



# A National Clean-Energy Smart Grid 101

## An Electricity Grid for the 21st Century

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### What is a national clean-energy smart grid?

A national clean-energy smart grid will use long-distance, extra-high-voltage transmission lines to move remote clean-energy resources to power load centers. This expanded and upgraded interstate transmission grid will connect to a modernized distribution system—enabled with digital technology—that delivers energy and detailed, real-time information about the use of such energy to consumers. This will allow utility companies and consumers to constantly monitor and adjust their electricity use, while providing a pricing and control system to flexibly integrate new distributed energy resources such as solar and wind power, energy storage devices, and electric vehicles as the batteries in our plug-in cars become a repository for clean electricity. In other words, the grid will allow renewable energy to travel to homes around the country, and enable consumers to feed any excess power they produce back to the grid for other consumers to use.

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### Why do we need one?

Our current electric grid is strained. It has begun to fail us more frequently and presents substantial challenges in three primary areas: geography, congestion, and the reliability of electricity transmission and distribution.

The current high-voltage transmission grid imposes constraints on the deployment of new renewable energy resources such as wind, solar, and geothermal power. It simply does not go where many of these renewable energy resources will be developed. And congestion bottlenecks hurt the reliability of the grid overall, particularly where it is needed to move large volumes of new power from remote generation areas (where renewable energy is created) to major urban and industrial centers—where demand for that energy is greatest.

The monitoring and control technology for both transmission and distribution networks is also weak and outdated. The lack of smart technology to provide utilities and consumers with better information in real time hurts the entire electricity system's security and effi-

ciency, and places unnecessary cost burdens on consumers. It also slows the adoption and integration of new technology such as solar panels on our homes, intelligent appliances to cut our energy bills, or micro-grids to help first responders cope with natural disasters.

There have been five massive blackouts over the past 40 years due to grid failure—three of these in the last nine years. These cost the U.S. economy upward of \$100 billion each year in damages and lost business. For example, the 2003 blackout in the Northeastern United States and Canada affected 50 million people and caused an estimated \$7 billion to \$10 billion in economic losses.

What's more, our grid's centralized infrastructure leaves us open to attack. Security experts increasingly identify cyber-security and direct terrorist threats to the grid as substantial hazards for the entire U.S. economy.

Another set of concerns is climate change and oil dependence. If we are to reduce global warming emissions and transition to clean, domestic vehicles, then renewable energy must be integrated into the nation's grid.

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## How does a smart grid work?

The electricity grid delivers electricity from points of generation to consumers through two primary systems. The transmission system brings electricity from power plants to distribution substations, while the distribution system delivers electricity from distribution substations to consumers.

A national clean-energy smart grid would involve constructing feeder lines that would allow new large-scale, renewable-energy projects to connect to the grid. It will require extra-high-voltage electricity transmission upgrades to the existing grid to permit power to reach consumers from remote renewable-rich regions.

On the distribution side, the smart grid would integrate new digital technology into local electricity distribution networks that would help manage the demand that appliances and other end-use equipment place on the grid at key times of the day, improve the efficiency of electricity distribution within local networks, and provide better information about electricity use in homes, businesses, and public institutions.

A smart grid will also provide the pricing and control system to flexibly integrate new distributed energy resources—solar panels, energy storage devices, and increasingly electric vehicles—close to the point of demand. Users could charge up their plug-in cars at night to later feed that power back into the grid as their cars are parked at work or at home during the day, cutting our nation's reliance on oil during daily commutes.

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## What are the benefits of a national clean-energy smart grid?

A national clean-energy smart grid will advance key priorities for our country, including the expansion of renewable electricity, enhanced energy efficiency, increased security and reliability for the electricity system, economic benefits and cost savings for ratepayers, job creation for American workers, and opportunities for businesses.

The grid would enhance reliability, lower power-line losses, and incorporate advanced digital controls and other smart transmission grid technologies. It would be planned specifically to reach from areas with the highest potential for new renewable electricity generation to areas where that energy is most needed.

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## How do we implement a national clean-energy smart grid?

This vision must include substantial changes to the regulatory structure for planning, siting, and paying for an extra-high-voltage backbone transmission grid and the new transmission lines needed to connect renewable generation to that backbone.

Federal policy changes will need to include:

- A framework for collaborative multi-state planning to match new grid investments to our resource base.
- A stronger proposal for siting new transmission projects tied to this plan, giving greater power to the federal government but requiring strong state participation.
- Broad-based cost allocation to ensure that no single region must bear the cost of a national undertaking.
- Smart-grid investments and standards to deploy new information technology, controls, and advanced metering infrastructure on the transmission and distribution grid.

Our economy, environment, and national security will be profoundly affected by the investment choices we make in forthcoming years. Establishing a powerful national commitment to build a clean-energy economy—and put in place the supporting infrastructure required to reach this goal—offers a compelling opportunity to strengthen our economy now and to ensure the enduring prosperity and welfare of future generations.