

TRANSFORMING THE NATION'S ELECTRICITY SYSTEM: THE SECOND INSTALLMENT OF THE QUADRENNIAL ENERGY REVIEW (PUBLISHED JANUARY 2017)

by
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In June 2013, the federal government initiated a quadrennial cycle (every 4 years) of energy reviews. The reviews are intended to provide a roadmap for U.S. energy policy. The first Quadrennial Energy Review (QER)¹ focused on the nation's infrastructure for transporting, transmitting and delivering energy (TS&D Infrastructure). The second installment of the QER focuses on the electricity system.² It examines the electricity supply chain in the context of three goals:

1. Enhance economic competitiveness;
2. promote environmental responsibility; and,
3. provide for the nation's security.

Electricity System	Transmission lines and substations Distribution lines and distributed generation Electricity storage Other electric grid-related infrastructure
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The second installment supports development of a Federal strategy for the electricity sector. It also identifies a number of trends that will shape the sector in the future.

- The changing generation mix
- Low load growth
- Increasing vulnerabilities to severe weather
- Proliferation of new technologies, services and market entrants
- Increasing consumer choice
- Emerging cyber/physical threats
- Aging infrastructure and workforce
- Growing interdependence of regulatory jurisdictions

Electricity supports the nation's critical infrastructure, which includes transportation, oil and gas production, water, communications and information, and finance. Below are some of the key findings from the report. To access the full report refer to footnote 2 for the link to the website.

- About 90 percent of the of the residential electricity consumption, 60 percent of commercial, and 30 percent of industrial is used in appliances and equipment that are subject to Federal minimum efficiency standards.
- Nuclear power provides 60 percent of U.S. zero-carbon electricity.

¹ U.S. Department of Energy (<http://energy.gov/epsa/quadrennial-energy-review-qer>)

² Quadrennial Energy review: Second Installment (<https://www.energy.gov/epsa/downloads/quadrennial-energy-review-second-installment>)

- Some energy technologies that reduce greenhouse gas emissions have the potential to increase energy's water intensity (for example, carbon capture, utilization, and storage) while others can lower it (for example, wind and photovoltaic (PV) solar power).
- There is no centralized permanent disposal facility used for nuclear fuel so this radioactive material is stored at reactor sites in 35 states.
- The reliability of the electric system underpins every sector of the U.S. economy.
- The time scales for power balancing have shifted from daily to hourly or less, with the potential to impact system frequency and inertia, as well as transmission congestion.
- Over 90 percent of electric power interruptions result from disruptions on the distribution system.
- Over 1.9 million people are employed in jobs related to electric power generation and fuels, while 2.2 million people are in industries directly or partially related to energy efficiency.

Recommendations to Support the Security and Reliability of the Electricity System

- Protect the electricity system as a national security asset – the clear and exclusive purview of the Federal Government – by amending the Federal Power Act to clarify and affirm the Department of Energy's (DOE's) capabilities to develop preparation and response capabilities.
- The U.S. grid faces danger from cyber-attack. Natural gas plays an important role as fuel for the electricity system so a cyber-attack that causes a gas pipeline outage or malfunction could also affect the reliability of the electricity system. Integrated security planning that covers the entire United States is necessary to ensure that there are no unnecessary vulnerabilities associated with state-to-state or utility-to-utility variations in protections.
- Increase financing options for grid modernization – the current DOE loan program should be expanded and made more flexible. Transmission projects can involve many entities and jurisdictions, and clarification is needed on lending authorities for multi-jurisdictional projects.
- Increase technology demonstrations and utility/investor confidence – the grid of the future requires a wide range of capital-intensive technologies. DOE needs a focused cost-shared program for utilities to demonstrate distribution system technologies at the community scale.
- Build capacity at the Federal, State and Local Levels – provide funding assistance to enhance analytical capabilities. These issues are highly technical and require human resources with a new knowledge base and skill set.
- Inform electricity system governance in a rapidly changing environment – DOE in collaboration with the National Association of Regulatory Utility Commissioners should establish a Federal advisory committee to examine and make recommendations regarding responsibilities for rates and resource adequacy.