Grid Modernization

Description:

The electric grid is a complex system of generation, transmission, distribution, and demand. Aging infrastructure and recent technological developments are forcing changes in electricity production, delivery, and use.

The transition to a digital economy requires affordable, sustainable, and reliable electricity and creates challenges and opportunities for the grid. Emerging physical and cybersecurity threats, along with increased demand for faster outage response times, require, at minimum, real-time incident tracking and response capabilities. Increased grid penetration of renewable energy coupled with the adoption of advanced metering, energy storage, microgrids, electric vehicles, and other technologies to modernize our electric system will provide economic benefits, increase security, and ensure more reliable, resilient, and clean electricity. These innovations will require substantial planning and investment in grid technologies.

Discussion:

Digital technologies have enabled utilities to better manage the grid and provide opportunities for consumers to customize their services to fit their priorities. These technologies allow a two-way flow of information between the electric grid and grid operators and between utilities and their customers.

Emerging technologies improve system reliability and resiliency by enabling better tracking and management of resources. These technologies allow grid operators to incorporate central and distributed energy resources, energy storage technologies, electric vehicles, and assist in addressing the challenges associated with planning, congestion, asset utilization, and energy and system efficiency.

On the customer's side of the meter, dynamic pricing, advanced metering infrastructure, and other technologies allow an exchange of information and electricity between a consumer and their electric provider. Grid modernization is associated with greater consumer choice by allowing customers to meet their energy priorities by producing their own energy or through contracting innovative clean energy services from different providers.

Grid modernization will require a suite of state and federal policy changes to support advancements in grid technologies, grid management, and utility regulation. Grid modernization strategies, while recognizing regional and inter-state diversity, should take a holistic view of the electric system. The following can be used to inform the development of a state's grid modernization strategy:

1. Establish a collaborative process, with clear goals, to develop a grid modernization strategy that will incorporate the viewpoints of utility customers, utility regulators, utilities, and other stakeholders.

2. States can require that utilities develop and propose a grid modernization plan to the public utilities commission within a specified timeframe. Utilities would then be required to implement that plan within another specified timeframe. Strategies and/or plans should outline a clear set of grid modernization goals and describe methods to measure, report, verify, and enforce progress towards those goals. States might also provide incentives or cost recovery mechanisms for utilities that meet grid modernization goals.

3. Grid modernization plans and strategies can incorporate consideration of the impacts of electric vehicles (EVs) on the grid. Providing for EV charging rates and incentives, and planning for increased adoption can help control the impact of these vehicles on grid operations.

4. States can require that utilities' integrated resource or long-term plans include strategies to enhance cybersecurity, integrate distributed energy resources (including electric vehicles and energy storage), increase

smart meter deployment and demand response and/or demand-side management (DSM) programs, and measure and report on the results of these efforts.

5. The technologies associated with grid modernization generate a wealth of information about the grid itself and about customer behavior. State policy should include measures to protect this data, but can also encourage the use of this information to facilitate additional improvements in grid management and customer service. To address this, policymakers can develop legislation or rules that clarify who owns the energy data associated with consumer energy usage; protect customer privacy; outline the process for allowing direct access to data by third parties; and promote access to the highest resolution of data possible. States could establish customer access to energy data through the Green Button Connect program, for example.

6. Utility regulation varies by state utility commission. Most commissioners and commission staff, however, still adhere to the regulatory principles outlined when utility companies were vertically integrated, experiencing increases in load, and had the ability to capitalize on economies of scale for new generation. These "natural monopolies" warranted a state regulatory body that could balance the tradeoff between efficiency (in the form of least cost production) and equity (consumer protection).

   Today, non-traditional energy resources, for example, customer-owned distributed generation, EVs, energy storage, and other emerging disruptive technologies are increasingly cost competitive with more traditional resources. This has not only led to shifting customer expectations but also to new market realities confronting energy providers. Considering this, many argue that the regulated utility industry needs a new set of principles that are more sophisticated, forward-planning, and incentive-based. To address this, states could implement alternative ratemaking mechanisms, adopt performance-based regulation, and/or work with utilities to develop new business models that support grid modernization.

7. State departments of workforce services or their equivalent can be directed to work with utilities and other stakeholders to develop training programs for grid technicians and engineers. With new grid technology and distributed energy systems coming online, a new generation of workers can be trained to meet evolving needs, which will keep jobs local, and contribute to economic development.[1]

Example State Programs:

- California's Smart Grid:
  http://www.cpuc.ca.gov/General.aspx?id=4693
- Hawaii State Energy Office, Grid Modernization:
  http://energy.hawaii.gov/renewable-energy/grid-modernization
- Transforming Maryland's Electric Grid (PC44):
  https://www.psc.state.md.us/transforming-marylands-electric-grid-pc44/
- Minnesota's e21 Initiative:
  https://e21initiative.org/about-e21/

More Information:

[1] For a discussion of specific workforce needs that states might explore see: GridWise Alliance and U.S. Department of Energy. 2020. "Grid Modernization Index Insights into a Transformation: Principles for the Next Decade of Progress."

- American Public Power Association: Utilities Must Transform to Keep Pace with Changes: Report: https://www.publicpower.org/periodical/article/utilities-must-transform-keep-pace-with-changes-report

- GridWise Alliance and DOE: Grid Modernization Index – Insights into a Transformation: https://gridwise.org/gmi-insights-into-a-grid-transformation/

- Interstate Renewable Energy Council: Grid Modernization: https://irecusa.org/regulatory-reform/grid-modernization/

- National Renewable Energy Laboratory: Grid Modernization: https://www.nrel.gov/grid/

- U.S. Department of Energy (DOE): Grid Modernization and the Smart Grid: https://energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid

- DOE: Grid Modernization Initiative: https://www.energy.gov/gmi/grid-modernization-initiative