

Overview

Southern California Edison’s (SCE) Preferred Resources Pilot (PRP) is a multiyear study designed to determine whether clean energy resources — including energy efficiency, demand response, renewable distributed generation and energy storage — can be acquired and deployed to offset the increasing customer demand for electricity in the central Orange County region.

PRP Phase 2 is focused on achieving the following two 2017 milestones:

- Demonstrate the ability to acquire and deploy a mix of preferred resources to offset the increasing customer demand expected in 2022 in the PRP region.
- Measure the performance capabilities of those resources to offset the increasing customer demand for electricity in the PRP region.

In 2016, SCE continued to make progress toward the year-end (YE) 2017 milestones. Acquisition activities have established a pipeline of preferred resources needed to offset the potential 1 in 10 year 2022 peak load demand. However, the delay in approval of the Local Capacity Requirements (LCR) contracts puts at risk achievement of the 2017 milestones. The number of resources expected to be in service by YE 2017 reduced from 113 MW to 83 MW. Additionally, the ability to deploy and measure these resources remains to be fully demonstrated. The status for achieving the PRP objectives is listed below and SCE’s 2017 planned actions are contained within this report.

SCE’s PRP seeks to:

- Inform emerging modern grid standards with distributed energy resource (DERs) performance data
- Demonstrate urban acquisition of DERs
- Provide insight about DER locational value
- Establish means to integrate and operationally manage DERs
- Facilitate customer choice of cleaner energy resources

Highlighted Topics of Interest:

- Changes in the Forecasted Peak
- Contracts that Anticipate Future Distribution Needs
- Using Preferred Resources to Meet Circuit Needs
- Delays in Preferred Resources Deployment
- Customer Engagement Complexity
- Trend in Energy Efficiency Program Participation
- Energy Efficiency Measurement

PRP Objective Areas and Performance Measures		Status
Acquisition	% of acquired preferred resources compared to the YE 2017 forecasted need for ~129 MW. Objective is at risk of not being met.	64%
Acquisition	% of acquired preferred resources compared to the YE 2022 forecasted need for ~238 MW. Objective is met.	100%
Deployment	% of executed contracts that are still in place. Objective is met.	93%
Deployment	% of deployed /acquired MW scheduled to be in service before YE 2017. Objective is not being met.	45%
Measurement	% completion of the measurement process. Objective is at risk of not being met.	64%
Legend	<div style="display: flex; align-items: center; gap: 5px;"> <div style="width: 15px; height: 15px; background-color: #90EE90; border: 1px solid black;"></div> ≥ 90% Objective is fully met <div style="width: 15px; height: 15px; background-color: #66B3FF; border: 1px solid black;"></div> ≥ 75% Objective is largely successful <div style="width: 15px; height: 15px; background-color: #FFD700; border: 1px solid black;"></div> ≥ 50% Objective is at risk <div style="width: 15px; height: 15px; background-color: #FF6347; border: 1px solid black;"></div> < 50% Objective not met </div>	

PRP Acquisition

Annually SCE evaluates the forecasted 24-hour, 365-day electrical demand needs of our customers. For the PRP region, the peak load shape is analyzed to inform the acquisition of preferred resources needed to offset the incremental load growth.

Portfolio Design Update

The forecasted load growth for the year 2022 in the PRP region continues to grow and the current rate is 24 MW/year. However, in 2016 the incremental peak need decreased by 37 MW to 238 MW. Key drivers affecting forecast changes are further discussed below. Based on the acquired preferred resources, their expected performance and remaining resource gap, a portfolio of 280 MW can meet the expected 2022 load growth.

Changes in the Forecasted Peak

Situation

Load forecasts fluctuate year to year. In general, long-term forecasts, e.g., 2022, are more uncertain than near-term forecasts. Fluctuations in the forecast occur in part as a result of updated information about construction projects, revised assumptions about distributed energy resources (DER) adoption rates and their impact on load, year over year temperature fluctuations, and economic and customer behavior changes. After a sharp increase in 2014, load growth in the PRP region declined for the last two years.

