2016

SCE's Preferred Resources Pilot

Forging a new approach to using clean energy

SOUTHERN CALIFORNIA EDISON®

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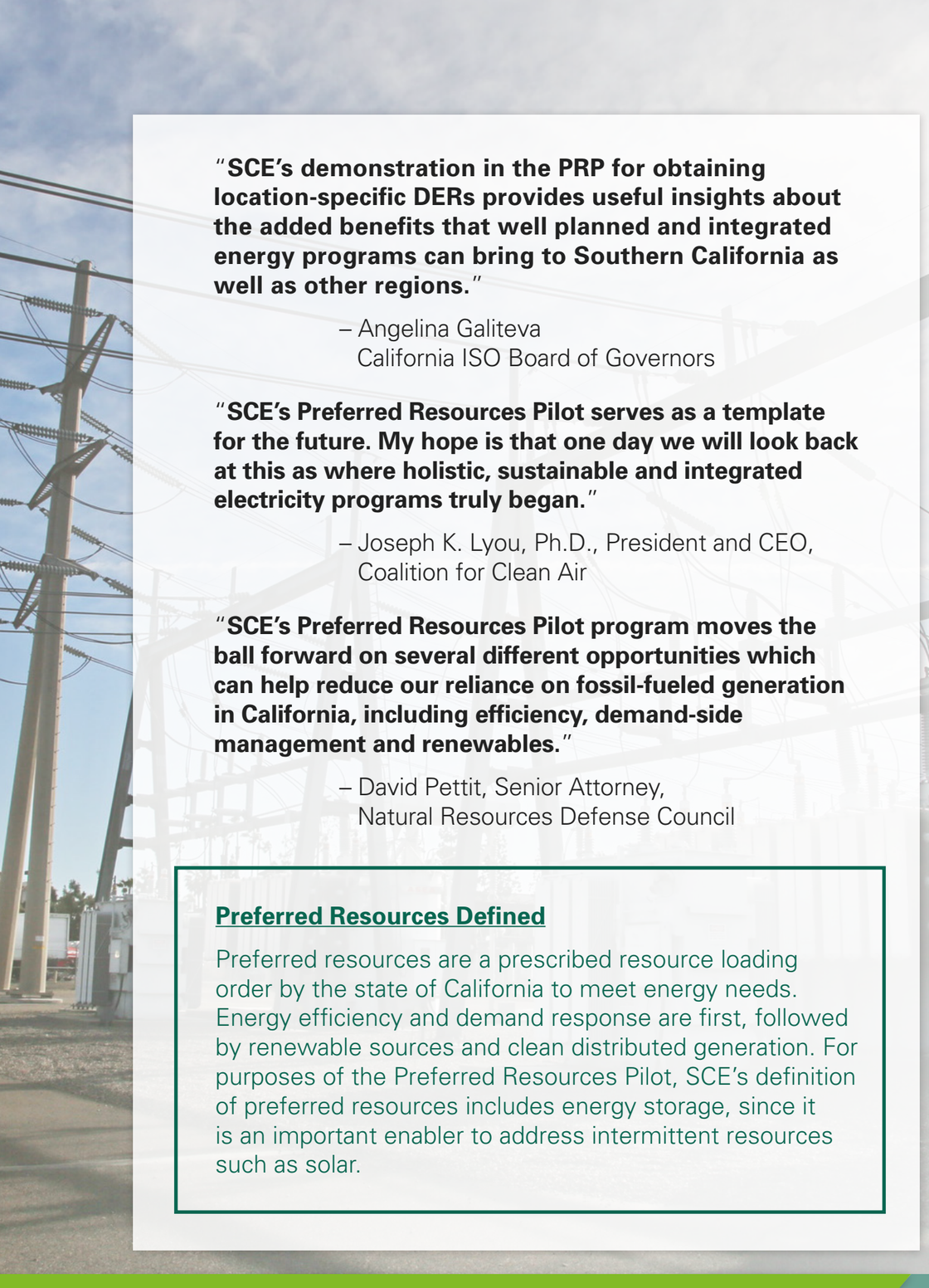


