FY 2016 Budget Request

Office of
Electricity Delivery and Energy Reliability

Assistant Secretary Patricia Hoffman

February 2, 2015

The Office of Electricity Delivery and Energy Reliability

The Office of Electricity Delivery and Energy Reliability (OE) drives electric grid modernization and resiliency in the energy infrastructure. OE leads the Department of Energy's efforts to ensure a resilient, reliable, and flexible electricity system. OE accomplishes this mission through research, partnerships, facilitation, modeling and analytics, and emergency preparedness.

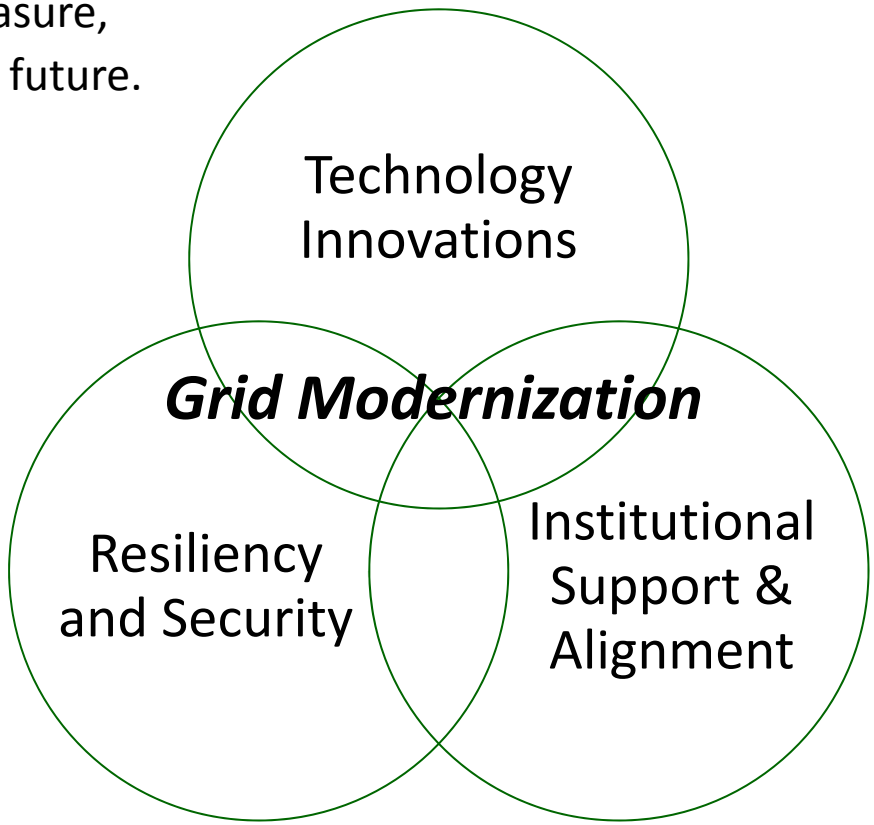
The FY 2016 request for OE advances Administration and Secretarial priorities addressing climate change and helping communities to adapt. The request plays a pivotal role in supporting the President's "All of the Above" energy strategy by helping ensure a reliable and resilient energy infrastructure to is a foundation for the Nation's energy, economic, security, and environmental goals:

- *Achieve public policy objectives*
  - Empower consumers to make better informed choices on energy use
  - Facilitate the integration of clean energy
- *Sustain economic growth and foster innovation*
  - Enable new energy products and services
  - Support efficient markets
  - Reduce entry barriers for new advanced technologies
- *Mitigate risks and secure the Nation*
  - Provide greater resilience against natural and manmade hazards
  - Strengthen energy infrastructure cybersecurity

The Office of Electricity Delivery and Energy Reliability
Investing in the Future of the Energy Infrastructure

OE's FY 2016 Request of $270.1M is a strong commitment to addressing the challenges and needs of the electric system of the future:

- Developing tools and technologies that measure, analyze, predict, and control the grid of the future.
- Increasing energy resiliency and security to better protect, prevent, and respond to all hazards with a more robust focus on cybersecurity and physical security.
- Establishing State Energy Reliability and Assurance Grants to help expand our technical expertise to and increase dialogue with states, local and tribal communities to highlight challenges and develop options for grid transformation.



