SCE PREFERRED RESOURCES PILOT

Lessons Learned About DER Sourcing and Deployment

August 1, 2019

EXECUTIVE SUMMARY

In late 2013, as the utility industry was starting to consider distributed energy resources (DERs) as a viable solution for electric grid needs, Southern California Edison embarked on its Preferred Resources Pilot (PRP). The PRP provides multiple tangible benefits. The primary focus is to determine if and how a diverse mix of clean DERs can serve the load growth of a local area similarly to a gas-fueled power plant. It also enhances grid reliability, offers customers choices to meet their energy needs and contributes to achieving the state's environmental goals.

Specifically, the PRP looks at how DERs can be deployed to meet the load growth expected through 2022 in a densely populated metropolitan area—13 cities covering 280,000 residential, commercial, and industrial customers in Orange County, California – and includes the use of energy efficiency (EE), demand response (DR), distributed generation (DG) and energy storage (ES).

SCE has completed the DER sourcing phase of the PRP: the current portfolio is in line with the pilot's needs and no capacity deficiencies have been identified in the region. SCE does not anticipate significant further findings that will differ markedly from the content of this report regarding DER deployment activity.

PRP operations are expected to continue until 2022. The ongoing focus will be validating the performance of DERs and reporting the findings in an annual compliance report to the California Public Utilities Commission (CPUC).

The PRP pilot has provided valuable insights, particularly on DER sourcing and deployment, for other regions where DERs are expected to play an important role as grid solutions. Consequently, this 2018 report is being issued to share key insights into these activities.

KEY INSIGHTS

- **DERs can be an effective means to manage load.** A 200 MW DER portfolio (about 14% of the forecasted peak load) will be available to serve the region's peak needs by 2021.
- **DER sourcing and deployment can potentially be improved when both competitive solicitations and customer programs are part of the DER sourcing strategy.**
  - Competitive solicitations enable access to innovative and broad pool of resource options.
  - Customer programs provided increased speed of delivery.
- **DER portfolio effectiveness factor may be less than initially estimated.** SCE initially estimated an 85% effectiveness factor at full deployment, but the portfolio's first-year operations performed at a 68% effectiveness factor (based on measured installed DER capacity).

THE PROJECT

The primary objective of the Preferred Resources Pilot is to determine whether locally deployed DERs can reliably serve the forecasted load growth for 2022 in south Orange County.

The PRP is an end-to-end project, encompassing resource portfolio design, DER sourcing, deployment, and measurement. In each of these areas, SCE identified key findings and suggested improvements for future DER grid solutions.

The location offers a live test environment with load growth and a diverse customer mix. At the start of the pilot, peak load was forecasted to grow by 267 MW in the year 2022. Over time, the forecast has fluctuated. Most recently, the forecasted peak load growth declined to 141 MW. Changes in the load forecasting methodology, variability in long-term forecasting, and the PRP's DER sourcing have contributed to the forecast change.

Although the rate of growth has declined, load growth is still expected and SCE will leverage its PRP DER portfolio to serve it.

1. DER PORTFOLIO DESIGN

The PRP's DER portfolio design work has been instrumental in advancing SCE's understanding of how to facilitate DER solutions for distribution grid needs.

SCE completed three PRP portfolio design iterations (2014 – 2016)[1]. The three iterations provided an important feedback loop given the distribution system's sensitivity to weather, economic, and customer changes. An iterative portfolio design process can ensure DER sourcing is appropriately focused on relevant DER quantities and attributes.

