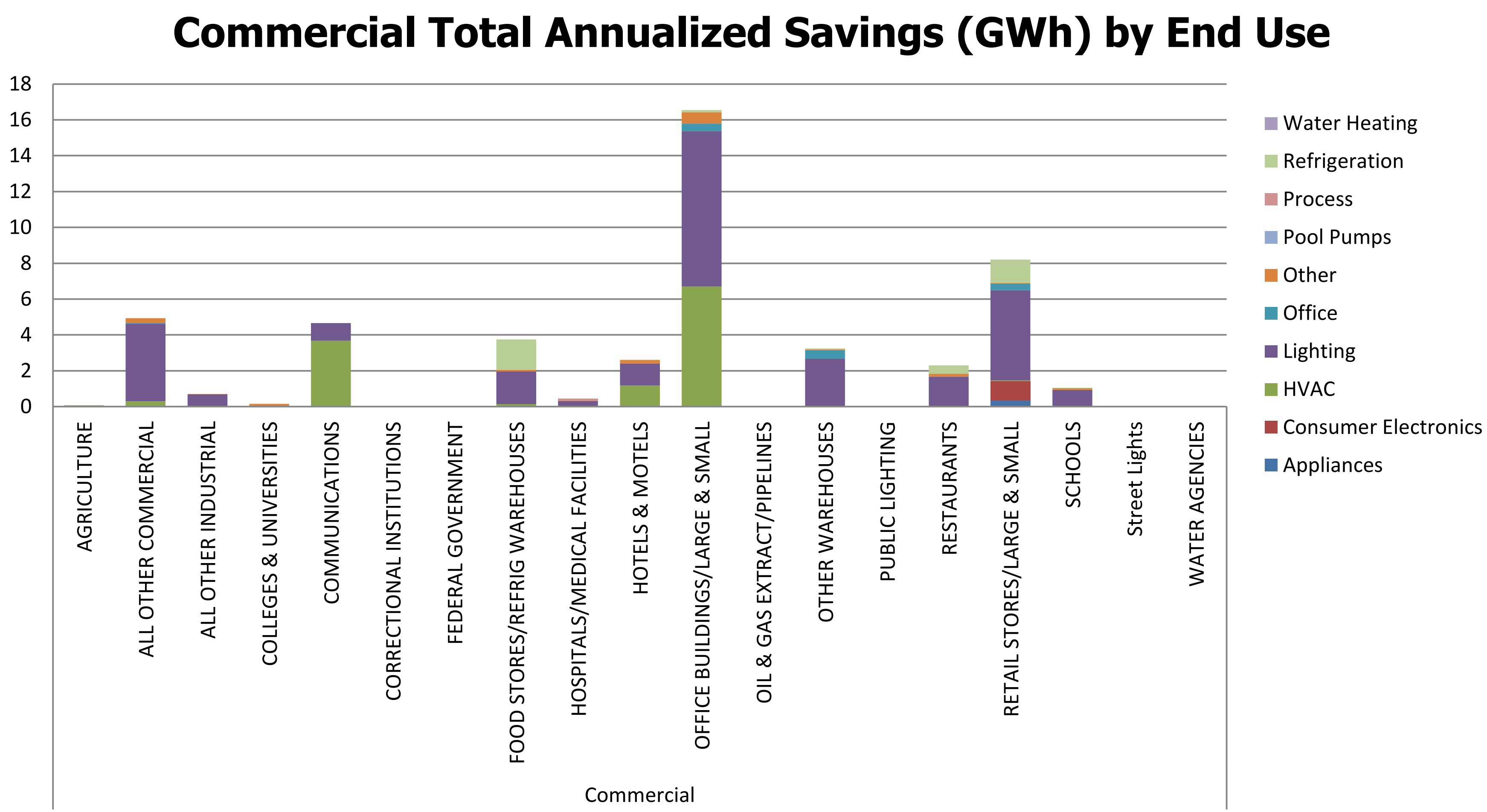
EE Measure End Uses (2010-2012): (J-S) Area

- Savings in each market sector driven by specific measure end use

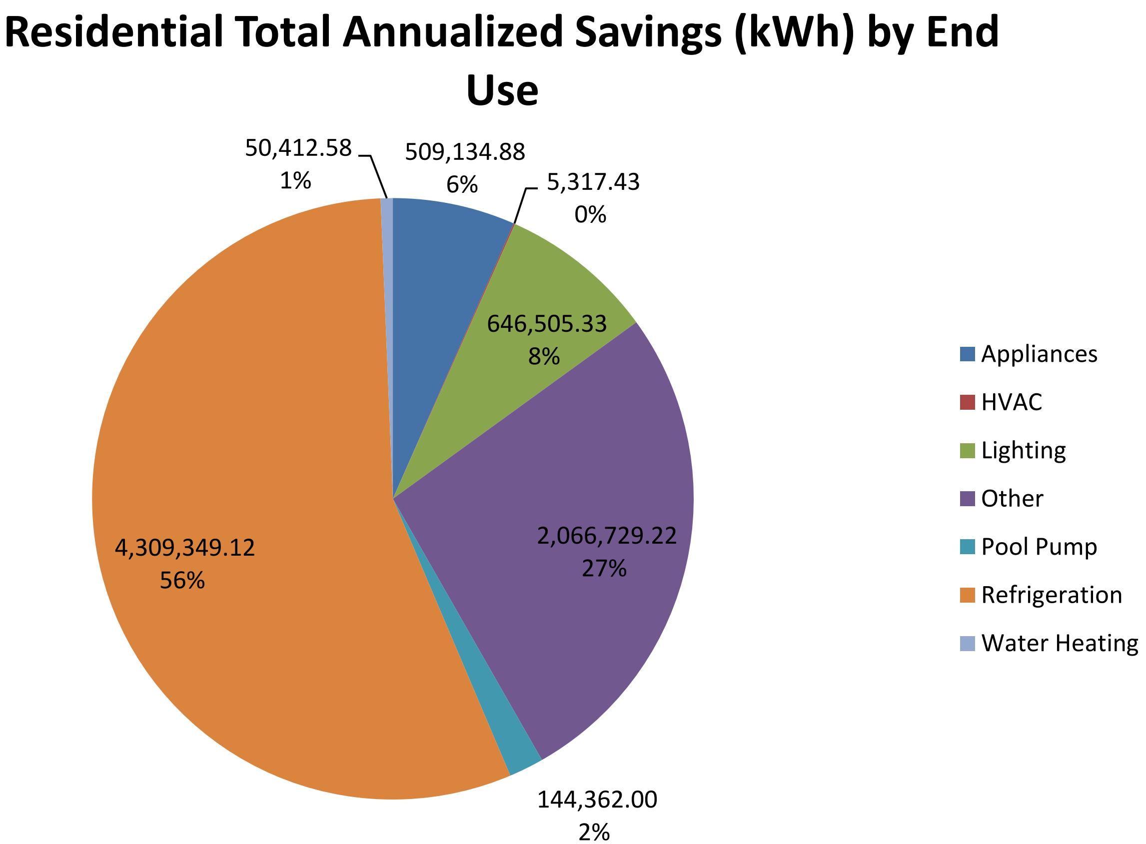


Note: Energy savings depicted are relative to a code or industry standard practice baseline. Grid impacts are estimated to be greater

EE Measure End Uses (2010-2012): (J-S) Area – Commercial



EE Measure End Uses (2010-2012): (J-S) Area – Residential



- Measure Details
  - 56 unique measure types installed
  - 74% of all savings attained through only 2 measures:
    - Mail-In EE Survey
    - Refrigerator Recycling
  - Energy Savings from upstream lighting was significant in this sector, but is not reflected here

Low-income EE Program Participation (2010-13)