"**SCE's demonstration in the PRP for obtaining location-specific DERs provides useful insights about the added benefits that well planned and integrated energy programs can bring to Southern California as well as other regions.**"

– Angelina Galiteva
California ISO Board of Governors

"**SCE's Preferred Resources Pilot serves as a template for the future. My hope is that one day we will look back at this as where holistic, sustainable and integrated electricity programs truly began.**"

– Joseph K. Lyou, Ph.D., President and CEO,
Coalition for Clean Air

"**SCE's Preferred Resources Pilot program moves the ball forward on several different opportunities which can help reduce our reliance on fossil-fueled generation in California, including efficiency, demand-side management and renewables.**"

– David Pettit, Senior Attorney,
Natural Resources Defense Council

Preferred Resources Defined

Preferred resources are a prescribed resource loading order by the state of California to meet energy needs. Energy efficiency and demand response are first, followed by renewable sources and clean distributed generation. For purposes of the Preferred Resources Pilot, SCE's definition of preferred resources includes energy storage, since it is an important enabler to address intermittent resources such as solar.

Overview

Can distributed energy resources (DERs) perform with the same reliability as a traditional power plant? This question is top-of-mind with utilities, policy makers and market resource providers. In 2013, Southern California Edison (SCE) launched the Preferred Resources Pilot (PRP) to test the ability of DERs to safely, reliably and affordably serve the electrical needs of customers in a real-world environment.

The PRP is designed to determine if and how the use of a diverse mix of "preferred" clean energy resources – including energy efficiency, demand response, renewable energy and energy storage – can offset up to 300 MW of increasing customer demand for electricity in a densely-populated metropolitan area, thereby deferring or eliminating the need to procure new gas-fueled power in the region. The PRP is an "end-to-end" project, encompassing resource portfolio design and acquisition, deployment, operation and measurement. The project is taking place in the Orange County region of Southern California, encompassing 13 cities and 250,000 residential and commercial customers.

A first-of-its-kind attempt using clean energy resources to meet localized power needs in a major U.S. metropolitan area, the PRP has implications beyond SCE's 50,000 square mile service area. Already, the PRP has provided scalable lessons that SCE can apply to other grid-constrained areas within its area, including:

- New approaches to portfolio design and acquisition, with 33 MW of preferred resources already deployed and 103 MW in the queue;
- New opportunities for customers to participate in different Demand Side Management programs to better meet their needs; and,
- New methods to measure DER performance that also impact distribution forecasting and planning.

SCE leadership saw the PRP as an opportunity to help redefine the company's energy future. To support the PRP, SCE leadership promoted broad workforce engagement, development of innovative solutions, and frequent communication and transparency with external stakeholders. They also made progress on the PRP a 2015 corporate measure of success.

The project is aligned with interests across a wide spectrum – policy makers, regulators, environmental organizations, environmental justice advocates and consumer groups – to maintain a glide path towards improved air quality and lower greenhouse gas emissions. With leadership support, the PRP is helping SCE advance California's environmental goals, grow the company's business, and inform the development of the smart grid of the future. In collaboration with customers, regulators, market providers and environmental advocates, SCE's PRP is creating a positive impact for all the stakeholders involved.

PRP Accomplishments To-Date

- Developed a bottom-up, load shape and resource attribute analysis methodology.
- Secured 136 MW of location-specific DERs.
- Established a new solar dependability methodology.
- Built a circuit-level DER tracking process.
- Established a method to measure DER impact on load.