[1] All three portfolio iterations are available under Market Design Information at sce.com/prp

PRP REGION FACTS

- ~250,000 customer accounts
- ~11% of demand in the Western Los Angeles Basin
- ~30,000 non-residential accounts drive peak (10 a.m. – 6 p.m.)
- 2013 peak load baseline: 1,272 MW
- Baseline incremental peak load forecast (2013 – 2022): 267 MW
- Revised 2016 incremental peak load forecast (2013 – 2022): 238 MW
- 2018 incremental peak load forecast (2013 – 2022): 141 MW
- Transmission level substations (220kV/66kV):
  - Johanna
  - Santiago

DISTRIBUTED ENERGY RESOURCES IN THE PRP

Energy Efficiency (EE)
The delivery of more services for the same amount of energy, or the same amount of energy services for a smaller amount of energy.
Portfolio: Acquired through business and residential customer programs for buildings and appliances that conserve and manage energy consumption. These include Non-Residential Integrated Distributed Energy Resources, Savings by Design, and Direct Install. Also includes EE contracted through competitive solicitations.

Demand Response (DR)
Reduction in electric usage by customers in response to periods of peak demand. Demand response customers are provided incentives to respond to help ease temporary strains on the electricity system.
Portfolio: Acquired through competitive solicitations, mainly enabled by customer-sited (behind-the-meter) energy storage.

Energy Storage (ES)
Technology, such as batteries, used to store energy for later use. When used in collaboration with renewable distributed generation, ES can create a dependable and predictable amount of clean power delivered over a period of time.
Portfolio: Acquired through competitive solicitations, SCE's utility-owned storage, and customer programs such as the Self-Generation Incentive Program.

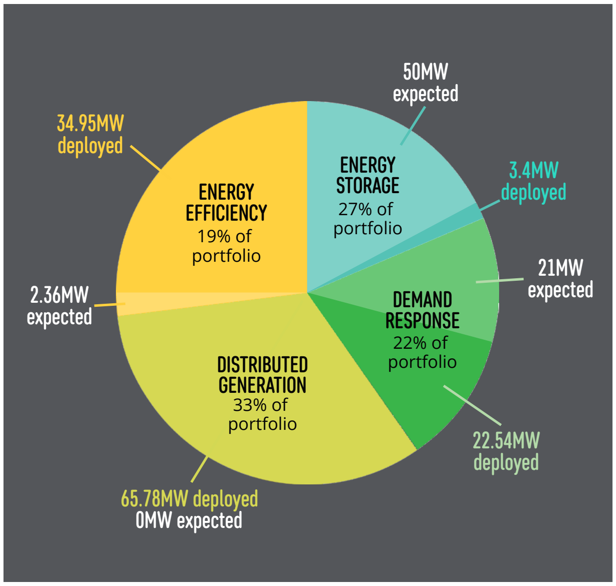
Renewable Distributed Generation (DG)
Electrical generation from local renewable resources such as solar, rather than from large, centralized generating facilities.
Portfolio: 1) Acquired through customer-sited (behind the meter) installations that participate in SCE programs and tariffs, including Single-Family Affordable Solar Homes, New Solar Homes Partnership, and Net-Energy Metering. 2) From grid-sited (in-front-of-the meter) Combined Heat and Power (CHP) plant. (The CHP resource is not under contract with SCE, however, it is interconnected in the PRP Region and serves the immediate load of customers in the PRP Region.)

Through each iteration SCE refined and updated its assumptions and incorporated forecast changes and DER sourcing results.

- The market potential studies and technology effectiveness factors served as a starting point to determine a possible resource mix.
- DER deliveries, based on their effectiveness factors, were stacked up to meet the PRP Region's peak hourly needs. At full deployment, SCE had expected the PRP portfolio to perform at 85% effectiveness. These assumptions may need to be adjusted down based on the observed effectiveness of the deployed DERs (see DER Performance Measurement).

IMPROVEMENTS TO PORTFOLIO DESIGN
The iterative portfolio design process confirmed that grid needs at the distribution level are dynamic: grid planning based on scenarios may be a more useful approach than solving for a single peak to determine local grid needs. Additionally, DER market potential studies are not indicative of the amount of DERs that may be achieved. However, incorporating robust customer insights can reduce forecasting error of the achievable DER adoption.