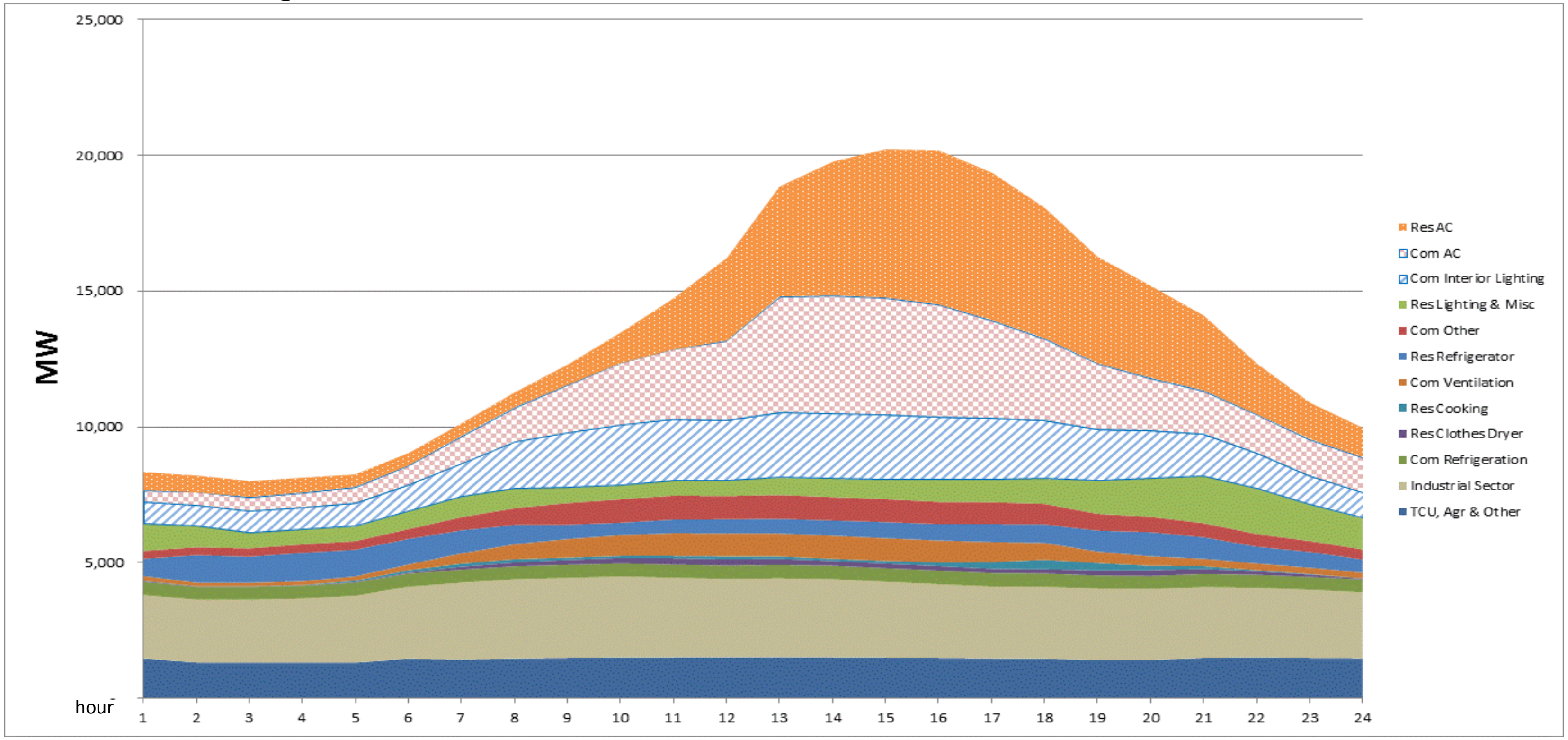
- Total ESAP (Energy Savings Assistance Program) Enrollments in J-S: **10,212**
  - Measures installed:
    - CFLs: **21,731**
    - Efficient refrigerators: **1,627**
    - Pool Pumps: **29**
    - Weatherization: **22**
  - Participation does not guarantee measure installation
  - Participants in J-S climate zones do not qualify for HVAC retrofit per CPUC rules

Approach to EE potential and targeting analysis

- Identify high value target segments and end uses for peak demand reduction
  - Commercial HVAC and lighting
  - Residential pool pumps and HVAC
- Similar to DR targeting analysis, identified the top weather sensitive non-residential segments
- Develop EE potential estimates based on target end uses and target segments
  - Using mix of SmartConnect data and existing studies (CEUS, RASS, CPUC EE Potential Study) to estimate EE potential

Electricity Use by End Use in the L.A. Basin

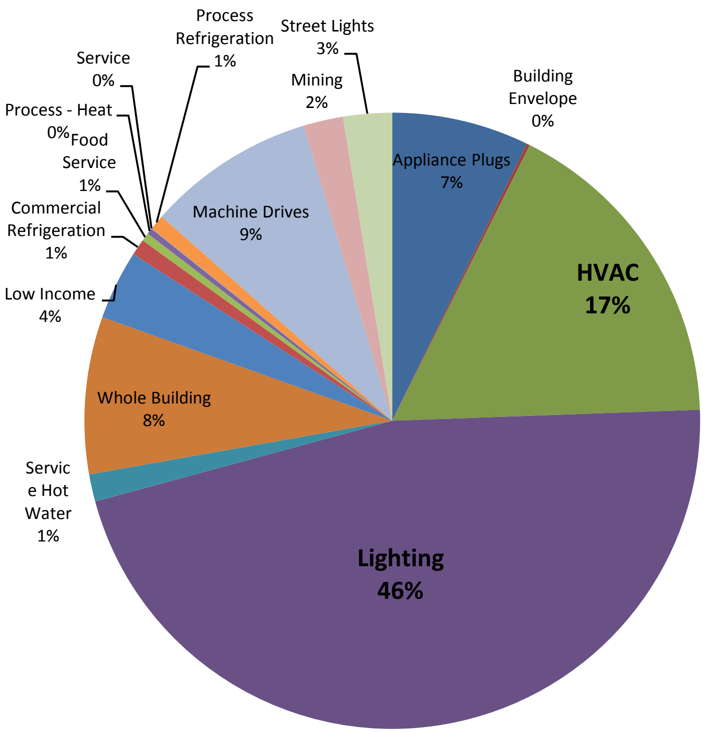
- Commercial and Residential HVAC, as well as Commercial Lighting are the primary consumers of electricity (kWh) in the greater L.A. Basin.
- Commercial and Residential HVAC are the primary contributors to load (kW) in the region



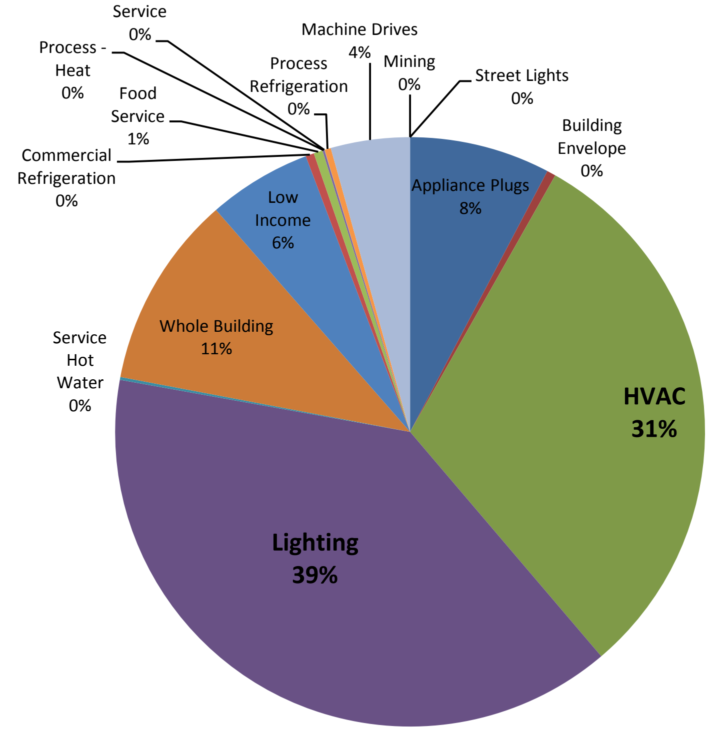
Source: CEC Demand Forecast for LA Basin

