

# 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 presents challenges and opportunities to 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 of the Policy:

New 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.

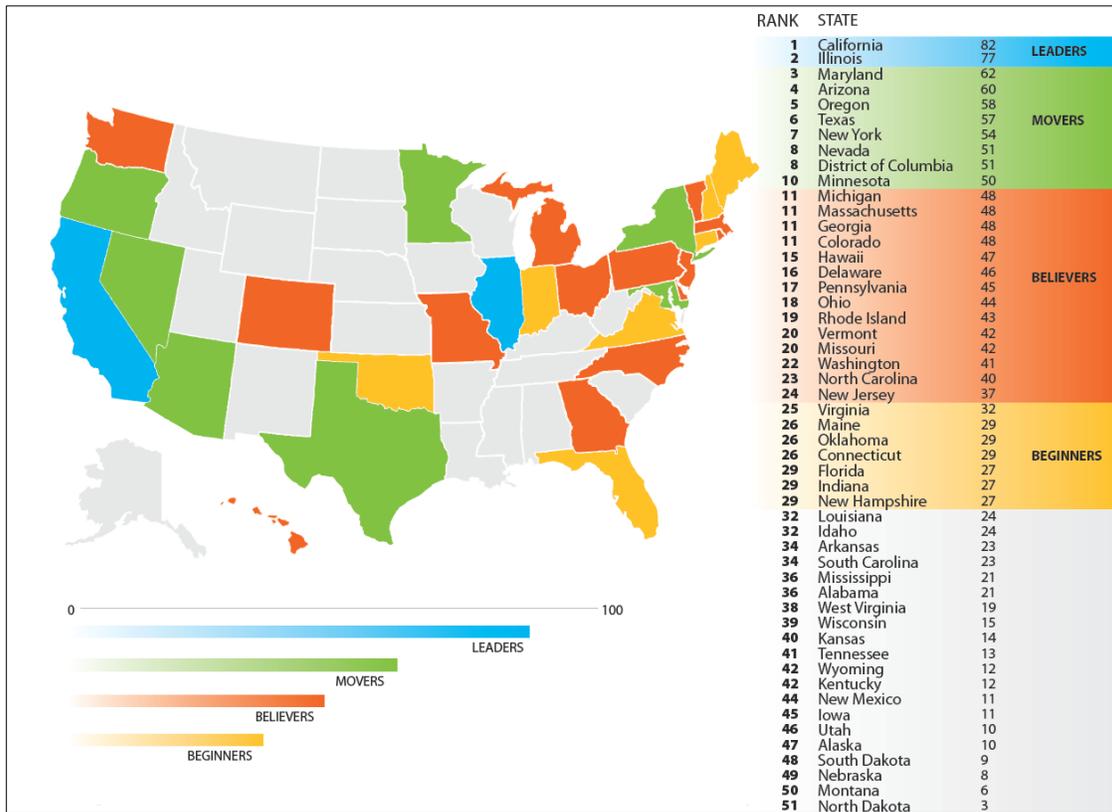
On the customer's side of the meter, advanced metering infrastructure, dynamic pricing, and other emerging technologies allow an exchange of information and electricity between a consumer and their electric provider. Grid modernization will be associated with greater consumer choice by allowing customers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

Grid Modernization efforts compliment other policies such as those targeting demand response, [customer data management](#), smart metering infrastructure, [electric vehicles](#), and other technologies. Grid modernization will require a suite of state and federal policy changes to support advancements in grid technologies, grid management, and utility regulation.

## 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>
- Illinois' NextGrid:  
<https://nextgrid.illinois.gov/>
- Transforming Maryland's Electric Grid (Public Conference 44):  
<https://www.psc.state.md.us/transforming-marylands-electric-grid-pc44/>
- Texas A&M Smart Grid Center:  
<http://smartgridcenter.tamu.edu/sgc/web/>

State scores, as determined by GridWise Alliance's [Grid Modernization Index \(December 2018\)](#), are in the figure below.



Source: [GridWise Alliance](#)

In November 2015, the Department of Energy (DOE) released the [Grid Modernization Multi-Year Program Plan](#) as part of its [Grid Modernization Initiative](#). This plan included [up to \\$220 million dollars](#), over the course of three years and subject to appropriations, to fund grid modernization research and development by DOE's National Laboratories and other participants in the [Grid Modernization Lab Consortium \(GMLC\)](#). In 2017, the Grid Modernization Initiative made an [additional \\$32 million dollars](#) available to fund grid resilience and distribution technologies research to advance, among other things, the integration of distributed energy resources and emerging grid technologies. In January 2018, GMI published the first [Grid Modernization Initiative Peer Review Report](#).

## Key Components:

Grid modernization strategies, while recognizing regional and inter-state diversity and avoiding one-size-fits-all plans, 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:

- Establish a collaborative process to develop a grid modernization strategy that will incorporate the viewpoints of utility customers, utility regulators, utilities, and other stakeholders.
- Consider requiring that utilities develop and propose a ten-year 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 can 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.

- Grid modernization plans and strategies can incorporate consideration of the impacts of electric vehicles on the grid. Providing for electric vehicle charging rates and incentives, and planning for increased adoption can help control the impact of these vehicles on grid operations.
- 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.
- The technologies associated with grid modernization generate a wealth of information about the grid itself and about customer behavior. Measures to protect this data are important, but state policy can also encourage the use of this information to facilitate additional improvements in grid management and customer service. Policymakers can develop legislation or rules that clarify who owns the data associated with 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](#) program, for example. (See: [Customer Data Access](#)).
- Utility regulation varies, to some extent, by a state's utilities 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). Many have argued recently that the regulated utility industry needs a new set of principles that are more sophisticated, forward-planning, and incentive-based. States could implement alternative ratemaking mechanisms, adopt [performance-based regulation](#), and/or work with utilities to develop new business models that support grid modernization. (See: [New Utility Business Model Proceeding](#)).

## More Information:

- DOE: Grid Modernization and the Smart Grid: <https://energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid>
- DOE: Grid Modernization Laboratory Consortium: <https://gridmod.labworks.org/>
  - National Renewable Energy Laboratory: Grid Modernization: <https://www.nrel.gov/grid/>
  - Sandia National Laboratories: Grid Modernization: <http://energy.sandia.gov/energy/ssrei/gridmod/>
- The Electric Power Research Institute: Smart Grid Resource Center: [http://smartgrid.epri.com/Data\\_Analytics\\_Initiatives\\_for\\_Transmission\\_and\\_Distribution.aspx](http://smartgrid.epri.com/Data_Analytics_Initiatives_for_Transmission_and_Distribution.aspx)
- Renewable Energy World: DERs and Grid Optimization - The Next Phase of the Grid Modernization Journey: <https://www.renewableenergyworld.com/articles/2017/11/ders-and-grid-optimization-the-next-phase-of-the-grid-modernization-journey.html>
- Solar Energy Industries Association: Grid Modernization Whitepaper Series: <https://www.seia.org/grid-modernization-whitepaper-series>