Activity

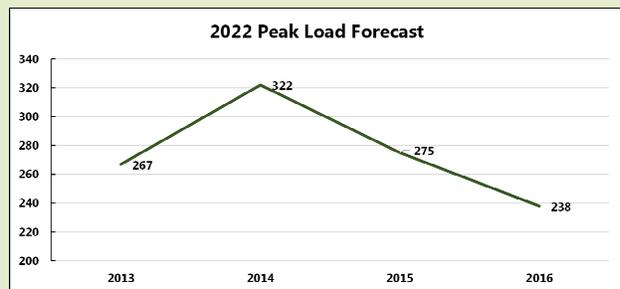
SCE develops a new load forecast as part of the annual Distribution Substation Plan and Transmission Substation Plan planning process. As a new load forecast is completed, SCE conducts an analysis of the changes in the PRP forecast to better understand the key drivers impacting load.

Findings

The year-to-year analysis of the PRP region load forecast for the year 2022 found:

- In 2014, forecasted load increased by 55 MW primarily due to new and updated known customer projects. Most of the new projects are residential developments.
- In 2015, forecasted load decreased 47 MW as a result of lower temperature adjustments in the starting point peak analysis and a decrease in growth projects.
- In 2016, forecasted load decreased 37.2 MW as a result of now taking into account whether known load growth projects' demand will coincide with the circuit peak.

Since the inception of the PRP, approximately 51 MW was deployed in the form of energy efficiency (EE) and un-metered customer sited solar distributed generation . The impact of these resources on the starting point peak is not easily discriminated. Undoubtedly, the EE and solar resources deployed since the start of the PRP are exerting downward pressure on the forecast, but just how much is unknown. While load forecast is declining there remains significant growth and the opportunity to learn more about the impact of preferred resources.



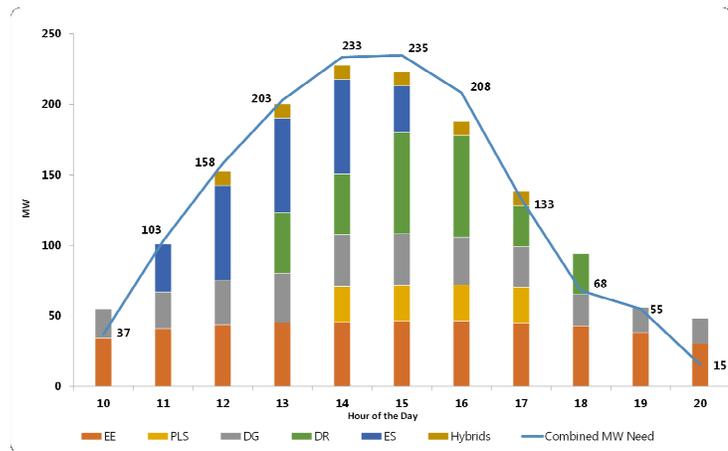
2016 Acquisition Update

Although previously on track, the acquisition and associated deployment toward the YE 2017 forecasted need is now lagging as a result of delays in regulatory approvals of contracts. The contracted resources in-service dates were rescheduled with some commercial operation dates moving to 2018. The PRP acquisition objective for the YE 2017 forecasted need for ~129 MW is likely not to be met.

SCE advanced PRP acquisition by:

- Acquiring through SCE’s customer programs 6 MW of energy efficiency (EE) and 2.8 MW of distributed generation (DG), against 7 MW and 6.4 MW 2016 goals for EE and DG, respectively.
- Executing contracts for 125 MW of preferred resources out of PRP Request For Offer (RFO) 2; submitted CPUC application for approval of contracts in November 2016.
- Receiving contract approval from the CPUC on PRP DG RFO resources. Unfortunately, the contracts were terminated due to the developer not meeting contract obligations.
- Contracting under the Aliso Canyon (AC) RFO for 2 MW of In Front of the Meter (IFOM) Energy Storage (ES) in the PRP region. The CPUC approved the contract in September 2016.
- Including PRP region as a preferred location in other SCE launched RFOs. The ES RFO is in progress.
- Developing a methodology for calculating PRP portfolio cost by using direct program expenditures and expected payments over the contract life.

The graph to the right represents the 2022 combined PRP region peak MW load and the YE 2016 portfolio of acquired preferred resources. Depending on the hour of the day, up to a 20 MW resource gap remains between the expected delivery capabilities of the acquired resources and the forecasted 2022 peak. The resource gap is expected to be filled through ongoing programs and procurement efforts. Therefore, SCE is not planning to pursue additional targeted solicitations for the PRP region.



The table below is a summary of the PRP RFO 2 contracted products.

