FAQ

USING RENEWABLES TO OPERATE A LOW-CARBON GRID

The ISO, the National Renewable Energy Laboratory (NREL), and First Solar conducted a series of tests on a 300-megawatt solar photovoltaic (PV) plant to demonstrate its operating flexibility.

The tests were conducted to determine if renewable resources could provide operating characteristics similar to a conventional resource. The unit was tested for its ability to provide ancillary services, such as frequency response, regulation up and down, voltage control, and active power management.

In each of the test categories, the solar unit performance was comparable to, or better than, conventional resources. These test results demonstrated how smart inverter technology can leverage PV technology from simply generating as a variable energy resource to providing ancillary services, such as spinning reserves, load following, voltage support, ramping, frequency response and regulation, and power quality.

Why was this testing done?

This test was done because the industry as a whole raised reliability concerns as higher levels of renewable resources are being integrated into the grid. On some days, the penetration of renewable resources, such as wind and solar power, has exceeded 49 percent of the supply. This penetration level is expected to dramatically expand as the state recently set its Renewable Portfolio Standard (RPS) to 50 percent by 2030. With fewer conventional resources on the grid during periods of low loads and high renewable production, grid operators raised concerns in maintaining stability and reliability.

What are the changes to the grid? Why are the needs of the system changing with increased renewable penetration?

As the electricity grid transforms into a greener grid, operational challenges are surfacing. The ISO is experiencing significant ramping needs during sunrise and sunset, as well as periods of oversupply conditions, especially pronounced during weekends when electricity demand is low and renewable production is high. These effects are primarily due to the large amount of solar resources connected to the transmission grid. The ISO is also seeing peak net-load demand on the system shifting towards the hours after sunset, which intensifies resource ramping needs in the afternoon when the system is losing solar production.

What are some of the California energy and environmental policies that impact grid operation?

California has several policies that impact grid operation. Some of these policies include:

- Greenhouse gas emissions are reduced to at least 40 percent below the 1990 level by 2030
- 50 percent of load served by renewable generation by 2030
- Ban on use of once-through cooling in coastal power plants
- Less predictable load patterns – rooftop solar, electric vehicles, and smart grid
- Double energy efficiency of existing buildings
- Over 1,300 megawatts (MW) of electricity storage resources deployed by 2024
- Governor Brown's 2030 goals:
    - » 1.5 million electric vehicles on California roads by 2025
    - » 12,000 MW of distributed generation
    - » 50 percent reduction in petroleum use for vehicles
    - » Make heating fuels cleaner
- Behind-the-meter growth – The rise in renewable generation for on-site use has been higher than originally expected. The ISO currently has more than 5,000 MW within its footprint and is anticipating that to increase by more than 1,000 MW per year through 2020.

How were the tests conducted?

These tests were conducted in partnership with First Solar, NREL, Southern Co., and the ISO. They were built upon the tests typically performed during resource commissioning to demonstrate the advanced capabilities of the solar resource already participating in the ISO markets

What did it find?

The test demonstrated that the advancement in inverter technology now allows renewable resources to provide essential reliability services similar to traditional resources using fossil fuels.

Why is it important?

The test was important because it shows that the advancement in inverter technology now allows renewable resources to provide essential reliability services, which means that with the right type of power control technology, renewable resources can help support further integration of renewable resources on the system. This is important to meet the 50-percent RPS target and beyond.

Since smart inverter technology is fairly widespread, can this concept be applied immediately at all renewable plants?

The inverter technology has been advancing quickly for many years, and is widely available and accessible for renewable generators. However, First Solar designed customized plant level controllers which guide the inverters into specific arrays that yield reliability services at a high level of accuracy.

What are the next steps?

The next steps are to identify regulatory and operational barriers to the feasibility of renewables providing essential reliability services and explore economic and contractual incentives to maximize the potential for renewables to provide these services. The ISO would also like to conduct a similar set of tests on a suitable wind resource to better understand the performance of wind generation using advanced inverter technology, compared to the results of the solar resources in this demonstration.