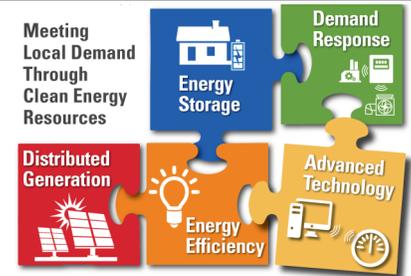


Annual Update

February 2018



Overview

Southern California Edison's (SCE) Preferred Resources Pilot (PRP) is a multiyear study designed to determine whether clean distributed energy resources (DERs) can be acquired and deployed to offset the increasing customer demand for electricity in the central Orange County region. The primary driver for the PRP is to validate untested assumptions associated with the ability of a portfolio of DERs to satisfy local capacity requirements. The study timing (milestone 1) was expected to be completed three years in advance of retirement of the ocean-cooled power plants when, in 2020, there will be increased reliance on DERs to satisfy customer electrical demands. The PRP Milestone 1 report is now expected in the winter of 2018.

Milestone 1 has the following objectives:

- 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 (i.e., customers connected and served by the Johanna and Santiago substations).
- Measure the performance capabilities of the deployed resources to offset the increasing customer demand for electricity in the PRP region.

Delays in DER deployment have significantly impacted the 2017 PRP demonstration milestone. Here is the current status:

- **Acquisition – Complete:** acquired 256 MW of DERs.
- **Deployment – In Progress:** deployed 74 MW of the acquired 256 MW of DERs.
- **Operations – In Progress:** PRP resource testing will take place after additional resources are deployed; currently forecasted for completion in October 2018.
- **Measurement – In Progress:** PRP DER portfolio performance assessment will be completed once additional contracted resources are deployed.

SCE's PRP seeks to:

- *Inform emerging modern grid standards with 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*

Highlights

- PRP RFO 2 cost recovery for the 105 MW of additional contracted DERs is pending CPUC approval
- Customer participation is key to meeting DER deployment target
- SCE completed a solar dependability study for use in estimating PRP region systems that do not have utility meters

PRP Acquisition

PRP Acquisition activities are largely complete. Key 2017 items of note include:

- The acquired PRP DER portfolio that may serve the 2022 incremental forecasted peak along with the expected contributions of each DER is depicted in Figure 1, on page 3.
- In 2017, seven PRP RFO 2 contracts totaling 20 MW terminated due to contracts not receiving CPUC approval by a certain date. The terminated resources include five hybrid contracts at 2 MW each from NRG and two DR contracts at 8.5 MW and 1.5 MW each from NextEra.
- No additional PRP region-specific acquisition is needed. Any remaining need for DERs can be met through SCE's customer programs, natural customer DER adoption or contracted resources obtained through SCE's standard procurement programs.
- SCE is awaiting the CPUC decision regarding cost recovery for 105 MW of contracted preferred resources. The decision is forecasted for March 2018.

PRP Deployment

- 86% of this year's 83 MW of expected DERs were deployed in 2017, mostly from SCE's customer programs.
- The majority of resources deployed to date continue to be programmatic energy efficiency (~28 MW) and customer-sited solar PV (~39 MW). These DERs are not designed to be dispatched or to deliver specific grid-level reduction/production. Table 1 on page 3 provides a detailed break down of resources acquired and deployed.
- Of the 32 MW¹ of contracted DERs expected in 2017, only 2 MW were deployed.
- An additional ~40 MW of contracted DERs are expected by the start of Q4 2018, totaling ~133 MW of DERs deployed. These additional 40 MW will provide a sample of grid-level measurement data to support SCE's PRP 2018 milestone reporting.

Finding the Turning Point for Higher Customer DER Adoption

Based on feedback from DER developers, challenges to deploying customer-sited DERs in localized areas, like the PRP region, include:

- Finite customer pool
- Viability/Eligibility
 - ◇ Business operations that do not match contract delivery specifications
 - ◇ Customers unable to meet developer's credit eligibility criteria
 - ◇ Customer sites do not contain available footprint to install DERs (e.g., storage, solar)
 - ◇ Customers lacking site ownership or have short-term leases. Most leases are 5 years or less. As a result, these customers are less likely to enter into a 15-year contractual commitment with DER developers.
- Conversion Rate: Working through a finite customer pool, filtering through customers to identify a realistic set of potential customers and applying a conversion rate even at a conservative level substantially shrinks the achievable potential, which may lead to some behind-the-meter contracts not coming to fruition.