OE FY 2016 Budget Request

(Dollars in Thousands)

Program/Activity	FY 2014 Current[a]	FY 2015 Enacted	FY 2016 Request	FY 2016 vs. FY 2015
Clean Energy Transmission and Reliability	31,474	34,262	40,000	+5,738
Smart Grid	14,125	15,439	30,000	+14,561
Cybersecurity for Energy Delivery Systems	42,301	45,999	52,000	+6,001
Energy Storage	14,706	12,000	21,000	+9,000
Transformer Resilience and Advanced Components	—	—	10,000	+10,000
National Electricity Delivery	5,997	6,000	7,500	+1,500
Infrastructure Security and Energy Restoration	7,996	6,000	14,000	+8,000
State Energy Reliability and Assurance Grants	—	—	63,000	+63,000
Program Direction	27,606	27,606	32,600	+4,994
Subtotal, Electricity Delivery and Energy Reliability	**144,205**	**147,306**	**270,100**	**+122,794**
Rescission of prior year balances	—	-331	—	+331
Total, Electricity Delivery and Energy Reliability	**144,205**	**146,975**	**270,100**	**+123,125**

[a] *FY 2014 funding is shown after SBIR/STTR transfers (-$3,036) and a contractor travel rescission (-$64).*

DOE's Grid Modernization Crosscut

(Dollars in Thousands)

Organization	Institutional Support and Alignment	Technology Innovation	Grid Security and Resilience	Total FY 2016 Request
Electricity Delivery and Energy Reliability	35,000	92,000	75,000	202,000
Energy Efficiency and Renewable Energy	2,627	149,900	—	152,527
Energy Policy and Systems Analysis	1,000	—	—	1,000
Indian Energy Policy and Programs	500	—	—	500
Total, Grid Modernization	**39,127**	**241,900**	**75,000**	**356,027**

This coordinated program of activities helps set the Nation on a cost-effective path to an integrated, secure, and reliable grid system that is flexible enough to provide an array of emerging services while remaining affordable to consumers.

- Coordinate Grid Modernization program activities across DOE and National Laboratories
- Strategically invest in the enabling technologies for the grid of the future
- Build and enhance security from the early stage of technology development
- Support states and institutions to improve the system

FY 2016 Request Summary of Changes

FY 2016 Request of $270.1M is a $122.8M increase compared to FY 2015 Enacted of $147.3M

- **Clean Energy and Transmission Reliability ($40.0M, +$5.7M)**
  - Increases support for value-added applications of synchrophasors for transmission asset owners
  - Expands university research in mathematics for power systems
  - Integrates R&D research outputs into analytical products
- **Smart Grid ($30.0M, +$14.6M)**
  - Advanced Distribution Management Systems
  - Increases simulation basis and evaluates competing theories in Market-Based Control Signals
- **Cybersecurity for Energy Delivery Systems ($52.0, +$6.0M)**
  - Establishes a virtual platform for the analysis of advanced digital forensics for the energy sector
- **Energy Storage ($21.0M, +$9.0M)**
  - Expands efforts on energy storage safety, initiates energy storage reliability efforts, increases co-funded state and regional energy storage demonstrations, develops valuation tools, and advances R&D efforts towards new battery chemistries

FY 2016 Request Summary of Changes

- **Transformer Resilience and Advanced Components ($10.0M, +$10.0M)**
  - Building on work in FY 2015, the program addresses transformer testing, analysis, and solutions
- **National Electricity Delivery ($7.5M, +$1.5M)**
  - Strengthens the modeling and analytical tools available to state regulators and policymakers to assist states and others to develop long-term energy system reliability plans
- **Infrastructure Security and Energy Restoration ($14.0M, +$8.0M)**
  - Supports expanded energy-focused exercises to improve local, state, and regional preparedness
  - Supports the building of the DOE Emergency Operations Center
- **State Energy Reliability and Assurance Grants ($63.0M, +$63.0M)**
  - Provides grants to states, localities, and tribal governments in support of:
    - Electricity transmission, storage, and distribution reliability ($27.5M)
    - Energy assurance planning ($35.5M)

Highlights of the FY 2016 Request

Clean Energy Transmission and Reliability

FY 2016 Request: $40.0M

The Clean Energy Transmission and Reliability (CETR) program improves energy system decision-making through system measurement, modeling, and risk analysis.

Transmission Reliability ($18.0M)

- Complete development and deployment of multiple synchrophasor-based software applications, improving reliability through the use of real-time high-resolution system measurements
- Develop value-added applications of synchrophasors for asset owners including equipment diagnostics and maintenance

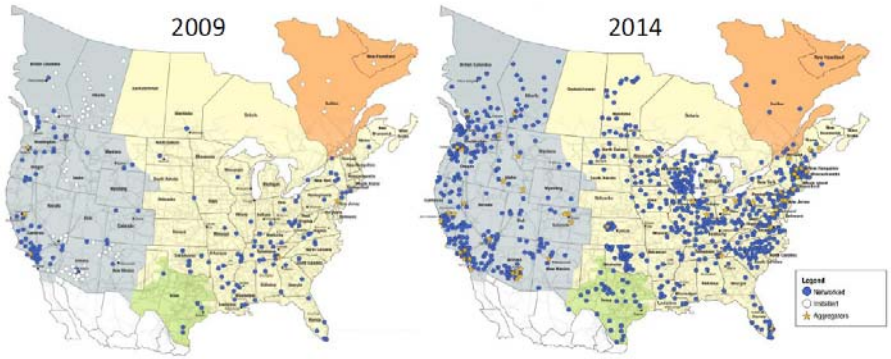
Advanced Modeling Grid Research ($15.0M)