Situation

The accelerating pace of change in the electric power industry is fundamentally altering the way electricity is generated, delivered and consumed. The key drivers are well known throughout the industry:

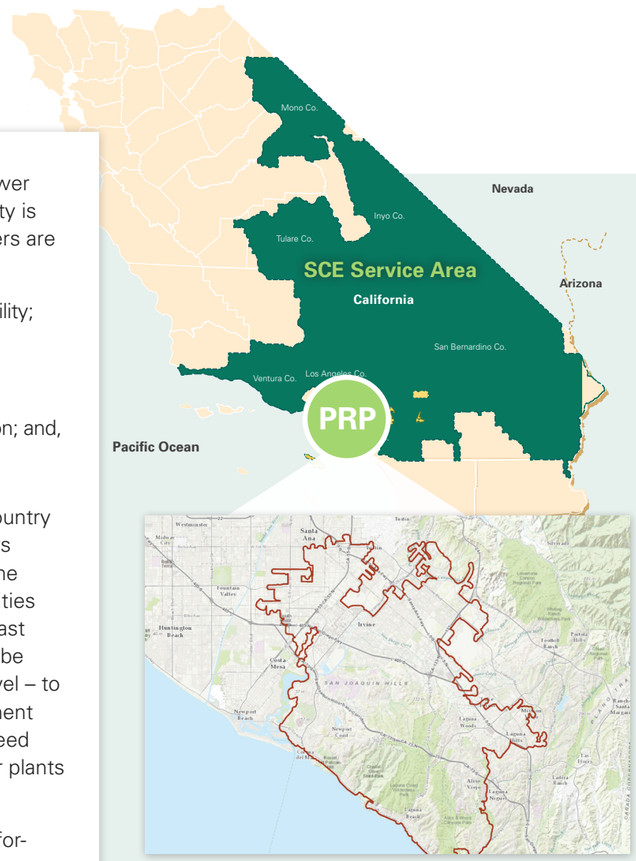
- Public policy prioritizing environmental sustainability;
- Technology and financing innovations facilitating conservation and self-generation;
- Regulations supporting new forms of competition; and,
- Flattening domestic demand for electricity.

Stakeholders in California and other parts of the country – including regulators, utilities and market providers – assert that DERs bring value to customers and the power grid. Early in 2013, the California Public Utilities Commission (CPUC) required SCE to procure at least 150 MW of preferred resources – which may also be considered DERs if deployed at the distribution level – to offset a minimum need for 1,400 MW of replacement capacity in the Western Los Angeles Basin. The need arose due to planned retirements of coastal power plants utilizing once-through cooling equipment.

However, the planning assumptions regarding performance capabilities of preferred resources made by state planning agencies and regulators were largely untested. A key challenge involves the level of uncertainty associated with delivering what is needed, when needed, and for as long as needed.

SCE initiated the PRP in 2013 to validate the state planning assumptions in anticipation of an increasing reliance on preferred resources. Subsequently in 2014, SCE was required to procure an additional 450 MW of preferred resources to address the Western Los Angeles Basin local capacity requirements.

Providing "real-time, real-world" experience, the PRP aims to reduce uncertainty surrounding the application and value of preferred resources, and to encourage greater use of such technologies in areas identified by system needs.