Take Away: Limit the number of developers with similar product offerings targeting the same customers during the selection process, allow for dual participation with proper controls to protect from paying twice for resources, allow time for developers to complete a bottoms-up market analysis.

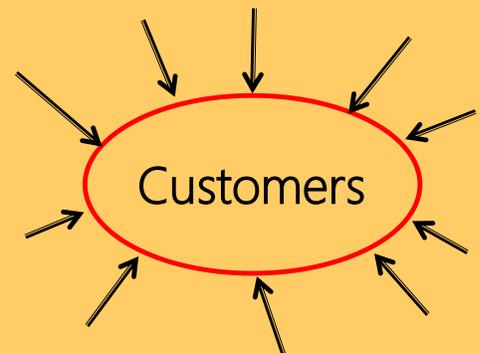


Figure 1—Acquired PRP Preferred Resources Hypothetically Operated to Serve the 2022 Forecasted Load

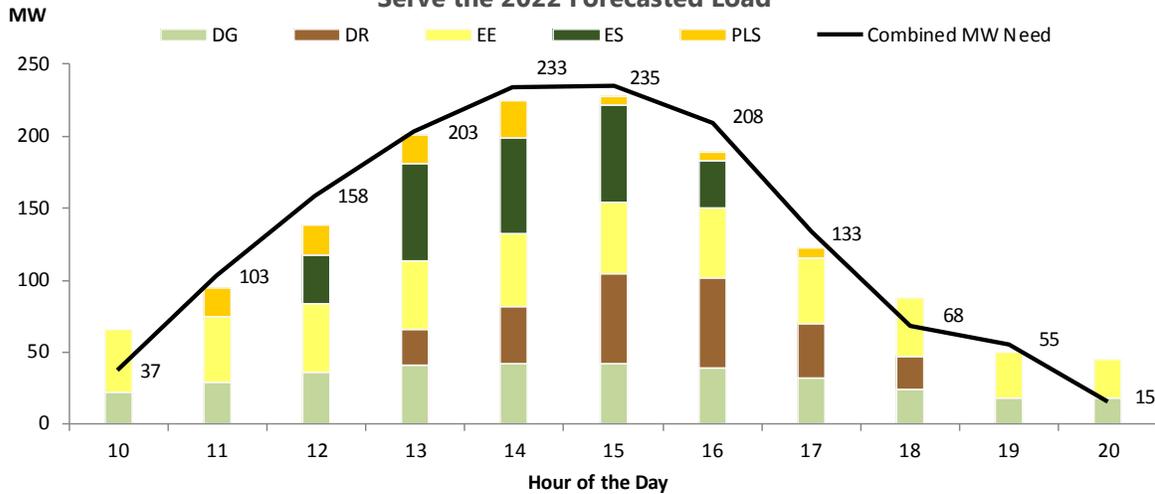


Table 1—PRP Preferred Resources Portfolio Summary

Resource	Acquired ²	Deployed	Incremental Projected Deployment		
		Through 2017	2018	2019	2020
Energy Efficiency (EE) and Permanent Load Shift (PLS)	75	29	25	14	8
SCE Programs	27	28	0	0	0
Onsite Energy Corp (LCR)	3	0	2	1	0
Sterling Analytics (LCR)	8	0	6	2	0
Generate Evaporcool	6	1	5	0	0
NRG-L (LCR)	5	0	5	0	0
NRG SPV 1 - PLS (LCR)	26	0	8	10	8
Demand Response (DR)	63	3	15	25	20
Stem (LCR)	8	1	5	2	0
Macquarie (LCR)	10	2	8	0	0
Advanced Microgrid Solutions (AMS PRP RFO 2)	40	0	0	20	20
Swell (PRP RFO 2)	5	0	2	3	0
Distributed Generation (DG)³	51	39	12	0	0
SCE Program/Tariff	39	39	0	0	0
SunPower (LCR)	12	0	12	0	0
Energy Storage (ES)	67	3	4	35	25
SCE Program/Tariff	1	1	0	0	0
esVolta (ACES)	2	2	0	0	0
Convergent (PRP RFO 2)	35	0	0	35	0
Hecate (PRP RFO 2)	15	0	0	0	15
NextEra (PRP RFO 2)	10	0	0	0	10
SCE Utility Owned or Other Project Related	4	0	4	0	0
Hybrids (PV & ES)	0	0	0	0	0
SCE Program/Tariff	0	0	0	0	0
Totals:	256	74	56	73	53

2. The Acquired totals represent the MW expected by YE 2020, rounded to the nearest whole number.

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

PRP Measurement

SCE plans to assess the deployed DERs' performance capabilities in terms of offsetting the increasing customer demand for electricity in the PRP region. The approach and status of this effort is summarized below.