EE Potential by End-Use in Target Area

Energy Savings Potential



Demand Savings Potential



CPUC's 2013 EE Potential Analysis identifies HVAC and Lighting as end uses in target area with greatest EE potential

2013 Draft CPUC EE Potential Study
Building Climate Zones 6 and 8

EE Priority Segments

Tier 1 - Top Target Segments	
SEGMENT	**RANK**
OFFICE BUILDINGS/LARGE & SMALL	1
RETAIL STORES/LARGE & SMALL	2
RESTAURANTS	3
SCHOOLS	4
OTHER WAREHOUSES	5
HOSPITALS/MEDICAL FACILITIES	6
COLLEGES & UNIVERSITIES	7
FOOD STORES/REFRIG WAREHOUSES	8

- Weather Sensitive
- High EE Potential
- Significantly Contributes to On-Peak Load
- Significant Per customer Peak Savings Potential

Tier 2 - Target Segments	
SEGMENT	**RANK**
RESIDENTIAL - SINGLE FAMILY	9
RESIDENTIAL - MULTI FAMILY	10

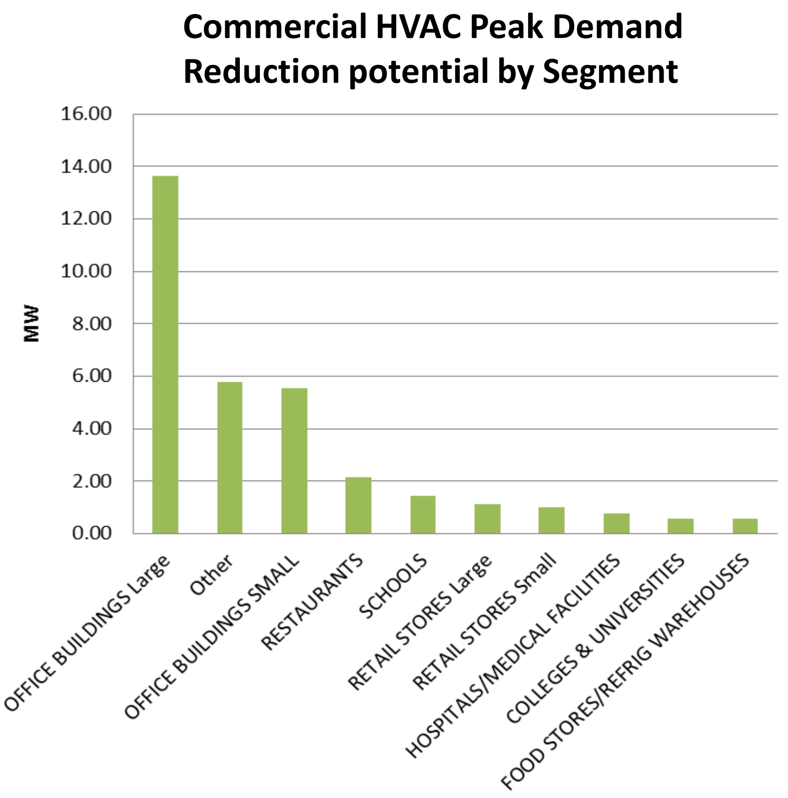
Not all segments depicted.

- Most of the above factors apply
- **Low Per customer Peak Savings (and high $)**

Target Sector EE Potential: Commercial HVAC

- EE Commercial HVAC Market Potential:
  - Grid Impacts: **32.6 MW**
  - EE Program Savings (Above code): **17.5 MW**
  - Estimate only considers package units >10 years old which makes up 41% of the commercial market
  - Assumes EER 9.5 replacement with EER 13.5

Row Labels	Peak Demand Reduction Potential (MW)
OFFICE BUILDINGS Large	13.64
Other	5.78
OFFICE BUILDINGS SMALL	5.55
RESTAURANTS	2.16
SCHOOLS	1.43
RETAIL STORES Large	1.14
RETAIL STORES Small	1.00
HOSPITALS/MEDICAL FACILITIES	0.76
COLLEGES & UNIVERSITIES	0.56
FOOD STORES/REFRIG WAREHOUSES	0.56
Total	**32.6**



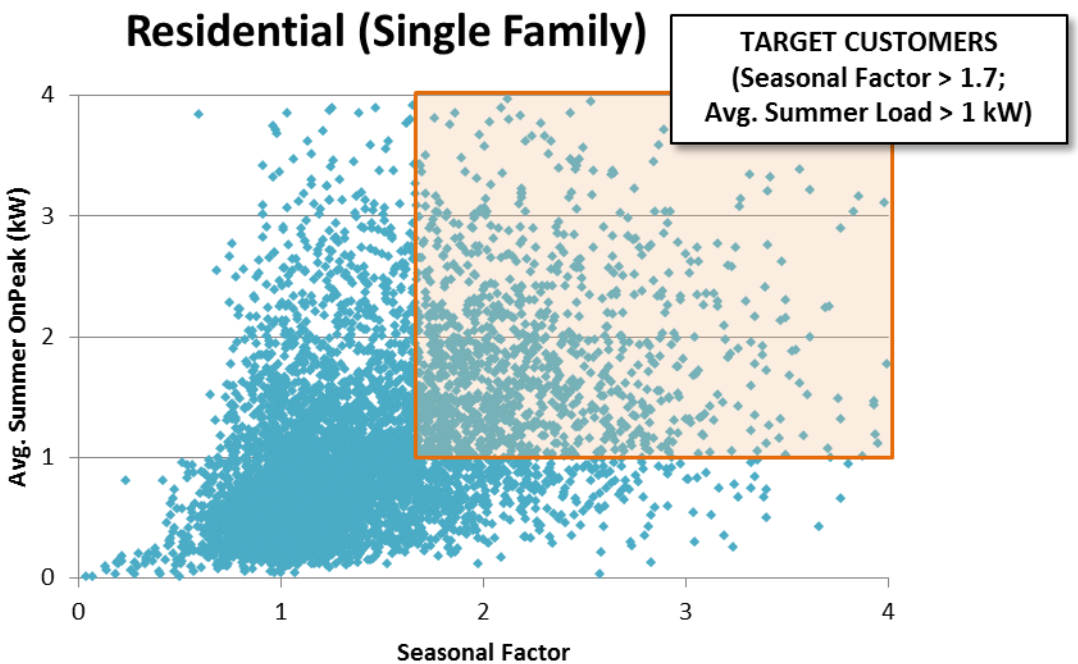
Target Sector EE Potential: Commercial Lighting

- EE demand reduction potential for all commercial sector lighting in target area
  - Grid impacts: **17.9 MW**
  - EE Program savings: **8.5 MW**

- EE potential for Linear Fluorescents
  - Grid Impacts: **4.5 MW**
  - EE Program Savings: **2.4 MW**

Source: 2013 CPUC draft EE Potential and Goals Analysis for climate zone 6 and 8, Navigant

Target Sector EE Potential: Residential HVAC EE Potential



	Target Customers	Remainder of Segment
Est. # of Service Accounts	23,446	113,051
% of Sector	**17%**	83%