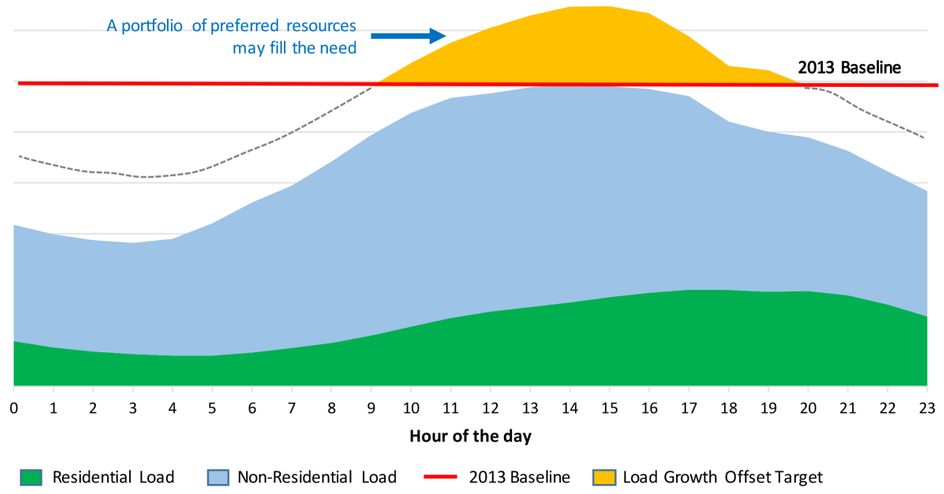
PRP Region Facts

- Approximately 250,000 customer accounts.
- Comprises 10.6% of demand in the Western Los Angeles Basin.
- 30,000 accounts are non-residential; these drive the 10 a.m. – 6 p.m. peak.
- Served by two "A" level 220kV/66kV substations: Johanna and Santiago.
- 2013-2022: Customer demand forecasted to grow by 300 MW.
- Generation or load reduction here contributes more towards system reliability than surrounding substation regions.

Call To Action

Recognizing key trends in the electric utility industry, SCE made a strategic decision to launch the PRP to understand how to depend on DERs for local reliability. It represented a unique opportunity to test the effectiveness of preferred resources to serve local needs by managing the 300 MW of incremental load growth to net zero, thereby deferring or eliminating the need for additional gas-fired generation in the region.

2022 Forecasted Peak Load Above 2013 Baseline for the PRP Region
Illustrative

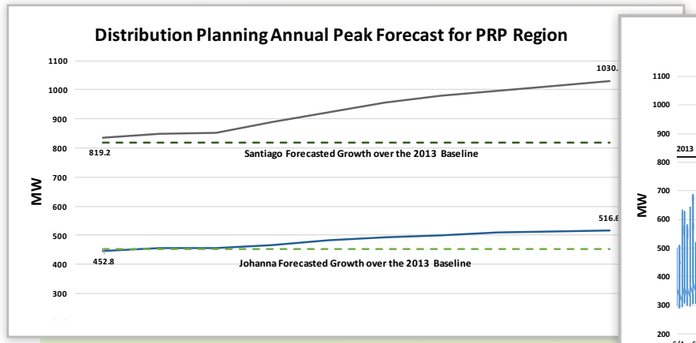


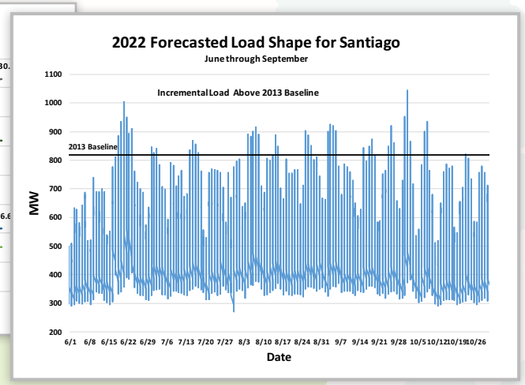
Proving the effectiveness of preferred resources should also:

- Lead to a greater utilization of these innovative technologies;
- Support improvements in air quality; and,
- Avoid or reduce greenhouse gas emissions.

Starting at the end of 2013, Phase 1 laid the foundation for the PRP by establishing the cross-functional implementation team, developing a workstream road map and establishing the initial processes to be carried into Phase 2, demonstration and proof. The road map divided the work into five workstreams: Design, Acquisition, Deployment, Measurement and Stakeholder Engagement. While each workstream has its objective, cross-collaboration and feedback loops were critical to support organizational learning and the speed of implementation.