Resource Type	Acquisition Type	How	When
DR	SCE's Base Interruptible Program (BIP)	Apply 10/10 Baseline: Industry standard of calculating baseline using the past 10 similar days	Now
	Contracted DR		Now
DG-PV	SCE Programs/NEM Tariff	Estimate production based on nameplate values and expected locational hourly production	Now
(EE) - traditional or through PLS	SCE Programs	Compare subset of customer energy usage before and after Energy Efficiency Measure installation	Now
	Contracted EE	Compare customer energy usage before and after Efficiency Measure installation	In-Test
	Contracted PLS		
ES	Contracted In-Front of the Meter ES	Utilize actual KW (charge and discharge) from Seller/ Performance Data Provider	Now
	SCE-Owned ES	Measurement approach for data capture and storage is under development	Apr 2018
	Customer-Owned (Behind the Meter) ES	TBD: Pending results of customer energy storage use study (see below)	Fall 2018

Obtaining Inverter-based DER Performance Data

Accessibility to DER performance data is limited. While today's DER inverters located at a customer's site can provide production data for solar and energy storage systems, this data is not required to be shared with utilities. SCE can approximate the production data based on the solar system information provided during interconnection.

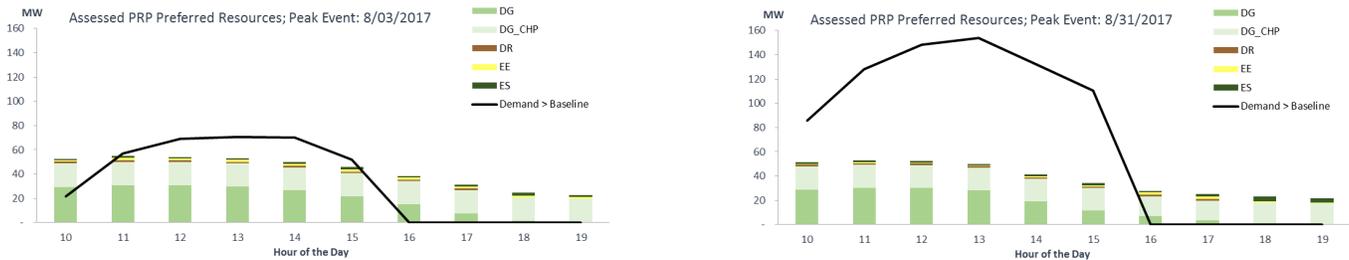
For energy storage, SCE is working with ***Advanced Microgrid Solutions*** (AMS) on a Customer Energy Storage Use Study. The goal is to better understand the customer energy storage use patterns to inform related industry policies and utility distribution planning efforts. In the study, use cases will be tested. For example, one use case involves systems that may be used to manage customer demand charges in addition to providing a utility requested Demand Response function. Insights from the study will be included in the PRP Milestone Report.

Summary of 2017 DER Performance

- Demand Response: SCE’s Base Interruptible Program was not dispatched on any of the 2017 PRP region peak days, but when dispatched delivered 13.17 MW of load reduction over a 2.25 hour dispatch period. This is a decrease to load reduction achieved in 2016 and is due to a slight decrease in participating customers and dispatched hours. Additionally, one resource contracted for 0.86 MW was dispatched on 5 peak days during 5 pm to 7 pm, supplying an hourly average of 1.51 MW. Persistent over-performance by this DR contract is not expected.
- Distributed Generation - Solar: Deployed Solar delivered peak output in the PRP region between 11:00 am to 1:00 pm. Since most of the systems are not metered, SCE developed an estimating approach for assessing DG-PV output as part of a [solar dependability study](#).
- Energy Efficiency: 1,650 non-residential, EE Program customers’ demand was assessed by comparing similar peak periods of recorded usage pre and post EE installation.⁴ Using this comparison, the sampled group produced about 2.5 MW of hourly reduction between 3 pm and 5 pm. Based on these results, it may not be possible to fully determine the energy efficiency upgrades’ grid-level demand reduction impact. Further, load growth in the PRP region, while still positive, is less than previous forecasts. More than 28 MW of energy efficiency upgrades were installed in the PRP region and these upgrades are likely contributing to the decreased load growth.
- Energy Storage: One contracted energy storage resource is deployed and delivered, on the peak days, an average hourly output of 0.58 MW and a maximum hourly output of 1.68 MW.

