In the Field

Integrating Rooftop Solar

APS, EPRI Pursue Answers in Project with 1,500 Residential Customers

By Chris Warren

With more than 40,000 residential solar systems installed in its service territory, utility Arizona Public Service (APS) reports that some solar arrays are causing problems with distribution system voltage, at times even tripping other customers' systems offline.

"We have a tremendous amount of rooftop solar on our system," said Scott Bordenkircher, director of technology innovation for APS. "We are still learning how to integrate these resources and mitigate these problems so our grid can better enable advanced technology such as rooftop solar."

Regulating voltage is just one of many technical challenges that APS faces as solar deployment grows. In 2015, EPRI and APS engineers framed 19 questions important to the effective integration of residential rooftop solar into the distribution grid.

Among them: To what extent can advanced inverters manage voltage fluctuations associated with intermittent solar generation? What are the best configurations and practices for advanced inverters during peak load and periods of low sunlight? How does distributed solar affect the duration of peak demand, and how can it reliably reduce the need for grid equipment upgrades?

Continuous Monitoring in Phoenix

Answers to these questions will become clearer soon, thanks to an APS-EPRI pilot project involving utility-owned solar systems on the roofs of 1,500 residential electricity customers in the Phoenix metropolitan area. The project is part of EPRI's Integrated Grid Pilots Initiative, which seeks to boost understanding of distributed energy resources and the most effective ways to integrate them into the power system. Each installation will include an advanced inverter and communications that enable the utility's grid operations center to change the unit's settings as needed.

APS and EPRI also installed sensors on underground feeders that will track for more than a year how inverter settings impact grid voltage, power flows, and power quality. "Every second, we are getting an update on the voltage, where the power is going, and whether it's good, clean power or is distorted in some way," said Ben York, EPRI senior project engineer.

To prepare for this analysis, EPRI completed extensive laboratory work to assess advanced inverters' data accuracy and responsiveness to external commands. "This informs our field work with APS," said York. "When we pull data from the inverters, we know how reliable it is. When we ask them to perform a certain function, we know how quickly and precisely they will complete it."

Advancing Industry Understanding

When data collection is completed in 2017, EPRI will issue a series of reports addressing the research questions and analyzing the requirements, benefits, and challenges of using advanced inverters for rooftop solar integration.

APS will use the insights and lessons to improve its grid planning and operations. The power industry will be provided data and findings generated by actual operating conditions and responses at customer sites and in

distribution circuits. “Previous understanding of the grid benefits of advanced inverters has come from computer modeling,” said York. “That has given us a lot of good ideas about how advanced inverters can help utilities manage solar on the distribution grid. This project backs up those ideas with the hands-on experience needed to advance the industry.”

Key EPRI Technical Experts

Ben York