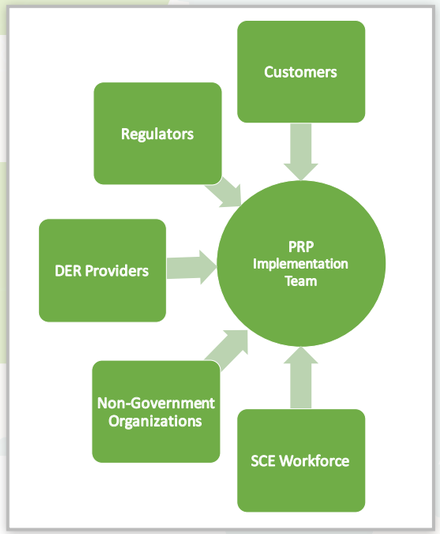
The PRP Roadmap





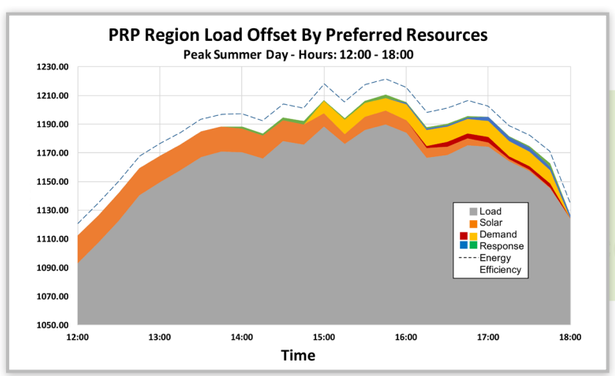
Design

A new approach to resource planning was developed that starts with traditional distribution planning calculating the annual peak at a substation and then forecasts a location-specific, bottom-up 24-hour, 365-day load shape. Since the PRP seeks to offset the incremental growth above the 2013 baseline, the load shape can be analyzed to define the peak load shape attributes. Portfolios options are then developed based on the hourly delivery capabilities of the preferred resources.



Stakeholder Engagement

Stakeholder engagement, frequent communication and transparency in activities is critical to the PRP's success. Through stakeholder engagement SCE obtains input, accelerates progress and builds trust.



Measure

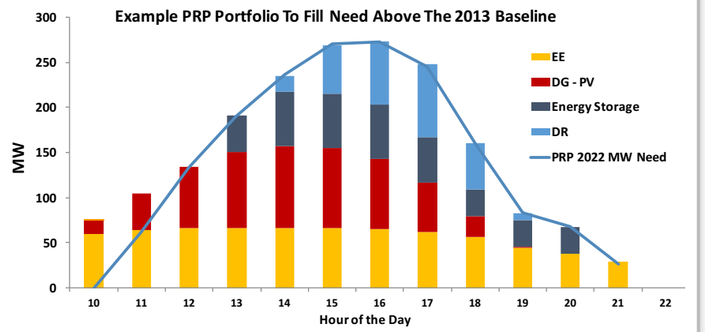
Measured load offset by preferred resources is determined using a new process. This process is validating the assumptions about the performance capabilities of preferred resources.

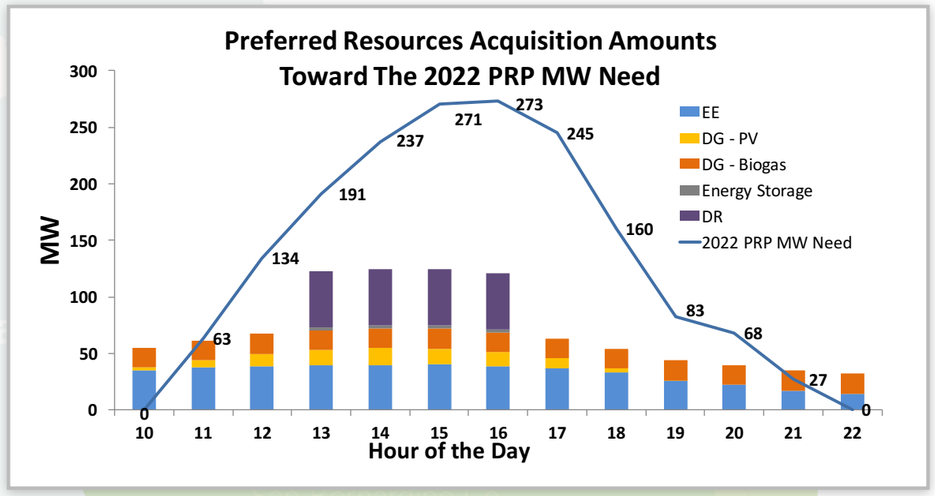
Five workstreams together achieving the Preferred Resources Pilot objectives