Portfolio Contribution to Serving the PRP Region Load

Figure 2 - Assessed DER performance (bars) and the customer demand (line) above the baseline value of 971 MW



SCE, through the PRP, seeks to validate the availability and performance of a DER portfolio within the PRP region by assessing its energy generation and grid load reduction. SCE forecasts that in the year 2020 there may be 20 days above the region’s 2013 consumption based on load growth.

As part of PRP Milestone 1, SCE will assess DER delivery amounts on the 10 highest demand days of 2018. To illustrate this approach, Figure 2 (above) represents customer demand (usage) above a baseline value from 10 am to 3 pm. For illustration purposes, on August 3, the portfolio of DERs deployed to date completely offset two hours. Since only a portion of the PRP DER portfolio is deployed, the deployed DERs did not fill the customers’ demand for the remaining hours for either day. The predominant offset for both days was DG (BTM-Solar); 56% total at its maximum hourly contribution. The second largest contributor was by DG-Combined Heat and Power (CHP), whose delivery was consistent across all hours; 28% total at maximum hourly contribution. Notably, although this DG-CHP is not contracted by SCE or under the control of SCE, it can be used to offset load.

As more contracted DERs come on-line, SCE will continue to validate their performance capabilities and report the conclusions in the PRP Milestone report later in 2018.

4. Pre-installation periods utilized were not meant to duplicate actual peak but only similar peak conditions. The goal in doing this is to ascertain reliably-likely reduction at peak rather than maximum possible reduction associated with any EE measure.

Preferred Resources Pilot Progress at a Glance

	Phase 1: Lay the Foundation Nov '13 – 2014	Phase 2: Demonstration and Proof 2015 – 2018	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 ✓ 276 total MW acquired ('14-YTD) that is capable of delivering 227 peak MW ✓ Developed contract provisions in PRP RFO 2 in anticipation of evolving grid needs 	<ul style="list-style-type: none"> ▣ Develop sustaining processes that are informed by preferred resource measurement and analysis in areas of <ul style="list-style-type: none"> ▣ Design and acquisition ▣ Interconnection ▣ Distribution Planning ▣ Grid operations
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 2014 through 2017: <ul style="list-style-type: none"> ✓ 28 MW EE from SCE programs ✓ 1 MW of contracted EE (LCR) ✓ 26.5⁵ MW DR from SCE programs ✓ 3 MW of contracted DR (LCR) ✓ 39 MW solar DG from SCE programs ✓ 1 MW ES from SCE programs ✓ 2 MW of contracted ES (AC) ▣ 46 MW of contracted EE/PLS (LCR) ▣ 60 MW of contracted DR (LCR/PRP RFO 2) ▣ 60 MW of contracted ES (PRP RFO 2) ▣ 12 MW of contracted DG (LCR) <input type="checkbox"/> 4 MW of SCE owned ES Terminated Contracts <ul style="list-style-type: none"> ↓ 10 MW of contract DR (PRP RFO 2) ↓ 10 MW of contracted hybrids ES/DG (PRP RFO 2) 	
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"> ▣ Implement measurement process for <ul style="list-style-type: none"> ▣ Contracted solar ✓ Contracted DR ✓ Contracted ES ▣ Contracted EE/PLS ✓ Implement EE measurement testing ▣ Implement Customer ES Use Study 	
Outreach	<ul style="list-style-type: none"> ✓ Engaged in two-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 - 2017 Annual Report 	<ul style="list-style-type: none"> ▣ Continue engagement with PRP Stakeholders <input type="checkbox"/> Publish YE 2018 Milestone report

✓ - Complete ▣ - In progress at YE 2017 - Planned post 2017 ↓ Terminated
 5 - 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>
 Please send your comments to: preferredresources@sce.com