Product	Developer	MW
Demand Response—facilitated by	AMS	40
• Load Reduction (LR) and ES	NextEra	10
• ES only	Swell	5
IFOM ES	Convergent	35
	Hecate	15
	NextEra	10
Behind-the-Meter (BTM) Hybrid—DG & ES	NRG	10

Contracts that Anticipate Future Distribution Needs

SCE is planning for a future where DERs take a larger role in serving local loads. As the amount of DERs on the grid increases, monitoring and control of DERs will be needed to operate the grid safely and reliably. Resources procured in PRP RFO 2 contain contract provisions that anticipate this future, such as:

- Interface/Communication with Grid Monitoring Systems — provides requirements to implement upgrades to DERs to support operating with SCE's future Grid and Distributed Energy Resource Management Systems.
- Local Resource Constraint Days — provides SCE with the ability to call on IFOM ES market resources in response to local load needs when these local needs are different than the system-wide needs.
- More Discrete Data — sets up a process for DER aggregators to provide information about the performance of DERs down to the individual DER.

SCE found that third party DER developers are willing to partner with SCE to tackle the changing system needs of a more modernized grid. Anticipating future needs is not always about immediately having all the right answers, but about establishing a framework that allows for development of more optimal solutions. Establishing a framework that supports future changes is critical as SCE enters into 10-year plus contracts.

Using Preferred Resources to Meet Circuit Needs

Situation:

PRP RFO 2 provided an early opportunity to test the ability to identify distribution circuit needs and acquire preferred resources to address those needs.

Activities:

Initially, the 2015-2024 forecast identified eight circuits that would require upgrades to meet projected energy demand. The forecast was generated using a distribution planning methodology that assumes new load will coincide with peak demand.

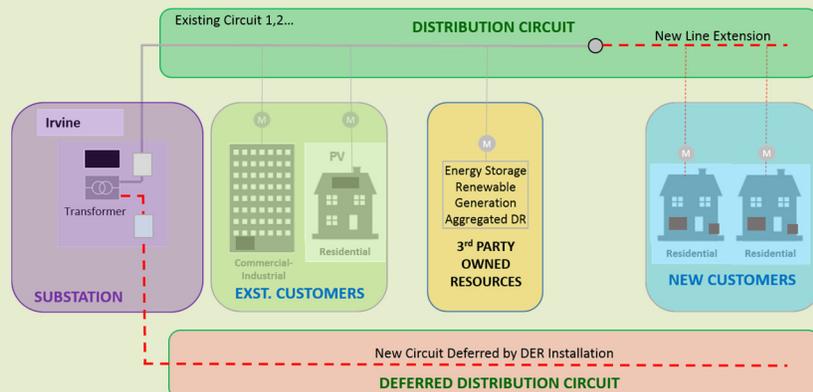
An updated approach for the 2016-2025 forecast evaluated the coincidence of known customer projects and circuit peaks, and found that they do not always align. As a result, only four circuits continued to require upgrades.

In PRP RFO 2, SCE negotiated a 1.5 MW Demand Response contract with NextEra to support the expected needs at two of the four circuits with need.

Findings:

Even with a robust response to PRP RFO 2, offers did not initially yield resource commitments down to the circuit level.

Several constraints may impact the ability to acquire resources at a circuit level such as: land availability and cost, limited number of customers, when and how much capacity is needed, and coincidence of peak as compared to substation level. This may be particularly challenging where peak is driven by residential load.



PRP Deployment

Preferred resources may be deployed to serve a customer's electrical needs—called a behind the meter (BTM) resource—or connected to the electrical distribution system—called an in front of the meter (IFOM) resource. While SCE is tracking deployment of the entire 260 MW of PRP acquired resources, the 193 MW subset of BTM resources being deployed in a concentrated area of SCE's territory has never been attempted and represents a new challenge for SCE, developers and customers.

2016 Deployment Update

Delays in the approval of contracts caused a delay of 33% to the deployment of preferred resources in 2016. SCE continues to discuss contract viability with developers. The only contracts to be terminated since the last PRP report were those associated with SunEdison executed under the PRP DG RFO.

Delays in Preferred Resources Deployment

Delays were experienced in both the LCR and PRP DG RFO approval process. The current time period between contract execution and contract approval through the regulatory process can be a year or more. SCE took actions to improve the likelihood of these contracted resources reaching deployment, such as:

- Continuing advocacy for approval of contracts through various regulatory and court proceedings.
- Meeting with LCR developers and customers to discuss SCE's contracted resources benefits to the customer and local region.
- Developing a marketing flyer to be used as a customer outreach tool to express our continued interest and support.

