

GRID MODERNIZATION

Devices and Integrated System Testing — Overview

Devices and systems on both sides of the electric meter can help the grid function more efficiently, manage variable generation, and be more resilient under adverse conditions.

The “Devices and Integrated System Testing” focus area has four main activities designed to support innovation and advancements in these technologies. Each activity has specific goals and target achievements to be completed by 2020.



Devices are individual energy generation, storage, delivery, and consumption technologies that connect to the electric grid.

Some examples: PV, wind power, electric vehicles, capacitors, wires, switches, HVAC systems

Integrated systems are networks of devices that are physically connected and linked by control systems and markets.

Some examples: microgrids, building and industrial facility loads that respond to the grid, FLISR systems

Activity 1: Develop Advanced Storage Systems, Power Electronics, and Devices

Goal: Increase electric grid flexibility, reliability, resiliency, and asset utilization by making step changes in the performance of grid-connected devices and technologies.

Target achievements:

- Develop power electronics-based converters for renewable, distributed energy, and energy storage systems.
- Decrease the cost of grid-scale energy storage systems to less than \$300/kWh by developing metrics around safety, reliability, and performance, and through technology advancements.
- Enable buildings, large building loads, and EV charging systems to regulate energy more effectively, including self-diagnosing performance, forecasting their energy needs, characterizing their available flexibility, and providing capacity, energy, and ancillary services to the grid.
- Develop grid infrastructure technologies such as advanced switches, wires, cables and transformers that can improve the efficiency and reliability of the electric grid. Target improvement= 10%.

Activity 2: Develop Standards and Test Procedures

Goal: Work with standards development organizations (SDOs) to accelerate the development and validation of standards and test procedures for device interoperability, performance, and safety.

Target achievements:

- Update standards and test procedures that characterize the ability of devices to provide a full range of grid services.
- Develop standards and test procedures for microgrids, storage, and other systems.

Activity 3: Build Testing Capabilities / Test and Validate Devices

Goal: Develop a testing infrastructure and validate device performance in both the laboratory and the field using the developed standards and test procedures.

Target achievements:

- Provide testing facilities, frameworks, and manage component model libraries in collaboration with universities and industry groups.
- Develop methods to couple hardware-in-the-loop devices with advanced simulations to evaluate systems at a variety of scales.
- Characterize a wide variety of technologies to validate that individual devices can provide a range of grid services.

Activity 4: Test and Validate Integrated Systems at multiple scales

Goal: Ensure that integrated systems of devices and controls are able to connect, communicate, and operate in a coordinated fashion at multiple scales.

Target achievements:

- Validate multi-scale systems that enable 100% renewable energy integration at the local level and 35% at the bulk system level.
- Validate transactive control constructs that coordinate distributed generation, storage, and controllable loads to reduce reserve margins by 33%.
- Validate 10% outage reductions by using advanced distribution system configurations (including microgrids) and fault location, isolation and service restoration (FLISR) systems.
- Conduct field demonstrations of energy storage providing multiple grid services cost effectively.

