The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Modernizing the U.S. Electric System

Statement of Task: In its 2018 appropriations for the Department of Energy, the U.S. Congress directed the National Academies of Science, Engineering, and Medicine to appoint an ad hoc committee of experts to "…conduct an evaluation of the expected medium- and long-term evolution of the grid. This evaluation shall focus on developments that include the emergence of new technologies, planning and operating techniques, grid architecture, and business models."

In developing its report, the committee will consider: 1) trends in generation resources, their operational characteristics, and what capabilities will be required in energy infrastructure to provide reliable and resilient service; 2) trends in end use, including technologies for intelligent load control, and their implications for grid modernization investments, and 3) interdependencies with other infrastructure systems such as natural gas, telecommunications, and transportation systems. The report will be informed by a broad suite of alternative scenarios for the medium- and long-term evolution of the grid, and will identify potential "no-regret" strategic federal investments and approaches that will help create a platform for a reliable, resilient, and secure power system including cyber security. In its discussions, the committee will consider the evolution of external forces that influence grid investment, planning, and operations, such as evolving technologies in electrification and consumer behavior, the need for community resilience, and the emergence of cyber and physical threats.

The committee will gather evidence, deliberate, and provide findings and recommendations across the following broad categories.

- *Technologies*—Identify opportunities to improve existing technologies or develop and apply emerging technologies in generation, storage, power electronics, sensing and measurement devices, controls systems, cyber security, and loads.
- *Planning and Operations*—Investigate how current planning and operational practices may need to evolve in the future given the breadth of potential scenarios for changes in generation, grid technologies, and end use.
- *Business Models*—Consider broadly the cost and benefits of modernizing the power system relative to current business and operating procedures and explore how oversight and market operations may need to change with new technologies and customer arrangements.
- *Grid architectures*—Evaluate both technical and jurisdictional challenges to implementing a broadly applicable approach to grid architectures.