The delays in the approval of the contracts for resources sited in the PRP region may impact the YE 2017 PRP milestones. The delay will mostly impact the availability of data, amount of time needed for data collection, and assessing the ability of developers who own BTM contracts to acquire customers. By YE 2017, 83 MW of predominantly BTM customer sited resources are expected to be online.

Customer Engagement Complexity

Much of the preferred resources scheduled for deployment in the PRP region require customers to choose to take actions. Preferred resources are available to customers from SCE's customer programs, third party developers working under contract to SCE, and independent third party providers.



- SCE's customer programs
- SCE contracted resources
- 3rd party sales of preferred resources



- Satisfied customers
- Preferred resources contribute to electrical reliability

Feedback over the past few years from some PRP customers, developers and SCE account managers identify the need to clarify the availability of customer products and to develop a customer-friendly delivery approach that helps customers prioritize their most cost-effective options. In the absence of an integrated marketing approach, customer participation tends to be limited to opportunities associated with new and emerging technologies. The impact from this complexity causes lower deployment of preferred resources.

Tracking Preferred Resources Acquisition and Deployment Progress

Resource Type	Acquired ¹	Deployed	Originally Expected Deployment ³	Expected		
	'14 - '16	'14 - '16	Through 2016	2017 ⁴	2018	2020
	MW					
Energy Efficiency and Permanent Load Shift	72	23	40	32	56	72
Demand Response	73	~1	0	18	19	73
Distributed Generation ²	39	27	32	27	39	39
Energy Storage	66	0	4	6	6	66
Hybrids	10	0	0	0	0	10
Total	260	51	76	83	120	260

1. The Acquired total represents the MW expected by YE 2020, rounded to the nearest whole number.

2. The DG number does not include a non-SCE 19.6 MW biogas-fueled resource connected at Santiago substation.

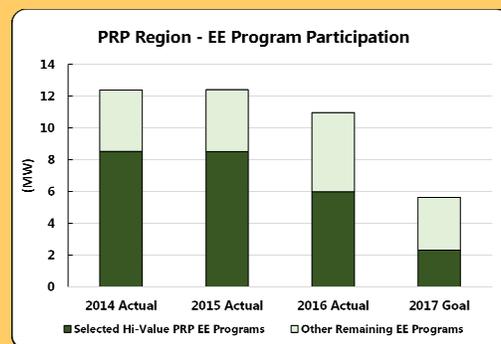
3. This number includes '14-'16 SCE's EE and DG Program targets and LCR RFO contracts with commercial operation dates prior to 01/01/17.

4. At the start of 2016, 113 MW were expected to be deployed by YE 2017; contract approval delays reduced this number to 83 MW.

Trend in Energy Efficiency Program Participation

The 2016 customer participation in EE programs was lower than goal due to overall challenges facing EE, such as:

- Reduced offerings due to EE measures that are no longer available, cost effectiveness, and changes in industry standard practice.
- High engagement costs for downstream EE products.
- Competing portfolio priorities (e.g., Aliso Canyon).
- Complexity in navigating through the various customer offerings.



SCE anticipates that adopting new marketing and engagement strategies as outlined in SCE's EE Commercial and Industrial Business Plan will result in higher EE program participation.

2017 Acquisition and Deployment Plan

In 2017, an additional 32 MWs of preferred resources are expected to be deployed. Nine (9) out of the original fifty-five (55) contracts are expected to deliver in 2017.

SCE's 2017 planned PRP activities include:

1. Acquire 3.4 MW of EE and 1.8 MW of ES through the SCE programs.
2. Obtain a favorable outcome for the PRP RFO 2 regulatory application that seeks approval for 125 MW of preferred resources.
3. Improve the deployment of contracted preferred resources by taking supportive actions with third-party developers to assist them in reaching their early completion milestones, which most often is 6-12 months before their commercial operation delivery deadline.