- Residential HVAC Grid Savings Potential: **6.5 MW**
  - EE program demand reduction potential: **2.7MW**
  - Utilized targeting process to identify likely HVAC users
  - Potential estimate for AC units >10 years old (51%)
  - Grid: SEER 20 replacing SEER 10
  - EE program: SEER 20 replacing SEER 15

Target Sector EE Potential: Residential Pool Pumps

- Background:
  - 89% of Pool Pumps are Single Speed (KEMA Study)
  - 9% of Residences in Target Area have pools (RASS 2009)
  - 65% of Pools Operate On-Peak (at least ½ Hour)

- Residential Pool Pump Potential grid impact demand reduction: **8.2 MW**
  - Assume single speed to variable speed replacement timed to run ½ time off-peak
  - EE program savings: **2.4 MW**

Savings Per Unit Retrofit

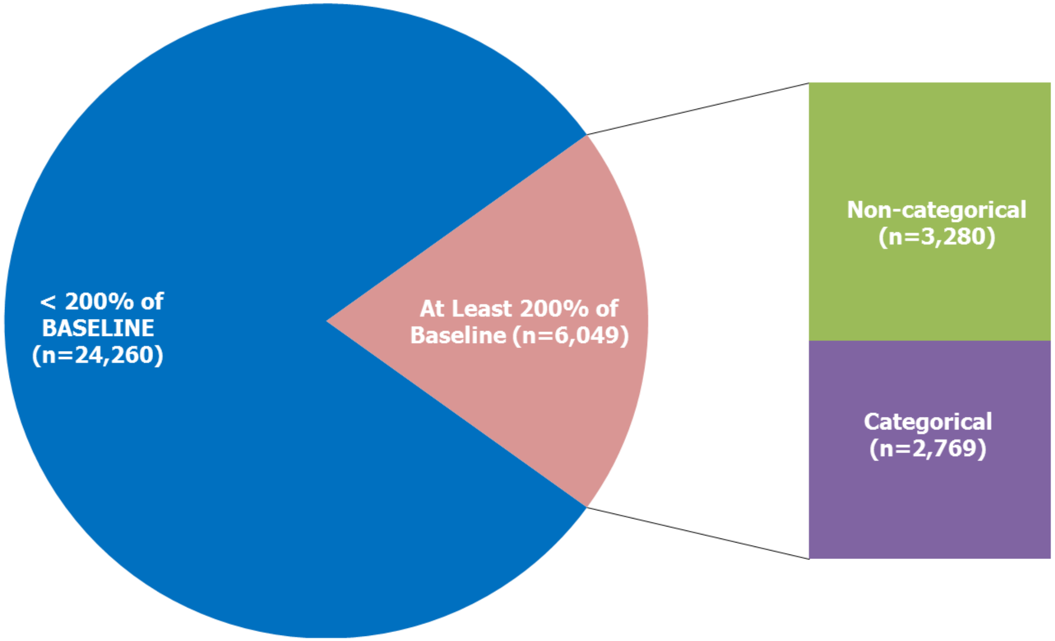
Savings Type	kWh	kW
Grid Level Impact - Hybrid (Accounts for Use Diversity) Replace 1-Speed with V-Speed	1,504	.68

Est. Total Customers with Pools

J-S Region	Service Accounts
Johanna	3,322
Santiago	10,164
Total	*13,486*

EE Income Qualified Program Potential

- Out of 30,310 CARE participants, 6,049 are potential ESA participants
  - 512 customers with monthly usage of > 400% above baseline
  - Customers with monthly usage >400% above baseline will be defaulted into ESA by 2017
  - Used CARE enrollment to proxy income qualification for ESA



EE Potential and Targeting Key Takeaways

- Roughly 15% - 20% participation by J-S commercial customers in EE programs during 2010-2013
  - Most installed lighting measures
  - Indicates potential for HVAC EE retrofits
- Commercial sector is most viable sector for EE to impact peak load
  - Commercial HVAC is the end use with greatest potential for reducing J-S area peaks
    - Targeting the segments identified (i.e. offices, schools, etc.) may improve EE program effectiveness/impacts
    - SCE HVAC Early Replacement program targets this sector and end use
- Commercial lighting remains a viable end use for load reduction in the target region
  - Direct Install EE program plans on targeting large commercial customers for 2014 and 2015 in PRP area for lighting retrofits
- Residential Pool Pumps represents a viable potential for peak load reduction
- Residential HVAC contributes to peak in target area, however broad customer base and uncertain HVAC usage limits reliable and cost-effective demand reduction

Gaps and Next Steps

- Customer site information would make targeting more robust
  - Customer site square-ft information would assist in targeting efforts
    - Enables use of EUI for targeting criterion
  - Customer ownership information would identify customer most likely to invest in high $ retrofits and DG
- More recent end-use saturation data would enhance EE potential estimates
  - Analysis team awaiting CEUS updates and other ongoing end-use survey analysis that CPUC is managing for incorporation into this analysis
- Load disaggregation techniques may assist in developing more refined EE and DR potential estimates
- Working with DSM program planning group to identify additional sectors/end uses to analyze
- Determining if deeper dive into DR is needed

Appendix

Seasonal Factor - Definition

Concept

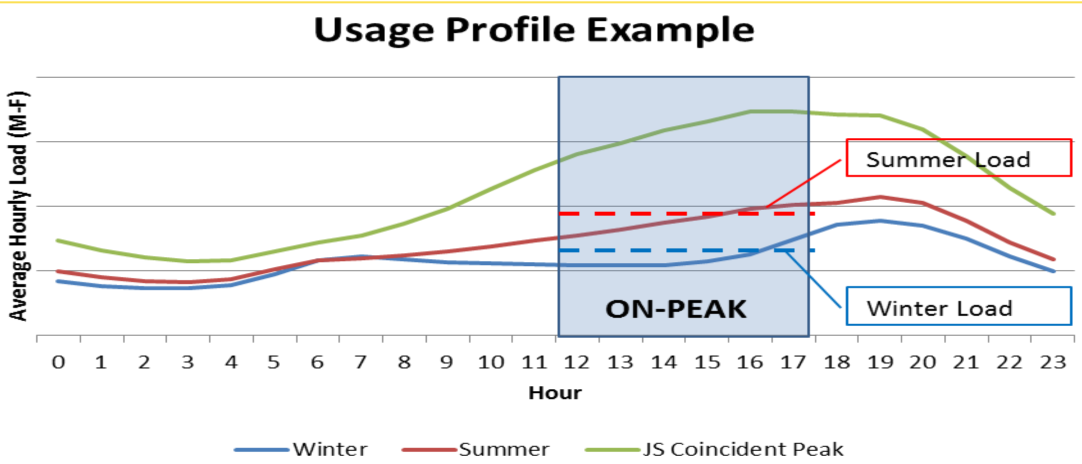
- Ratio of Summer load to Winter load

Customer Calculation

- (Avg Summer hourly load)/(Avg Winter hourly load) [On-Peak hours]