CURRENT PRP PORTFOLIO BY RESOURCE



TOTAL = ~200MW

SCE also learned that it is best not to be overly prescriptive on the portfolio design and to use it as a guide; market response and customer willingness to adopt DERs ultimately determine the optimal DER portfolio mix.

The following improvements would help future portfolio design processes:

- Develop a range of risk-informed grid need scenarios, using a dynamic forecasting approach that includes a sensitivity analysis to account for forecasting variability.
- Avoid over-estimating DER potential and properly guide DER sourcing strategies by leveraging customer insights and historical performance in the portfolio design process.
- Focus more on the attributes (e.g., quantity, duration, and frequency) needed from DERs and less on specific technologies or technology mix when creating DER sourcing strategies.

2. DER SOURCING

KEY INSIGHTS

DER sourcing and deployment can potentially be improved when both competitive solicitations and customer programs are part of the DER sourcing strategy.

- Competitive solicitations enable access to innovative and broad pool of resource options.
- Customer programs provided increased speed of delivery.

DER sourcing for the PRP focused on 1) using existing programs and broad, CPUC-approved competitive solicitations and 2) implementing region-specific-competitive solicitations.

Both approaches provided advantages. Sourcing DERs through competitive solicitations gave SCE the ability to select DERs from a broad pool of options while customer programs and tariffs were a good way to quickly acquire and deploy DERs through the ready nature of Energy Efficiency and Distributed Generation customer programs and tariffs.

- Solicitations (RFOs) offer the flexibility for third parties to design creative customer offerings that would otherwise take longer to become available through the standard customer programs' regulatory cycle.
- SCE's existing programs and knowledge of customer needs provided the opportunity to use location-specific marketing and in some cases offered an additional incentive for customized EE project applications. This approach enabled SCE to source 74 MW of DERs through customer programs— about 45% more than originally planned.

IMPROVEMENTS TO COMPETITIVE SOLICITATIONS

For more efficient transactions and better understanding between buyers and sellers, the solicitation process could be streamlined. The development of standardized distribution service products and associated pro forma contracts coupled with pre-approved contracting options could speed and add clarity to the process. Additionally, timely regulatory approval of contracted DERs is critical. The regulatory approval and DER deployment timelines could be better aligned to help account for customer acquisition, engineering, equipment procurement, construction, and interconnection lead times.

In this regard, the ongoing Integrated Distributed Energy Resources (IDER) proceeding at the California Public Utilities Commission will undertake further discussions on ways to make solicitations more effective. The IDER has established a competitive solicitation DER sourcing framework for distribution services and is currently evaluating the role that customer programs and tariffs play in this framework.

IMPROVEMENTS TO CUSTOMER PROGRAMS AS A SOURCING MECHANISM

While effective at delivering DERs, there are some limitations with today's customer programs. These programs were designed to primarily meet system grid needs, but system and local grid needs can be mismatched.

Two approaches can make programs more effective as a DER sourcing option for local area needs:

- Provide program flexibility for location and time-based incentives, as a complement to system wide incentives, to align with the grid's location-specific time-of-day needs.
- Develop customer insights to target the best situated customers with the most effective technologies to improve overall marketing outreach.

The PRP's DER sourcing strategy coordinated the use of competitive solicitations and customer programs. This coordination improved overall DER adoption. Thus far solicitations have provided 32 MW of installed DERs and are forecasted to install an additional 73 MW by 2021. Customer programs were a good complement to solicitations providing increased speed of delivery.

Ultimately, when determining whether to use competitive solicitations or customer programs or both, the grid needs and customer mix will dictate the optimal DER sourcing strategy. As demonstrated in this pilot, these approaches can be complementary and may allow for more cost-effective DER solutions. Customer programs can leverage existing pre-funded and pre–approved incentives, to minimize incremental cost to a DER solution. Coordinating communications to customers can help avoid customer fatigue and confusion. Multiple and similar customer offerings from programs and contracted DERs caused some customer confusion in the PRP Region that was eventually mitigated through customer outreach.