Load Shape Attributes Above The 2013 Baseline

Forecasted MW Required to Meet Any 2022 Need			
Johanna		Santiago	
MW Required	Days	MW Required	Days
> 60 MW	1	> 200 MW	1
> 45 MW	3	> 150 MW	2
> 30 MW	12	> 100 MW	6

2022 Forecasted Capacity Resource Attributes				
	Johanna		Santiago	
Duration	Days	MW	Days	MW
0-2 Hours	5	5	2	8
2-4 Hours	6	17	8	51
4-6 Hour	15	11	13	49
> 6 Hours	13	32	17	103



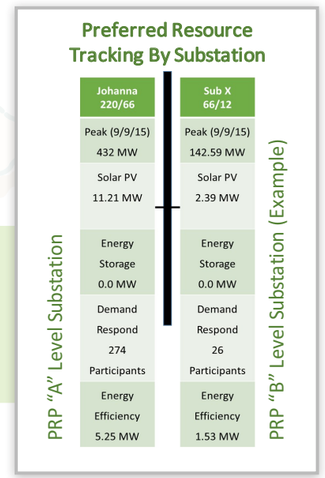


Acquire

Preferred resources are acquired to fill the gap up to the PRP MW need. Using location targeting, preferred resources are acquired through (1) utility programs, (2) existing solicitations, and (3) unique solicitations and transactions.

Deploy

Deployed preferred resources are tracked down to the circuit level. SCE works to identify and develop solutions to overcome the barriers to deployment, such as in areas of interconnection and customer outreach.



Leadership: Leaning in to Build the Future

To spur the dynamic thinking necessary for rapid development and deployment of creative and transformative solutions, SCE leaders empowered the workforce to become part of designing, building and implementing the PRP plan. Utilizing a small core PRP project group along with change leaders from within SCE's departments, executive leadership fostered a combination of operational experience, collaboration, and problem-solving that quickly identified opportunities and work process changes.

Externally, the PRP engagement strategy emphasizes outreach to a broad group of community stakeholders, including customers, vendors, non-governmental organizations (NGOs) and industry groups. This approach provides opportunities to partner with stakeholders in testing new approaches to design, acquisition, deployment and measurement.

For example, SCE tested the use of cash incentives ($30/kW for customized energy efficiency projects) and new technologies that are less expensive to deploy (LED Tube Retrofit Pilot) in the PRP area; each delivered increased customer participation and kW saving.

Workers are installing mechanical window shades that are operated by a control system to optimize energy efficiency and lighting level throughout the day.

LED Tube Retrofit Pilot

Situation

- LEDs promise to be the next large opportunity for lighting energy savings. LED tubes offer businesses a lower-cost alternative to full fixture replacements or full retro fit kits.
- Regulators have concerns about potential equipment performance, light quality, and persistency.
- SCE requested and received approval from the CPUC to pilot an LED Tube limited offering in the PRP region.
- The demand and energy savings would provide grid relief as well as valuable real-world performance, quality, and customer satisfaction data.

