

# GRID MODERNIZATION

## Sensing and Measurements—Overview

To assess the grid's health in real time, predict behavior and potential disruptions, and quickly respond to events, it is necessary to understand vital parameters throughout the electric infrastructure, from generation through the end user. Improved sensing and measurements across these spatial scales and at multiple time scales—from microseconds to hours and days—is needed to support advances in system operation and control.

The “Sensing and Measurements” focus area has six main activities designed to support innovation and advancements for grid modernization. Each activity has specific goals and target achievements to be completed by 2020.

### ***Activity 1: Improve Sensing for Buildings and End Users***

**Goal:** Enable buildings to communicate with grid control systems to offer grid services while continuing to serve occupants and keep sensitive information secure.

**Target achievements:**

- Develop an open architecture for Building Energy Management Systems and develop low-cost sensors that enable building owners and end users to assess the state of their energy assets.
- Accelerate the integration of secure, low-cost communications with advanced sensor technologies.

### ***Activity 2: Enhance Sensing for Distribution Systems***

**Goal:** Develop sensors, visualization techniques, and tools to better determine the distribution grid status.

**Target achievements:**

- Develop a visibility strategy for distribution grids that incorporates an extended view of the network—including the state and topology of the power system, whether assets are operating or not, the operating temperature of the grid assets, etc.
- Develop and demonstrate new low-cost sensors for distribution-level electrical state and status monitoring that can operate in both normal and off-normal conditions.

### ***Activity 3: Enhanced Sensing for Transmission Systems***

**Goal:** Develop detailed, system-wide monitoring of the transmission system and external effects, including weather events for predictive failure analysis.

**Target achievements:**

- Develop advanced synchrophasors that are reliable during transient events as well as steady-state conditions and can be upgraded remotely.



- Develop novel, inexpensive sensors and algorithms for electric grid components to monitor their health, real-time loading (including environmental factors such as temperature), and accumulated stress that could lead to component failure.

#### ***Activity 4: Develop Data Analytics and Visualization Techniques***

**Goal:** Data volumes are expected to grow exponentially in the next few years; this activity will identify the most important parameters for turning this data into actionable intelligence.

##### **Target achievements:**

- Develop a real-time data management system for ultra-high volumes of grid data, with the ability to identify and compensate for inaccuracies and errors.
- Develop techniques and software tools that allow system operators to visualize generators, loads, and system parameters across the electric infrastructure.
- Develop measuring and modeling techniques for estimating and forecasting renewable generation both for centralized and distributed generation.

#### ***Activity 5: Demonstrate a Unified Grid Communications Network***

**Goal:** Develop a communication infrastructure capable of managing the anticipated increase of grid data traffic. This will support the automation of the power grid, improving reliability and safety in the face of high renewable penetrations and cybersecurity threats.

##### **Target achievements:**

- Incorporate communications models into grid simulation and management tools and improve the dynamic management of data flows to minimize latency in protection and control systems.
- Develop and demonstrate a unified grid and network management framework, and build a demonstration network using state-of-the-art technology.

#### ***Activity 6: Regional and Crosscutting Initiatives***

**Goal:** Create a federal network for sharing grid data and develop regional and national infrastructures for environmental sensing and forecasting.

##### **Target achievements:**

- Provide real-time information on solar and wind generation and building loads at high spatial and temporal resolution.
- Provide forecasts of solar and wind generation and loads for minutes to days ahead.
- Incorporate environmental sensors that identify and predict weather-related effects to mitigate infrastructure impacts or to prevent widespread disturbances.
- Develop and demonstrate a unified grid and network management framework, and build a demonstration network using state-of-the-art networking technology.

