Sandia National Laboratories

Energy, Climate, & Infrastructure Security

New Mexico Collaboration Demonstrates Viability of Commercial-Scale Microgrids

Sandia is working with several partners to bring local power generation, advanced storage technologies, and advanced load controls together in microgrids—supplying electricity to meet rising demand while controlling price and environmental costs.

Vision

To enhance the nation's security and prosperity through sustainable, transformative approaches to our most challenging energy, climate, and infrastructure problems.

The Mesa del Sol commercial microgrid project is a collaboration that demonstrates improved localized control of generation, transmission & distribution; improved information use for load smoothing and a more resilient grid; and a nationally replicable technology integration. The Aperture Center building's integrated energy controls are demonstrating a commercial-scale microgrid with photovoltaics (PV), fuel cells, combined heat and power, advanced load controls, and advanced energy-storage components. As the Mesa del Sol community to grow, it will further implement these technologies.

The Mesa del Sol project is a collaboration among several partners, each of which provides unique technology strengths to the overall product. It is led by Japan's New Energy and Industrial Technology Development Organization (NEDO), which sponsors several Japanese companies' participation. NEDO funds the hardware and software development and provides overall project management, with Sandia's project contributions funded by DOE. Mesa del Sol is a sustainable development community offering a clean slate for testing and demonstrating the latest microgrid technologies. Its mandate/vision is to apply advanced technologies and integrated grid solutions to an energy efficient, sustainable community that co-locates residential, retail/commercial, and industrial space. PNM, New Mexico's largest public electric utility, is incorporating intelligent technology into the Mesa del Sol site and linking it to a DOE-sponsored PNM substation project that uses PV and battery storage for advanced grid functionality. The University of New Mexico is contributing system-level modeling/simulation and related research. Sandia is applying research and technology-development capabilities to help the partnership demonstrate efficient, intelligent, and sustainable electricity generation and energy management. Sandia's projects include a collaborative smart-grid and grid-integration effort with PNM and UNM, anti-islanding performance testing of selected Japanese advanced energy management systems, implementing

The Aperture Center is a 78,000-square-foot mixed-use commercial building at the center of Forest City's Mesa del Sol model sustainable community. It is the heart of a planned community with 18 million square feet of office, retail, and industrial space and 4,400 acres for residential development.

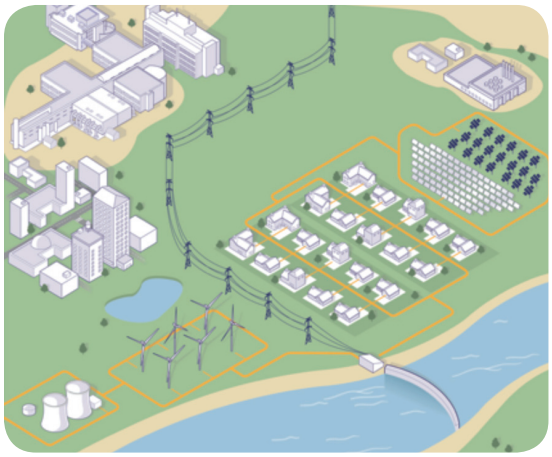
U.S. DEPARTMENT OF ENERGY

a high-resolution all-sky digital camera and solar forecasting algorithms, and a display center for visualizing NEDO smart-grid system performance.

As electricity prices increase, consumers are assuming an active role in power use and efficiency. The 21st-century electricity grid is incorporating renewable energy generation, like solar and wind, to preserve the environment. Communities, military bases, universities, etc. are moving to incorporate these concepts with microgrids. A microgrid is a small-scale version of the electrical grid—which can be tied to the larger grid, yet retain the ability to independently supply energy if the larger grid experiences power interruptions. Microgrids can take advantage of local power resources (small wind, PV, energy storage systems, engine-generator systems, etc.) rather than relying on large-scale centrally generated electricity.

Ideally, a microgrid can quickly switch between operating on or off the larger grid: when the grid offers cheap electricity, the microgrid uses it. If prices rise or a power failure occurs, the microgrid can isolate itself and operate using its own power-generation and -storage resources. While the microgrid concept is gaining popularity, much of the cutting-edge hardware, software, and control systems necessary to implement microgrids have yet to be field tested/demonstrated.

The microgrid project at Mesa del Sol fits well within the broader context of Sandia's ongoing R&D in advanced grid technologies, microgrids, and the high penetration of renewable energy generation on our electricity infrastructure. Sandia strives to optimize local resource use through advanced control architectures and communications, thereby lowering the overall cost of delivered electricity while enhancing delivery quality and value by applying new integrated storage technologies. Sandia implements these programs as internal R&D and on behalf of U.S. Department of Energy and Department of Defense customers.



A microgrid manages multiple distributed electricity generation and storage resources via intelligent load controls and metering. It promotes sustainability by using renewable power generation and storage to optimally balance energy production, storage, and demand within a local region.

Sandia and PNM jointly led use-case development for the NEDO team members and U.S.-side collaborators. The use-case analysis promoted a common understanding between the technical teams and helped develop requirements for individual components. Sandia will use project data measurements for PV system performance modeling, energy system control studies, and anti-islanding experiments.

The Mesa del Sol microgrid project is part of a broader collaboration, led by the State of New Mexico, called the New Mexico Green Grid Initiative. This is one of two NEDO-led projects—the other being in Los Alamos County—demonstrating integrated smart-grid technologies using renewable technologies, storage, and advanced controls in a clean, efficient electrical grid. The project is being constructed at the Mesa del Sol Aperture Center (see photograph) and includes a robust integration of several technologies to ensure optimal energy management in a commercial building. Ultimately, Mesa del Sol seeks to become a real-world example of a walkable, mixed-use urban development (co-located residential, retail/commercial, and industrial space) in contrast to the automobile-dependent suburban developments of the past. It will promote energy efficiency and sustainability by using intelligent load controls and electricity metering that incorporate distributed, renewable power generation and energy storage.

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