3. DER DEPLOYMENT

KEY INSIGHTS

DERs can be an effective means to manage load.
A 200 MW DER portfolio (about 14% of the forecasted peak load) will be available to serve the region's peak needs by 2021.

As part of SCE's PRP efforts, nearly 127 MW of new clean DERs are online (as of May 2019) to meet Orange County's peak demand. An additional 73 MW of DERs have been sourced and will be included in the PRP. Partly because of these efforts, load growth has declined.

Customer programs played an important role in deploying resources, as deployment from competitive solicitations were lower than expected.

Close to 100 MW of contracted DERs have cancelled for various reasons, including delays in regulatory and permitting approval, challenges in acquiring customers, inability to secure funding, and changes in market rules. Delays on competitive solicitation contracts led to some contract cancellations. Delays stemmed from regulatory approval times, the detailed process for interconnection studies, and acquiring permits from local government agencies.

Two key strategies can help improve DER deployment: aligning operational timelines to regulatory timelines to improve DER sourcing, and a sourcing approach that maximizes portfolio flexibility.

STRATEGIES TO ALIGN OPERATIONAL AND REGULATORY TIMELINES

Aligning timelines across multiple areas is critical because grid constraints are time sensitive and pose reliability and safety concerns. Strategies to help align operational and regulatory timelines, in particular when contracting for DERs, include:

- Establishing a regulatory proceeding timeline for DER contract approval that incorporates deployment lead times and in-service need dates.
- Enhancing the interconnection process by sequencing CPUC approval to launch competitive solicitations with the application window for interconnection cluster studies, streamlining the interconnection study process, and conducting ad-hoc location-specific cluster studies as needed.
- Engaging local planning agencies to collaborate in the development of standardized regulations for the permitting of DERs.

STRATEGIES TO MAXIMIZE DEPLOYMENT

Portfolio flexibility is vital to maintaining a robust DER pipeline to achieve deployment goals. There are several strategies that can help maximize portfolio flexibility, including:

- Obtaining timely approval of DER contracts to allow for early customer engagement and identification and resolution of deployment issues.
- Contracting DER projects with proven technologies and successful management track records to improve viability.
- Sourcing DER quantities in proportion to timing of grid needs to account for potential grid changes, DER contract fall outs, changes in DER costs and technology innovations.
- Diversifying the DER portfolio through a mix of technologies and a mix of customer and grid-sited DERs to balance some of the risks associated with customers' willingness to adopt DERs and potential permitting and interconnection delays associated with grid-sited resources.
- Incorporating robust customer insights to help maximize marketing efforts to improve DER adoption.
- Building a reserve margin into the DER sourcing targets based on historical project termination rates and technology effectiveness factors to establish appropriate DER sourcing goals.

4. DER PERFORMANCE MEASUREMENT

KEY INSIGHTS

DER portfolio effectiveness factor may be less than initially estimated. SCE initially estimated an 85% effectiveness factor at full deployment, but the portfolio's first-year operations performed at a 68% effectiveness factor (based on measured installed DER capacity).

The portfolio performance in the summer of 2018 indicates DERs can be an effective means to serve load.

However, the effectiveness of the portfolio as a whole is less than originally forecasted[2] (although additional measurement periods are needed to draw definitive conclusions). The technology effectiveness factors may have been set too aggressively and need to be adjusted down.

The portfolio's effectiveness was estimated at 85% in the last (2016) Portfolio Design. But, the effectiveness at the highest peak hour of demand for 2018 was observed at 68% (measured as a ratio of measured level reduction to DER capacity deployed). At the highest peak hour, ES and DG performed close to 70% of their installed or contracted capacity. EE and DR performance was more modest (Table 1).