Segment Calculation

- Average of individual customer seasonal factors



JS Coincident Peak Factor - Definition

Concept

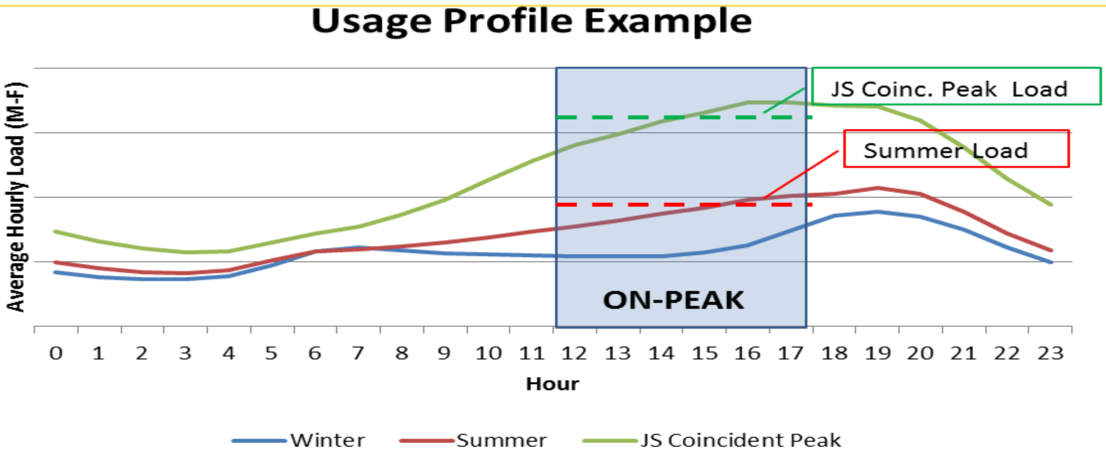
- Ratio of JS coincident peak load to (whole) Summer load

Customer Calculation

- (Avg hourly load – JS peak period)/(Avg Summer hourly load) [On-Peak hrs.]
- JS Coincident Peak period: 6 highest A-Bank load days in 2013 (same 6 days for both A-Banks). [8/29-30, 9/3-6]

Segment Calculation

- Average of individual customer seasonal factors



EE Potential and DR Eligible Load - Definitions

EE Potential

- Estimated EE achievable (market) potential by sector.
- Based on 2013 CPUC EE potential study conducted by Navigant.

DR Eligible Load

- Estimated available DR load by sector, based on expected load impact for eligible customers not enrolled in DR.
- Load impact estimates based on 2012 DR Load Impact studies.
- This factor represents the "tech potential" or estimated maximally available DR load.
- (Log transformation applied in scoring to moderate scaling issues.)

Summer On-Peak Load Definitions

Customer Calculation

- Average hourly load for Summer On-Peak hours (M-F, non-holidays, 12p-6p)

Segment Calculation (Aggregate)

- Customer average hourly load aggregated (MW) across the segment.
- (Log transformation applied in scoring to moderate scaling issues.)

Segment Calculation (Average)

- Mean of customer average hourly load (kW) across the segment.
- (Log transformation applied in scoring to moderate scaling issues.)

JS Coincident Peak Load Definitions

Customer Calculation

- Average hourly load for the JS coincident peak period, on-peak hours (12p-6p).
- JS Coincident Peak period: 6 highest A-Bank load days in 2013 (same 6 days for both A-Banks). [8/29-30, 9/3-6]

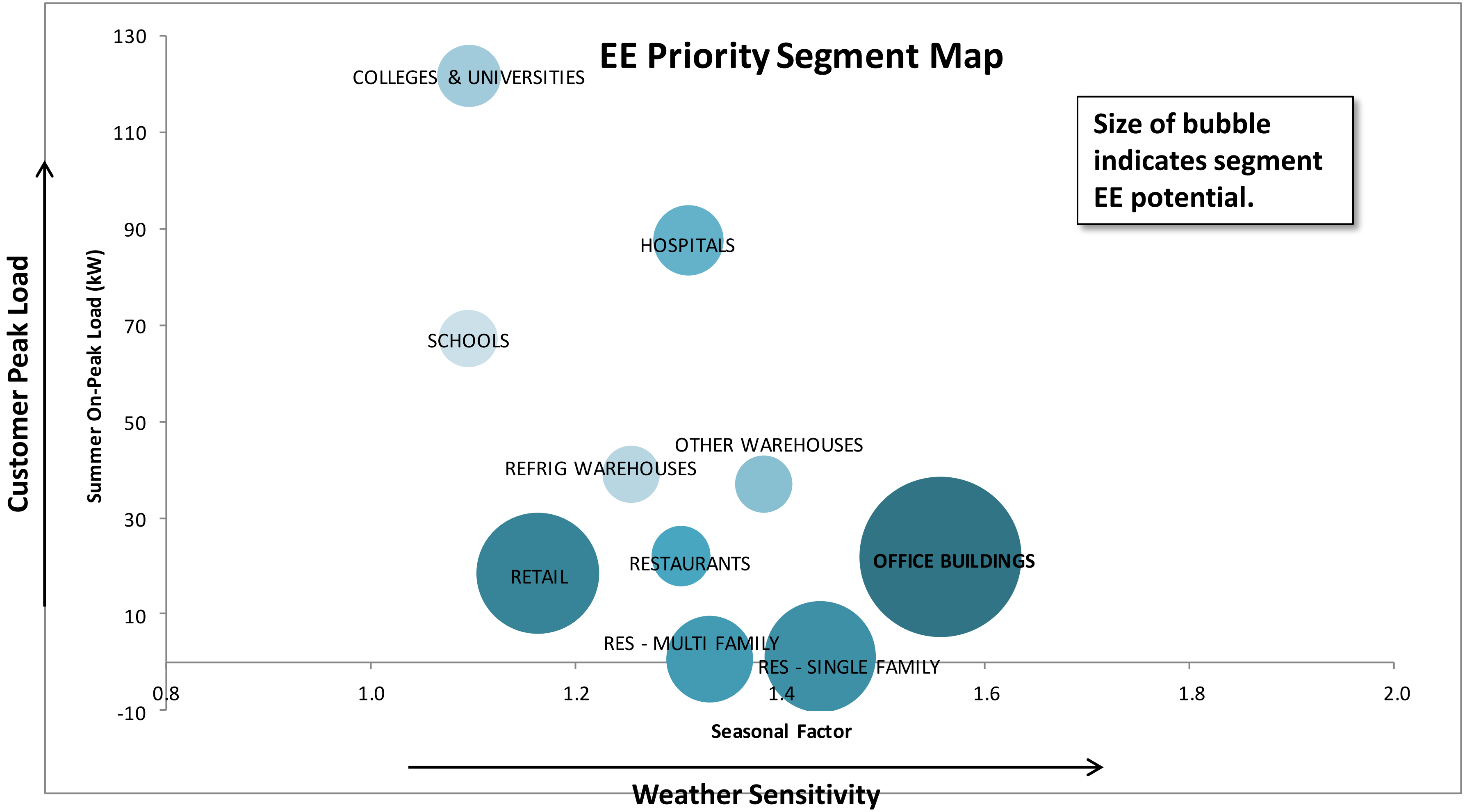
Segment Calculation (Aggregate)

- Customer average hourly load aggregated (MW) across the segment.
- (Log transformation applied in scoring to moderate scaling issues.)

Segment Calculation (Average)

- Mean of customer average hourly load (kW) across the segment.
- (Log transformation applied in scoring to moderate scaling issues.)