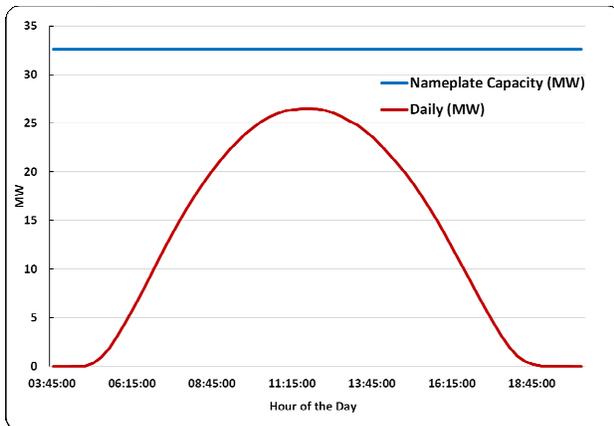
PRP Measurement

SCE is measuring preferred resources to confirm they are available when called upon (dependability), can deliver an expected load reduction or production (predictability), and can deliver in future years (persistence). The PRP is measuring the performance of preferred resources during times of peak demand. The 2016 peak load at the PRP Johanna and Santiago Substations was 1090.5 MW on June 20. Based on measurement results, the potential load offset is indicated in the table below.

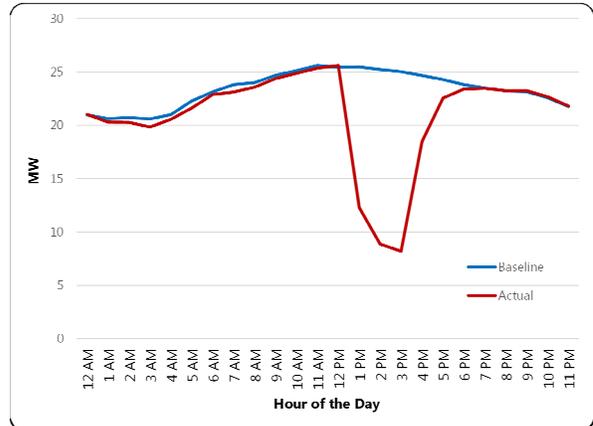
2016 Preferred Resources Performance Data

Preferred Resource	Peak MW	Comments
Distributed Generation (DG from solar)	26.55	The MW amount reflects ~80% of nameplate capacity of 32.66 MW, delivered on 6/20/16; see graph below.
Demand Response (DR)	26.50	DR savings measures the sum of peak MW delivered from the Summer Discount Program and Base Interruptible Program (BIP). BIP was called on 10/19/16 and delivered 15.5 MW on average for the 3 hour period; see graph below.
Energy Storage (ES)	0	0.18 MW of ES is deployed to date but SCE does not have access to these systems' meters.
Energy Efficiency (EE)	0	23 MW of acquired EE measures were deployed prior to the peak day but the grid level impact is unknown. (See below)

PRP Region Solar Generation Performance on 6/20/16



PRP Region DR BIP Performance on 10/19/16



Energy Efficiency Measurement

In an effort to calculate EE savings, SCE developed a tactical EE measurement (TEEM) model. TEEM estimates customer baseline energy use based on customer's historic energy use and weather data. TEEM then seeks to validate savings against the contracted energy efficiency resources. TEEM will be tested in 2017 once the EE associated with the LCR contracts is installed.

The TEEM model may be too complex to broadly implement in procurement of EE. Solicitation of EE for grid level savings may need to rely on setting an upper bounds of aggregated electrical load for a set of customers. SCE is exploring a more simplified 2-year monthly baseline approach that would measure aggregated customers electrical load to confirm it remains below some committed level.

2016 Measurement Update

Execution of the PRP measurement plan is still in progress. The deployment delays associated with the contracted preferred resources impacted the ability to identify the customers under contract and then collect and analyze customer usage data. Based on the revised in-service dates, many of measurement activities will be completed in 2017 for contracted resources.

Grid level measurement methods still need to be defined for customer sited non-utility metered energy storage (ES) and for energy efficiency (EE).

- SCE continues to test methods of measuring meter based savings from energy efficiency upgrades. The grid level impact of the deployed EE to date is not yet discernable but declining PRP load growth is likely impacted by energy efficiency.
- Since customer sited ES does not always require metering that is visible to the utility, SCE is exploring means to access this ES production data.