- Accelerate the transition of the foundational research in mathematics and models into industry-relevant applications to improve reliability and security
- Expand mathematics and computational research to include uncertainty quantification, model formulation and reduction, and controls

Energy Systems Risk and Predictive Capability ($7.0M)

- Further the development of analytical tools that estimate seasonal and regional risks to energy systems for the public, the energy industry, and State and Federal partners
- Continue engagement through the State Energy Risk Assessment Initiative

Phasor Measurement Units across North America



Source: North American Synchrophasor Initiative (NASPI)

Highlights of the FY 2016 Request

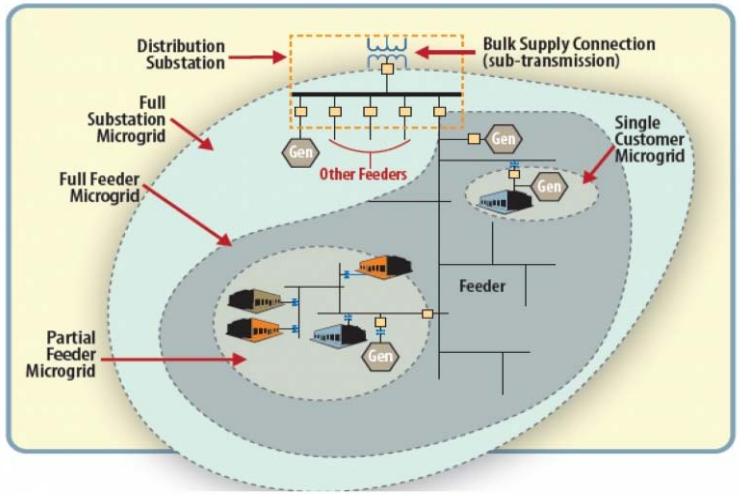
Smart Grid R&D

FY 2016 Request: $30.0M

The Smart Grid program focuses primarily on the development of technologies, tools, and techniques to modernize the distribution portion of the electric delivery system.

The FY 2016 request continues to pursue strategic investments to improve reliability, operational efficiency, resiliency, and outage recovery, building upon previous and ongoing grid modernization efforts:

- In partnership with utilities, develop the Advanced Distribution Management System, an open source integrated software platform for various vendor systems that will enable enhanced visibility and controllability of system assets
- Help balance electricity supply and demand by using market-based control signals to actively seek participation of customer-owned and third-party assets in grid services



Microgrids are localized grids that can disconnect from the traditional grid to operate autonomously and help mitigate grid disturbances to strengthen grid resilience.

Highlights of the FY 2016 Request

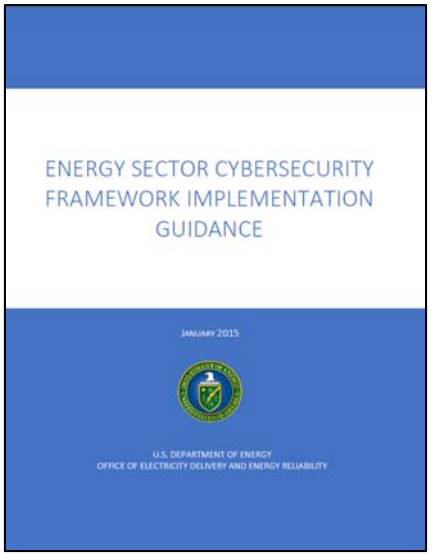
Cybersecurity for Energy Delivery Systems

FY 2016 Request: $52.0M

Cybersecurity for Energy Delivery Systems (CEDS) supports research on cutting edge cybersecurity solutions, information sharing to enhance situational awareness, implementing tools to help industry improve their cybersecurity posture, and building an effective, timely, and coordinated cyber incident management capability in the energy sector

The FY 2016 request reflects the critical need to accelerate and expand efforts to strengthen the energy infrastructure against cyber threats:

- Conduct R&D that leads to next generation tools and technologies that enhance and accelerate deployment of cybersecurity capabilities for the U.S. energy infrastructure.
- Accelerate information sharing to enhance situational awareness in the electricity and oil and natural gas subsectors
- Expand online access to the Cybersecurity Capability Maturity Model (C2M2) and Risk Management Process and conduct benchmark and data analytics of C2M2 evaluation results
- Exercise and refine the energy sector's cyber incident response capabilities
- Establish a new Virtual Energy Sector Advanced Digital Forensics Analysis Platform