EE Priority Segments – Top 10

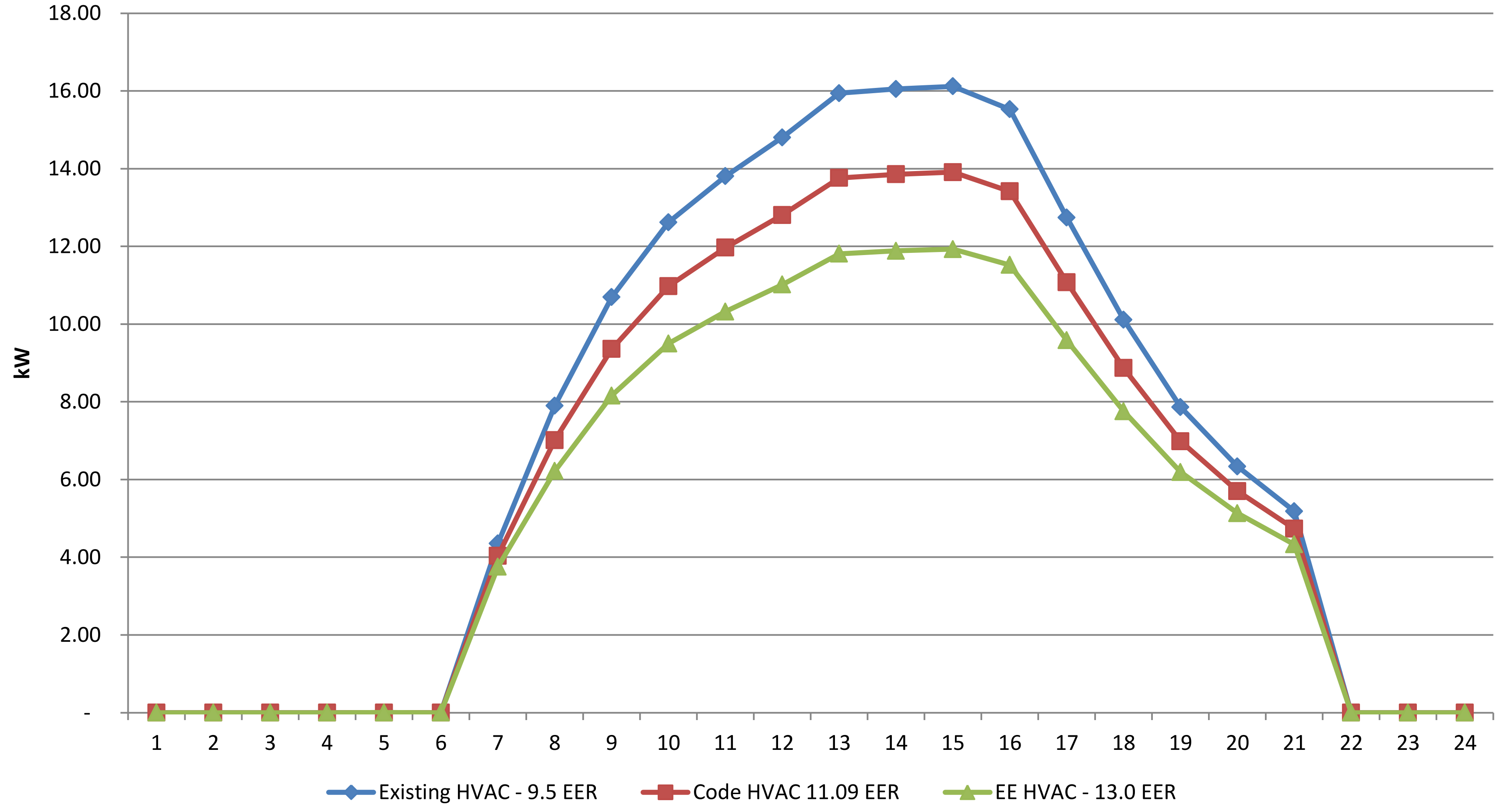


Commercial HVAC Early Replacement Demand Reduction Potential

- Assumptions
  - Number of commercial accounts
    - # non-residential accounts: 29,811
    - % RTUs: 68% (source draft 2013 CSS/CMST Study)
    - 60% RTU >10 years old
    - SEER 13.5 replaces SEER 9.5

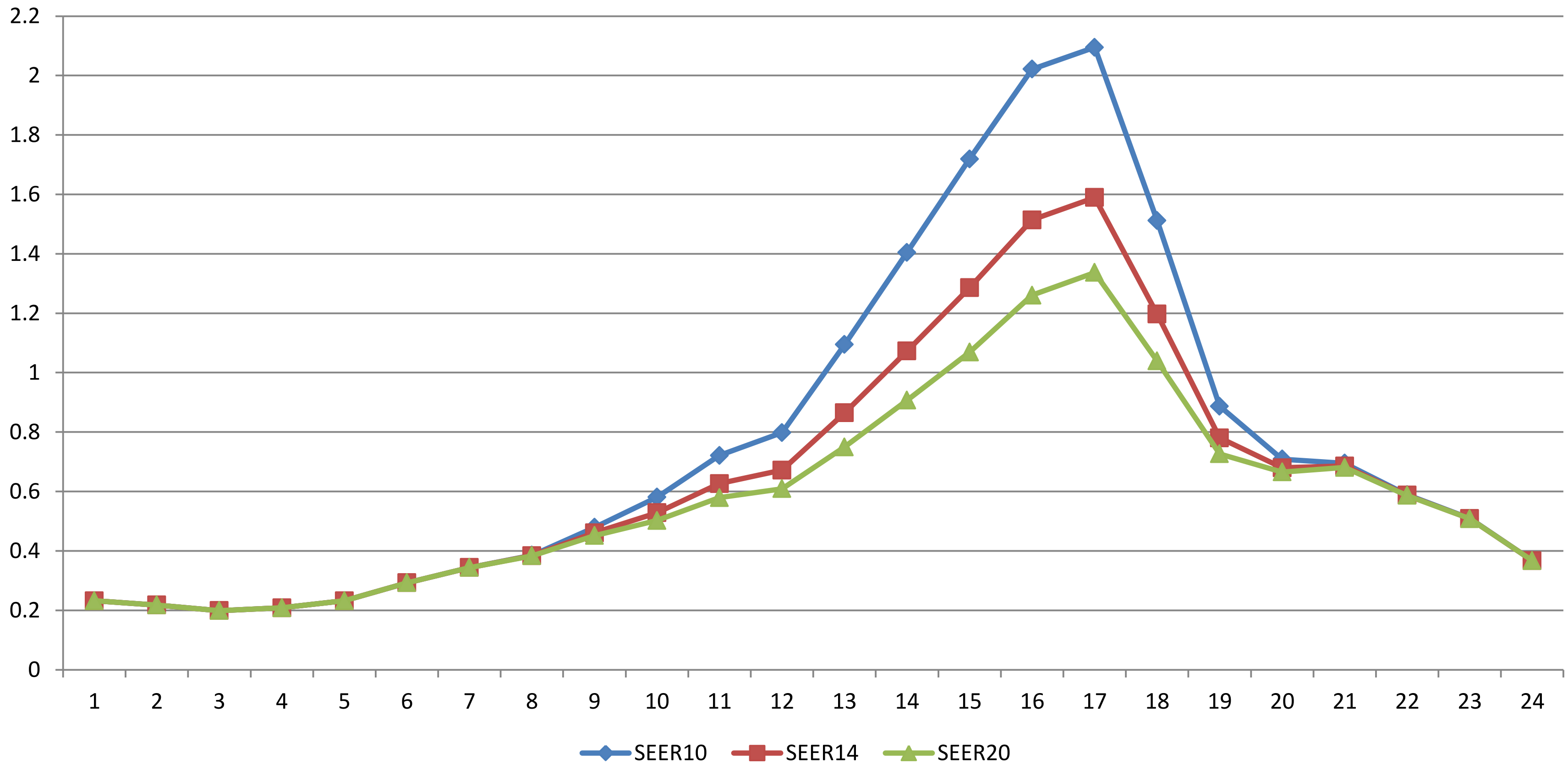
Small Office HVAC Average Daily Load Profile