2017 Measurement Plan

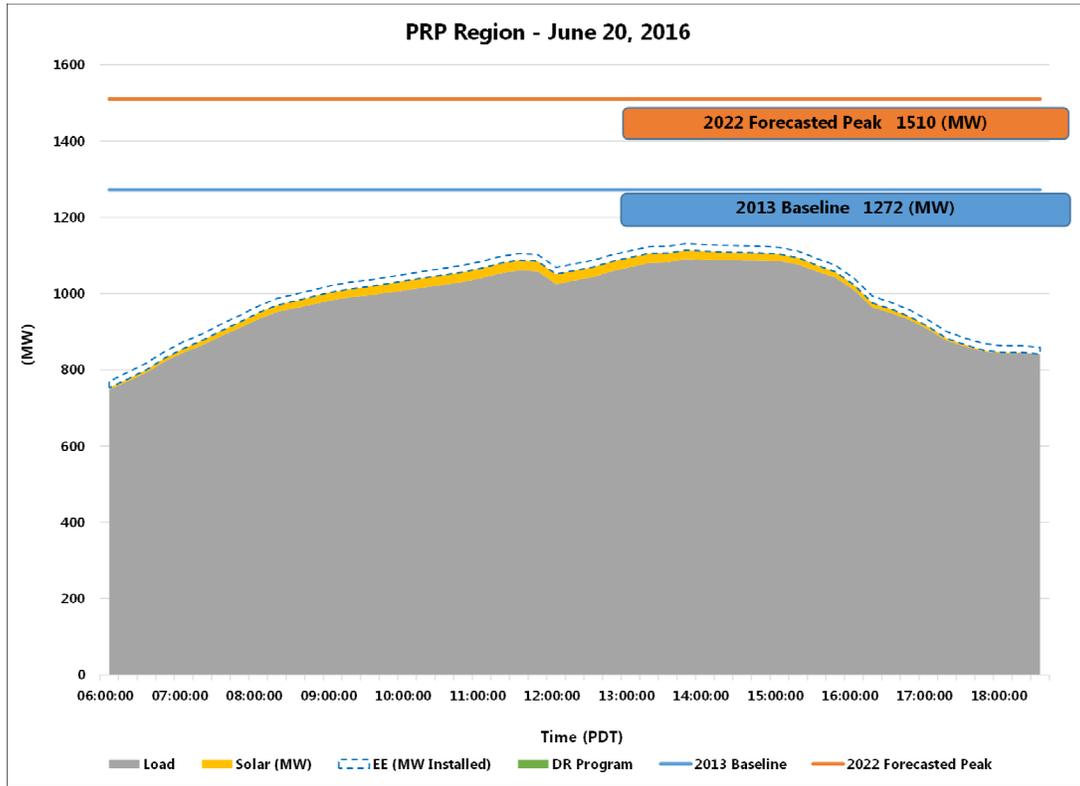
1. Continue execution of the Measurement Development Process.
2. Explore customer relationships that will support better understanding of customer energy storage use patterns.

PRP Region Measurement Development Progress

Resource Type	Acquisition Type	Status of Measurement Work	First Deployment Time Period
Distributed Generation - Solar (DG-PV)	SCE Programs	Monitoring Phase	Systems Deployed
	Contracted BTM DG	Information technology system upgrades in progress	May 2018
	Contracted IFOM DG	On hold due to no current procured resources; process will be similar to Contracted IFOM ES	None
Energy Efficiency (EE) - traditional or through PLS	SCE Programs	Testing Phase	Systems Deployed
	Contracted EE	Information technology system upgrades in progress	September 2017
	Contracted PLS		December 2017
Demand Response (DR-LR or DR-ES)	SCE Programs	Monitoring Phase	Systems Deployed
	Contracted DR-LR	Information technology system upgrades in progress	June 2018
	Contracted DR-ES		Systems Deployed
Energy Storage (ES)	SCE Programs	Plan still in development	Systems Deployed
	Contract BTM ES	On hold due to no current procured resources	None
	Contracted IFOM ES	Information technology system upgrades in progress	January 2017
	SCE-Owned ES		September 2017

Preferred Resources Contribution to PRP Load Reduction

The PRP objective is to determine whether preferred resources can offset the year 2022, 1-in-10 year forecasted peak. While the electrical use by PRP customers in 2016 did not exceed the 2013 baseline, the graph below depicts the contribution of preferred resources in reducing the load seen at the distribution level. Solar includes 28 MW of solar acquired prior to start of the PRP. The EE contribution is the estimated 23 MW of deployed EE since 2014.