[2] Methodology and assumptions about the DER portfolio are captured in the PRP's Portfolio Design reports available at sce.com/prp

DER measurement is based on resources deployed as of July 6, 2018, the highest recorded load peak in 2018. (Note that the amount of resources deployed to date is actually more than was available during the measurement period.) The DER measurement analysis consists of a distributed generation production model, analyzing meter data pre- and post-installations for EE programs, the production of energy storage based on meter data, and analyzing and validating performance through contract settlement data (when actual meter data is unavailable).

The 2018 performance measurement validates the need for a diverse mix of resource types to manage peak load growth because no one resource type has all the performance characteristics to meet local and temporal grid needs. However, when the PRP DER portfolio is not serving the peak load it is still contributing to yearly and seasonal load demands.

Table 1. Portfolio Performance

Resource type	Deployed as of July 6, 2018 (MW)	Portfolio share Deployed as of July 6, 2018	Percentage contribution toward peak	Counted in measurement (MW)	Assessed effectiveness at the peak hour
Energy Efficiency	32	29%	7%	9.4[1]	59%
Demand Response	12.2	11%	10%	12.2	54%
Distributed Generation – PV	45	40%	41%	45	71%
DG- Combined Heat & Power[2]	19.6	17%	37%	19	70%
Energy Storage	2	2%	5%	2	69%
ES Behind-the-Meter[3]	1	1%	–	0	–
Total	111.8		100%	87.6	Portfolio average: 68%

[1] Instead of the forecasted savings, the EE upgrades in the PRP region are assessed by comparing customer metered energy usages pre and post EE installation to determine grid-level reduction impact. Only those EE MW with observable grid-level reductions were counted in the measurement analysis.
[2] Resource not under contract with SCE. However, resource is interconnected in the PRP region and serves the immediate load in the region and counted in the measurement analysis.
[3] A small amount of behind-the-meter energy storage adopted by customers leveraging Self-Generation Incentive Program funds is not counted in the measurement analysis given the lack of available performance data.

RECOMMENDED ACTIONS

The following key actions are recommended for future DER grid solutions:

- Develop a dynamic forecasting approach for grid needs that accounts for forecasting variability by incorporating a sensitivity analysis that is more probabilistic than deterministic.
- Leverage customer insights to incorporate technical potential and customer adoption potential into the DER portfolio design process to right-size and improve DER adoption.
- Further evaluate a sourcing framework that includes both competitive solicitations and customer programs/tariffs in the IDER Proceeding (R.14-10-003).
- Improve marketing coordination between customer programs and competitive solicitations to avoid customer confusion.
- Enable more transparency on the performance of DERs by providing host utilities access to real time performance data via customer programs and DER contracts.
- Further evaluate the performance of DERs by sourcing mechanism type (i.e. how did DERs sourced from customer programs perform compared to DERs sourced from competitive solicitations) to further evaluate the effectiveness of each sourcing approach for grid needs.

THE FUTURE OF THE PREFERRED RESOURCES PILOT AND DERS AT SOUTHERN CALIFORNIA EDISON

SCE will not be sourcing additional DERs for the PRP, however additional contracted DERs will be coming online in the PRP area. These include energy storage, demand response and permanent load shift, which currently make up a small percentage of the resources deployed. The added expected resources may provide further sourcing and performance insights, and the portfolio will be re-examined after these resources deploy.

The existing and expected DER portfolio is in line with the current forecasted load growth. There are no capacity deficiencies currently identified in the region. The ongoing focus for the remaining duration of the PRP will be on analyzing the performance of DERs and reporting the findings in the annual compliance report required by CPUC Decision 18-07-023.

SCE initiated its PRP to validate the State's DER performance assumptions that a portfolio of DERs could perform similar to a large gas-fired power plant, while ensuring reliable and affordable energy delivery. The learnings here are significant – validating that DERs can be relied upon in appropriate circumstances to serve grid needs and support California's important environmental goals. It also provides insights into how to incorporate DERs across SCE's service territory.

For more information visit sce.com/prp