- Climate Zone 8 – Peak Day



Residential HVAC Average Daily Load Profile

- Climate Zone 8 – Peak Day

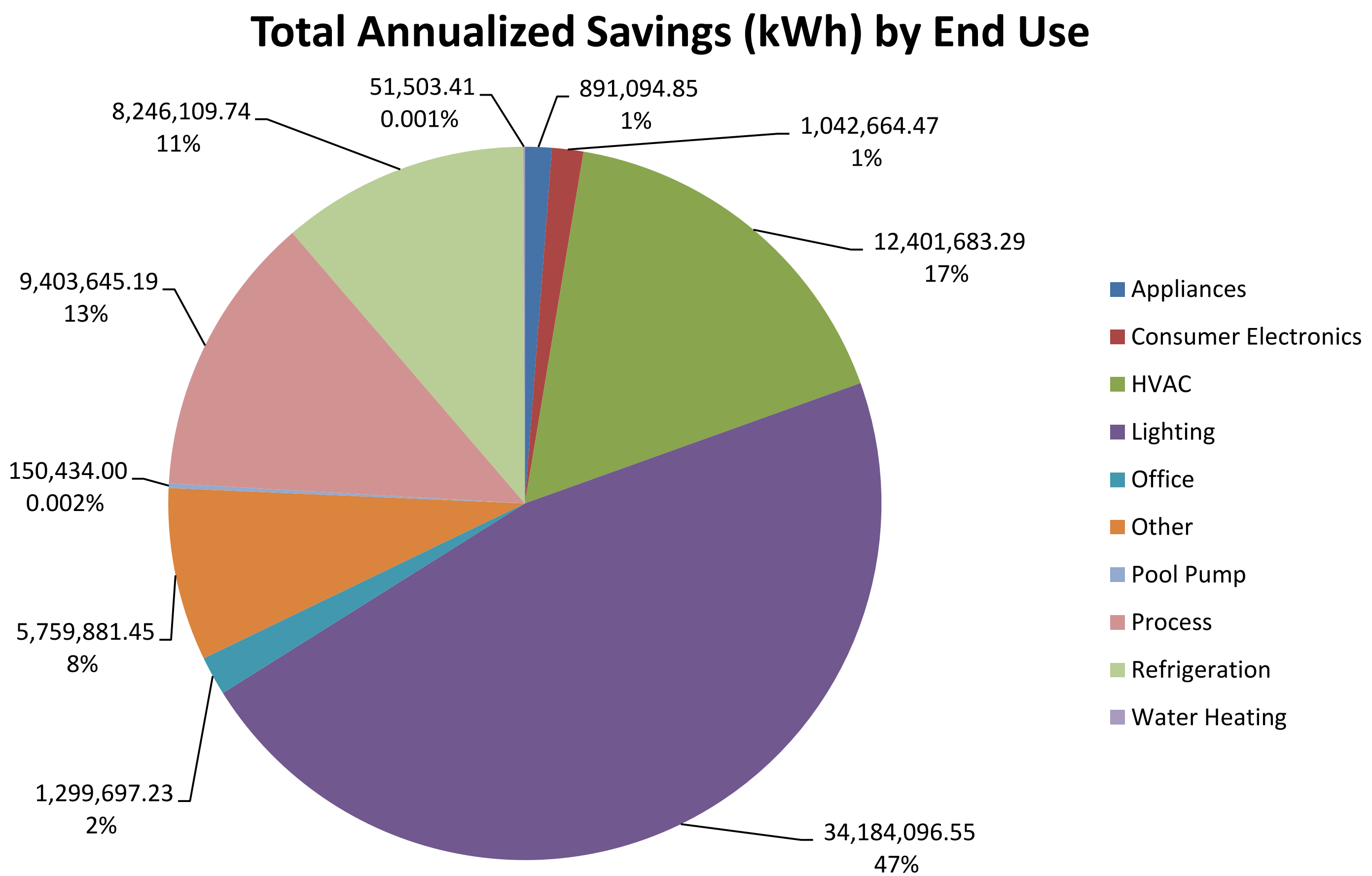


Technical Market Potential: Residential Single Family Dwelling Pool Pumps

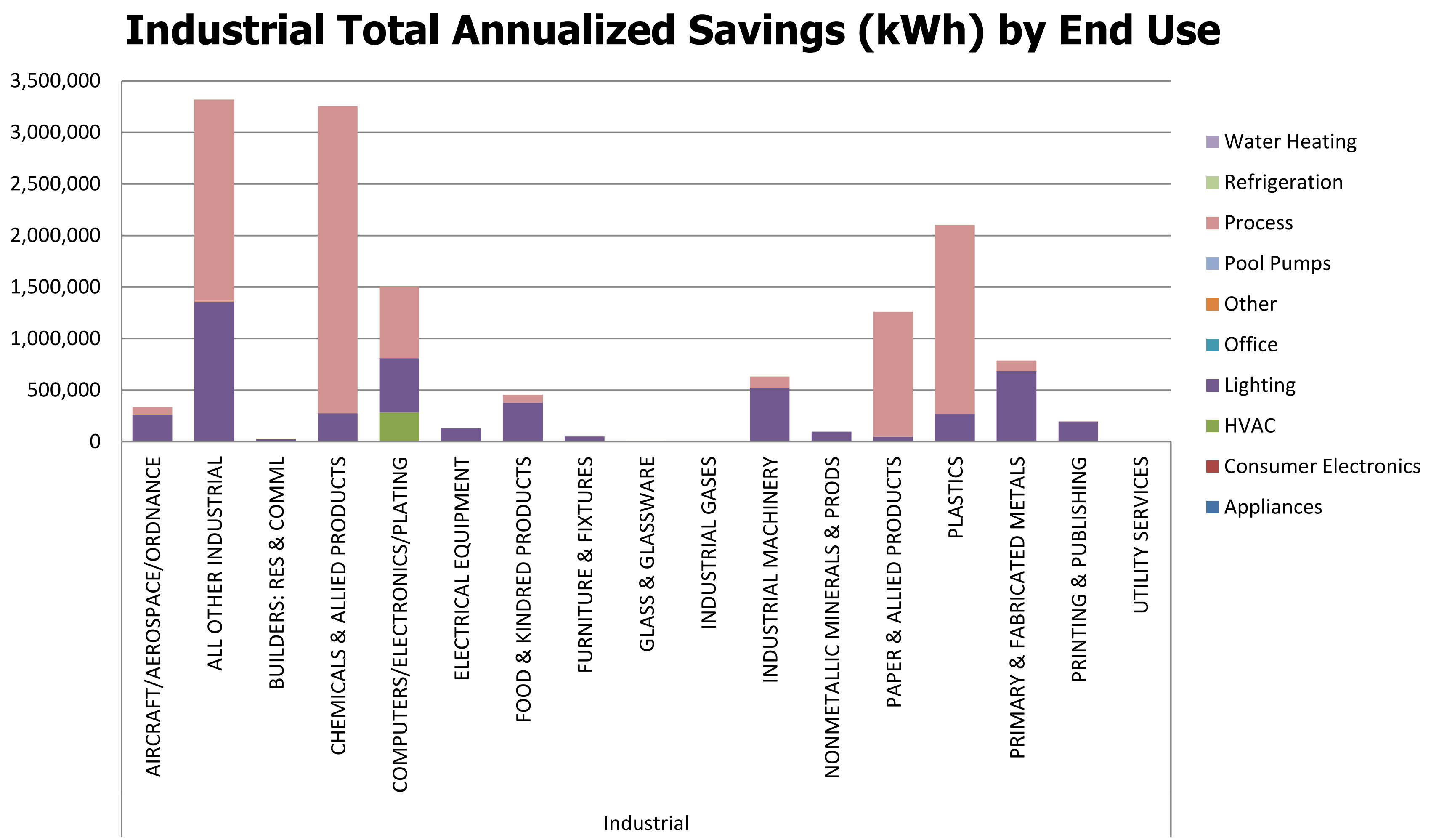
Johanna			
	Savings Type	kWh	kW
	EE Program Claimed Savings - Pool Pump - Rebate	2,290,476	651.1
	EE Program Claimed Savings - Pool Pump - Early Retirement (for first 3.3 years)	5,786,750	1,820.4
	Grid Level Impact - Replace 1-Speed (Run at least 1/2 Hr On-Peak) with V-Speed	5,944,976	2,573.5
	Grid Level Impact - Hybrid (Accounts for Use Diversity) Replace 1 Speed with V-Speek	4,996,262	2,271.3
Santiago			
	Savings Type	kWh	kW
	EE Program Claimed Savings - Pool Pump - Rebate	7,008,364	1,992.2
	EE Program Claimed Savings - Pool Pump - Early Retirement (for first 3.3 years)	17,706,211	5,570.0
	Grid Level Impact - Replace 1-Speed (Run at least 1/2 Hr On-Peak) with V-Speed	18,190,350	7,874.4
	Grid Level Impact - Hybrid (Accounts for Use Diversity) Replace 1 Speed with V-Speek	15,287,489	6,949.7
Total			
	Savings Type	kWh	kW
	EE Program Claimed Savings - Pool Pump - Rebate	9,298,840	2,643.2
	EE Program Claimed Savings - Pool Pump - Early Retirement (for first 3.3 years)	23,492,960	7,390.4
	Grid Level Impact - Replace 1-Speed (Run at least 1/2 Hr On-Peak) with V-Speed	24,135,327	10,448.0
	Grid Level Impact - Hybrid (Accounts for Use Diversity) Replace 1 Speed with V-Speed	20,283,751	9,221.0