Highlights of the FY 2016 Request

Energy Storage

FY 2016 Request: $21.0M

The Energy Storage program develops and demonstrates new and advanced energy storage technologies that will enable the stability, resiliency, and surety of the future electric utility grid as it transforms into a resilient grid, as well as support increased levels of renewables

The FY 2016 Request supports work on materials research, device development, demonstrations, and grid analysis:

- Expand efforts on energy storage safety to improve acceptance and speed deployment of storage, including a quarterly Energy Storage Safety Forum for the storage community
- Initiate energy storage reliability efforts with stakeholder workshops and research to improve operating lifetimes of energy storage systems
- Increase growth of co-funded state and regional energy storage demonstrations to quantify storage performance and develop valuation tools under a wide variety of applications
- Accelerate R&D efforts to advance new battery chemistries such as zinc-iodide with the potential to dramatically improve the cost/benefit ratio of storage

Commercialized DOE energy storage research: 125 kW Redox Flow Battery unit by UniEnergy, as deployed by Avista

Highlights of the FY 2016 Request

Transformer Resilience and Advanced Components

FY 2016 Request: $10.0M

The Transformer Resilience and Advanced Components (TRAC) program supports modernization and resilience of the grid by addressing the unique challenges facing transformers and other critical components that are responsible for transporting electricity from where it is generated to where it is needed.

FY 2016 activities expand upon initial work funded in the Infrastructure Security and Energy Restoration program to monitor and analyze impacts of ground-induced currents (GIC) on the electric infrastructure and support power electronic activities:

- Begin modeling and testing of transformers to evaluate vulnerability to geomagnetic disturbances (GMD) and electromagnetic pulses (EMP)
- Evaluate GMD/EMP mitigation, blocking devices, and solid state solutions
- Continue improvement of GIC monitoring, modeling, and prediction

Large Power Transformer Fire from Bushing Failure

Source: http://tdworld.com/substations/risk-equals-probability-times-consequences

Highlights of the FY 2016 Request

National Electricity Delivery

FY 2016 Request: $7.5M

The National Electricity Delivery program provides analytical tools and technical assistance to states, regional, local and tribal entities to facilitate the development of reliable and affordable electricity infrastructure—generation, transmission, storage, distribution, or demand side electricity resources.

The FY 2016 request:

- Expands and strengthens the modeling and analytical tools for grid modernization discussions at the Federal, state, and local levels
- Provides technical assistance on electricity-related topics, upon request, to states, public utility commissions, tribes, and other regional and Federal entities
- Implements the Integrated Interagency Pre-application process to improve Federal permitting of transmission infrastructure pursuant to section 216(h)

Highlights of the FY 2016 Request

Infrastructure Security and Energy Restoration

FY 2016 Request: $14.0M

The Department of Energy is the lead agency for maintaining and restoring energy supplies under the National Response Framework, and serves as the Sector Specific Agency for Agency for energy infrastructure and resilience. To help achieve this mission, the Infrastructure Security and Energy Restoration (ISER) team in OE works with public and private sector stakeholders to enhance the reliability, survivability, and resilience of our Nation's energy infrastructure.

- Support the development of advanced mitigation solutions for hardening infrastructure against all hazards, natural and man-made
- Develops and conducts energy sector specific preparedness and response exercises at the Federal, state and local governments as well as with industry partners to assess planning and capabilities and readiness
- Contribute to the Department of Energy Response and Operations Center (DOE-ROC) to create an operational environment with the technology, methods, and tools to enable analysts to, in real time, monitor, simulate, and track energy disruptions

Highlights of the FY 2016 Request

State Energy Reliability and Assurance Grants

FY 2016 Request: $63.0M

State Energy Reliability and Assurance Grants are designed to provide tools to bring state, local and tribal decision-makers together to address the emerging challenges of modernizing the electricity grid with comprehensive plans that integrate reliability, environmental protection and energy assurance.

The program provides grants to states, localities, and tribal governments in support of electricity transmission, storage, and distribution reliability and energy assurance.

Grants for Electricity Transmission, Storage, and Distribution Reliability ($27.5M)

- Provides grants to assist states and others to develop long-term energy system reliability plans that advance electric reliability planning and integrate it with planning and action for environmental protection, climate resiliency, and energy efficiency

Grants for Energy Assurance ($35.5M)

- Provides formula grants to state, local, and tribal governments to enhance resiliency through energy assurance planning, compliance, and training, including exercises