Findings

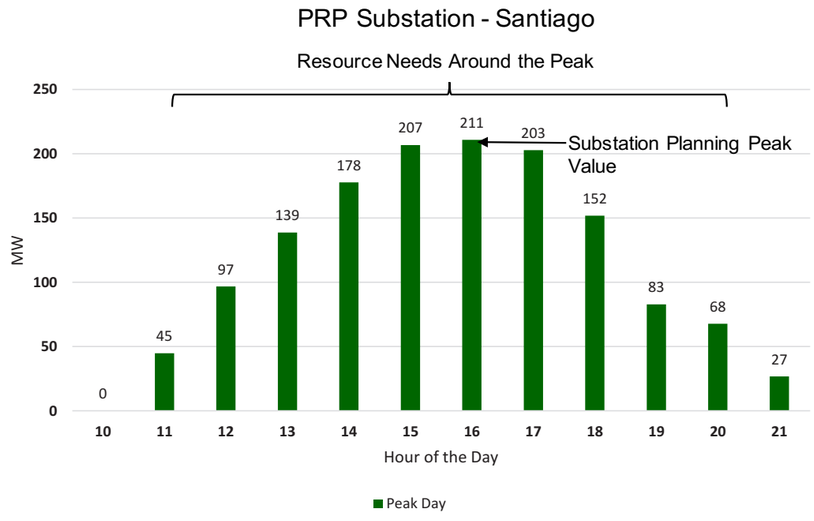
- The subsequent LED Tube Retrofit Pilot resulted in 24 projects completed across a diverse range of businesses in the PRP region, representing a savings of 557 kW.
- Customers and vendors responded positively to the introduction of new, lower-cost LED lighting.
- Rigorous protocols were employed to collect lighting measurement and customer satisfaction survey data at each project site before and after installation, and again six weeks after installation.
- If the LED pilot results satisfy regulatory concerns, the LED tube technology can be expedited as a full-fledged energy efficiency program offering.

Innovation:

The path to using "Preferred Resources" for Reliability

If directed to serve 300 MW of additional customer demand, many utilities would opt for traditional solutions like a new gas-fired peaking plant. Yet in 2013, SCE proposed via the PRP to use preferred resources with variable performance attributes, including: intermittency, limits on the number of hours for delivery, and limits on the number of times the resource can be called. This provides an opportunity to determine the cost for using preferred resources for reliability needs.

SCE determined that the hourly customer load shape associated with the 300 MW peak demand lends itself to a preferred resources portfolio approach. Previous distribution planning would focus on the peak demand (single point) at each of the local areas; yet attributes such as time of day and the electrical demand around that peak provided an opportunity to optimize the procurement and use of preferred resources.



The shift to ***hourly planning at the distribution level*** resulted in new approaches to resource portfolio development, use of customer meter data, procurement based on hourly attributes, and use of grid level resource measurement results.

Portfolio Design:

SCE's new approach begins with traditional distribution planning and then forecasts a location-specific, bottom-up, 24-7, 365-day load shape that defines the peak demand attributes that may be met by distributed energy resources. Attributes are defined by the MW needs: how much, how many hours, how often per year, and what time of day. This approach was applied to loads below the 220/66 kV substation level. Further refinement of the annual portfolio design process allowed SCE to evaluate circuits where DERs may support deferral of distribution upgrades for some period of years.

Insights and Learning:

Improving Customers' Understanding

Early in the project, customers in the PRP region quickly became overwhelmed with choices and mixed messages as SCE and vendors promoted demand side management products from utility programs and contracts, respectively. Learning about this through stakeholder engagement activities, SCE developed a continuously evolving integrated marketing and outreach plan to help customers navigate through the various offerings.

Innovation:

The path to using "Preferred Resources" for Reliability

Location-Specific Procurement:

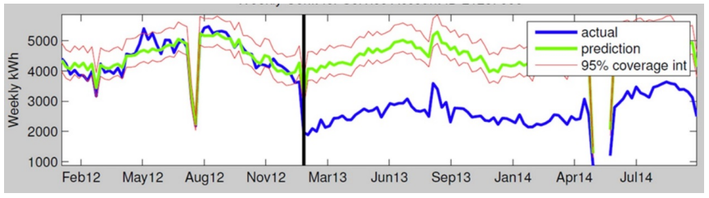
In procuring resources to meet CPUC mandates, SCE sought contracts in the designated PRP region that would deliver two years earlier than needed for the larger Western Los Angeles Basin region. The attributes developed in the portfolio design process informed the resource selection process. A total of 78 MW was contracted, representing a diverse mix of resources and suppliers:

- 25.6 MW of permanent load shifting (NRG);
- 17 MW of customer-sited energy storage (Advanced MicroGrid Solutions and Stem);
- 23.4 MW of energy efficiency (NRG, Onsite Energy, and Sterling Analytics);
- 12 MW of customer-sited solar generation (SunPower).