EE Measure End Uses (2010-2012): (J-S) Area

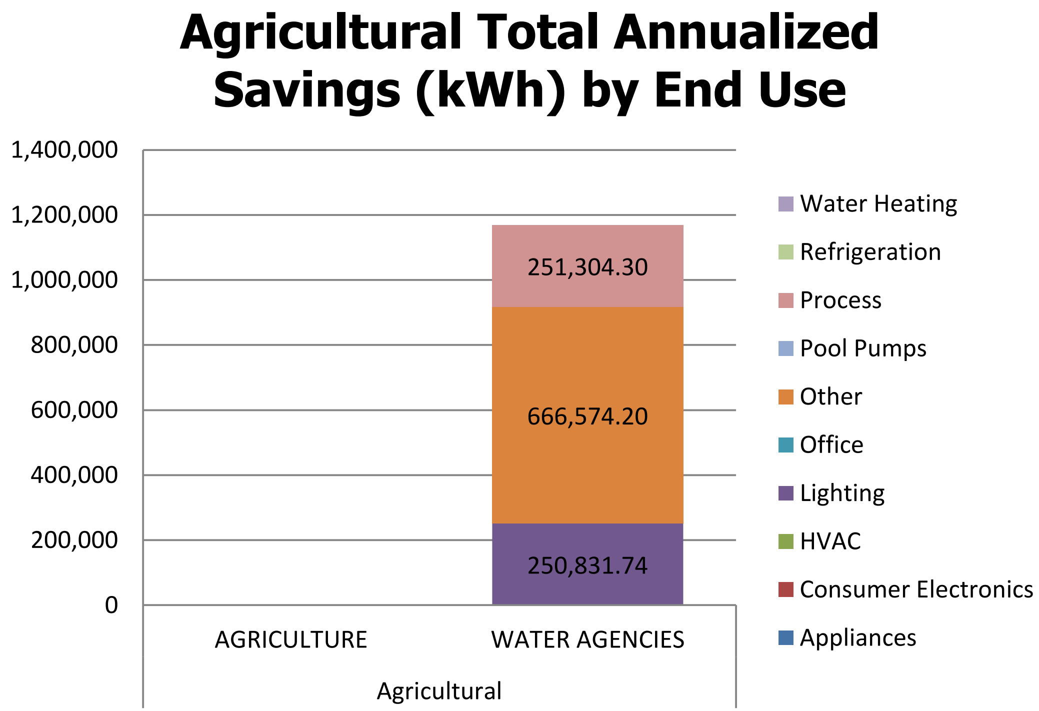
- kWh savings driven by Lighting, HVAC, and Process measure retrofits



EE Measure End Uses (2010-2012): (J-S) Area – Industrial



EE Measure End Uses (2010-2012): (J-S) Area – Agricultural



- Measure Details
  - 19 unique measure types installed
  - 75.5% of all savings attained through only 2 measures:
- PM-45201: Agricultural Pump System Overhaul (53.98%)
- PR-17464: Wastewater Controls (21.46%)
- Savings attributed to retired measures (e.g. T12 replacement): 10.30%

EE Measure End Uses (2010-2012): (J-S) Area – Commercial

- Measure Details
  - 272 unique measure types installed
  - 35.48% of all savings attained through 15 lighting measures (7 of which have been retired)
  - 16.03% of all savings attained through 6 HVAC measures:

- AC-32976: Parking Garage Exhaust Fan (2.33%)
- AC-43210: Chiller (HVAC) Compressor – VFD (1.74%)
- AC-50398: Chilled Water Pump Motor VFD (0.67%)
- AC-61734: Computer Room Air Handling Unit-VFD (2.5%)
- AC-85073: High Efficiency Chiller (Air cooled) (2.5%)
- AC-97352: VSD for HVAC fans (2.04%)

- LT-12866: 101- to 175-watt lamp existing, up to 128-watt replacement fixture (1.76%)
- LT-26100: 400-watt lamp existing, up to 244-watt replacement fixture (2.84%)
- LT-39008: Exterior Linear Fluorescent Retrofits (2.48%)
- LT-51003: Interior Linear Fluorescent Retrofits (2.62%)
- LT-58209: Wall-box lighting sensor (3.94%)
- LT-80693: LED refrigerated display case lighting retrofit (2.02%)
- LT-92133: PAR38: 51- to 90 watts existing, up to 25 watts LED PAR38 (2.27%)

- Savings attributed to retired measures (e.g. T12 replacement and server virtualization): 11.12%

EE Measure End Uses (2010-2012): (J-S) Area – Industrial

- Measure Details
  - 83 unique measure types installed
  - 54.2% of all savings attained through only 6 measures:

- PR-20847: Process Motor – VFD (9.5%)
- PR-32303: Air Compressor Retrofits (7.58%)
- PR-43665: Optimize Performance of Bag Processing Machine (7.87%)
- PR-57774: Efficient Water Distillation Systems (21.03%)
- PR-93841: Air Compressor – VFD (5.6%)
- PR-94826: Dust Collector –VFD (2.66%)
- Savings attributed to retired measures (e.g. T12 replacement): 11.59%

8. Acronyms

AMI	Advanced Metering Infrastructure
BIP	Base Interruptible Program
BTM	Behind the Meter
CEUS	California Commercial End Use Survey
CHP	Combined Heat and Power
CMST	Commercial Market Share Tracking Survey
CPUC	California Public Utilities Commission
CSI	California Solar Initiative
CSS	Commercial Saturation Survey
DR	Demand Response
DSM	Demand Side Management
ERR	Eligible Renewable Resource
EE	Energy Efficiency
ES	Energy Storage
EV	Electric Vehicle
FC	Fuel Cell
HVAC	Heating, Ventilation, and Air Conditioning
IFTM	In Front of the Meter
J-S	Areas Serviced by the Johanna and Santiago Substations
kVA	Kilo-volt-amperes
kWh	Kilowatt-hours
LCR	Local Capacity Requirement
MVA	Mega-volt-amperes
MW	Megawatts
NPV	Net Present Value
NREL	National Renewable Energy Laboratory
OTC	Once Through Cooling
PR	Preferred Resources

PRP	Preferred Resources Pilot
PV	Photovoltaic
RASS	Residential Appliance Saturation Survey report
RTU	Rooftop Unit
SCADA	Supervisory Control and Data Acquisition
SONGS	San Onofre Nuclear Generating Station
SPP	Starting Point Peak