Acronym List

AC	Aliso Canyon	ES	Energy Storage
BIP	Base Interruptible Program	IFOM	In Front of the Meter
BTM	Behind the Meter	kW	Kilowatts
CPUC	California Public Utilities Commission	LCR	Local Capacity Requirement
DER	Distributed Energy Resources	MW	Megawatts
DG-PV	Distributed Generation from Solar	PDT	Pacific Daylight Time
DR	Demand Response	PLS	Permanent Load Shift
DR-LR	Demand Response enabled by customer load reduction	PRP	Preferred Resources Pilot
DR-ES	Demand Response enabled by use of energy storage to serve customer load	RFO	Request For Offer
EE	Energy Efficiency	SCE	Southern California Edison
EPIC	Electric Program Investment Charge	TEEM	Tactical Energy Efficiency Measurement
		YE	Year-End



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Preferred Resources Pilot Progress at a Glance

	Phase 1: Lay the Foundation Nov '13 - 2014	Phase 2: Demonstration and Proof 2015 – 2017	Phase 3: Sustainability & Close-out 2018 – 2022
Design & Acquisition	<ul style="list-style-type: none"> ✓ Developed portfolio design process ✓ Issued 2014 PRP Portfolio Design Report ✓ Contracted for 78 MW of resources out of the LCR RFO ✓ Leveraged the scope of EPIC Integrate Grid Project to support the PRP in designing systems to monitor and operate DERs in concert 	<ul style="list-style-type: none"> ✓ Issued updated PRP 2015 & 16 Portfolio Design Report <input type="checkbox"/> Contract for future PR <ul style="list-style-type: none"> ✓ PRP RFO 2 - 125 MW ■ Aliso Canyon RFO – 2 MW ■ Included in Energy Storage RFO ✓ 260 total MW acquired (*14-YTD) that is capable of delivering 228 peak MW ✓ Developed contract provisions in PRP RFO 2 in anticipation of evolving grid needs 	<ul style="list-style-type: none"> <input type="checkbox"/> Develop sustaining processes that are informed by preferred resource measurement and analysis in areas of <ul style="list-style-type: none"> <input type="checkbox"/> Design and acquisition <input type="checkbox"/> Interconnection <input type="checkbox"/> Distribution Planning <input type="checkbox"/> Grid operations <input type="checkbox"/> SCE customer program implementation
Deployment	<ul style="list-style-type: none"> ✓ Increased energy efficiency program participation in 2013-2014 through enhanced customer outreach ✓ Deployed: <ul style="list-style-type: none"> - 9 MW EE from SCE programs - 5.51 MW solar from SCE programs ✓ Sited EPIC Integrated Grid project in PRP region to determine ways to optimize the operation of the grid with a higher penetration of DERs 	<ul style="list-style-type: none"> ✓ Deployment progress through 2016: <ul style="list-style-type: none"> ✓ 23 MW EE from SCE programs ✓ 26.5¹ MW DR from SCE programs ✓ 27 MW solar from SCE programs <input type="checkbox"/> 49 MW of contracted EE/PLS (LCR/PRP RFO 2) ■ 73 MW of contracted DR (LCR/PRP RFO 2) ■ 62 MW of contracted ES (AC/PRP RFO 2) <input type="checkbox"/> 12 MW of contracted DG (LCR) <input type="checkbox"/> 10 MW of contracted hybrids ES/DG (PRP RFO 2) <input type="checkbox"/> 4 MW of SCE owned ES 	
Measurement	<ul style="list-style-type: none"> ✓ Developed measurement process for SCE solar and DR acquired through SCE programs 	<ul style="list-style-type: none"> ■ Develop measurement process for <ul style="list-style-type: none"> ■ Contracted solar ■ Contracted DR ■ Contracted ES ■ Contracted EE/PLS ■ Implement EE measurement testing <input type="checkbox"/> Implement Customer ES Use Study 	
Outreach	<ul style="list-style-type: none"> ✓ Engaged in 2-way information sharing sessions (e.g., one on ones, forums) with PRP Stakeholders ✓ Published 2014 Annual Report 	<ul style="list-style-type: none"> ✓ Continued engagement in 2-way information sharing sessions with PRP Stakeholders ✓ Published 2015 Mid-Year and 2015 & 2016 Annual Report 	<ul style="list-style-type: none"> <input type="checkbox"/> Continue engagement in 2-way information sharing sessions with PRP Stakeholders <input type="checkbox"/> Publish YE 2017 Milestone Report

✓ - Complete ■ - In progress at YE 2016 - Planned post 2016

¹ - DR numbers from SCE programs renew each year and are not counted in the 2022 acquisition total.

For more information about SCE's PRP visit :

<http://on.sce.com/preferredresources>

<http://edison.com/preferredresources>

Please send your comments to: preferredresources@sce.com