Still needing more capacity, SCE launched two subsequent PRP-specific Request for Offers (RFOs). The second solicitation highlighted preferred circuits with specific hours of delivery. Offers were received that match some of the circuit needs and may support deferral of some distribution system upgrades for several years.

Use of Customer Meter Data:

SCE analyzed Advanced Metering Infrastructure (AMI) usage and load data from PRP region customers to identify the most impactful end-uses driving the demand for electricity. Using this data, SCE estimated the region's technical potential for traditional demand response and energy efficiency. This formed the foundation for the resource portfolio and informed the viability assessment for PRP procurement. SCE extends the value of this analysis by identifying and reaching out to specific customer sets that could most benefit from demand side management programs while also contributing to peak mitigation. Below is an example of measuring the effects of energy efficiency projects in the PRP region at customer's meter.



Measuring Performance:

A primary objective of the PRP is to obtain more certainty about DER performance. SCE is examining each preferred resource type's impact on the grid to fully understand its availability (available when called upon), dependability (ability to deliver an expected load reduction or production), and durability (ability to deliver in future years).

For example, since most of the solar in the PRP region is customer-sited and the production is not metered by SCE, a measurement methodology was developed that takes the individual system specifications and, using a model implemented by Clean Power Research, determines the solar production. This calculated solar production is compared to the metered production to confirm modeling accuracy. Using this information, SCE is able to develop a greater understanding of the solar production in this semi-coastal region.

Insights and Learning:

Taking Solar Measurement to the Next Level

One early PRP achievement is SCE's development of a solar dependability methodology to support the distribution planning process. Using two summers of behind-the-meter (BTM) solar data provided from a subset of PRP customers, SCE calculated a curve of dependable solar generation in terms of the percent of nameplate capacity. The curve represents the level above which 95% of the solar resources are typically generating.

Using this analysis, SCE determined that BTM solar can dependably deliver up to 40 percent of its installed capacity to offset the summer needs in the PRP area; previous methods identified dependability only up to 19 percent. The advanced, more precise methodology allows SCE to increase the forecasted amount of dependable BTM solar for use in distribution planning purposes.

Forging a New Approach to Using Clean Energy

"Our paramount responsibility is to safely deliver reliable, affordable and clean electricity to our customers. We must execute every day to meet that responsibility, and by doing so, we will earn the public trust. Innovative solutions to solve the industry's challenges and a strong commitment to serving the public are essential to continue the mission and legacy of Edison International."

Ted Craver
Edison International
Chairman and CEO

SCE's mission is to safely deliver reliable, affordable and clean energy to our customers. We believe that embracing the waves of change that are transforming the electric power industry is the key to growing our business. For 130 years, the people of SCE, and the innovations they have created, have led our company toward a dynamic energy future, and we expect that tradition to continue for decades to come.

The PRP is just one example of how our company is preparing for the future. SCE is also advancing:

- **Grid Modernization** to support more customer choice in energy technology and how customers interact with the grid. These efforts include grid investments to increase integration capacity where DER deployment may be beneficial; and tools development, such as the SCE's Distributed Energy Resource Interconnection Map (DERIM).
- **Transportation Electrification** through its Charge Ready program, a five-year, $355 million effort to install the infrastructure for up to 30,000 electric vehicle (EV) charging stations at long dwell-time locations across SCE's service area. Working in close partnership with a wide range of stakeholders – including environmental organizations, consumer advocates and EV charging companies – SCE recently received CPUC approval to begin piloting the program.
- **Energy Storage** through both utility-owned and market-driven applications. In 2014, SCE initiated contracts for 264 MW of energy storage technology, the largest procurement in the U.S. at the time. In addition, SCE is testing one of the world's largest grid-connected lithium-ion energy storage systems at our Monolith Substation in the Tehachapi Wind Resource Area.

For more information visit:
http://on.sce.com/preferredresources
http://edison.com/preferredresources