EERE FY 2017 Budget Request

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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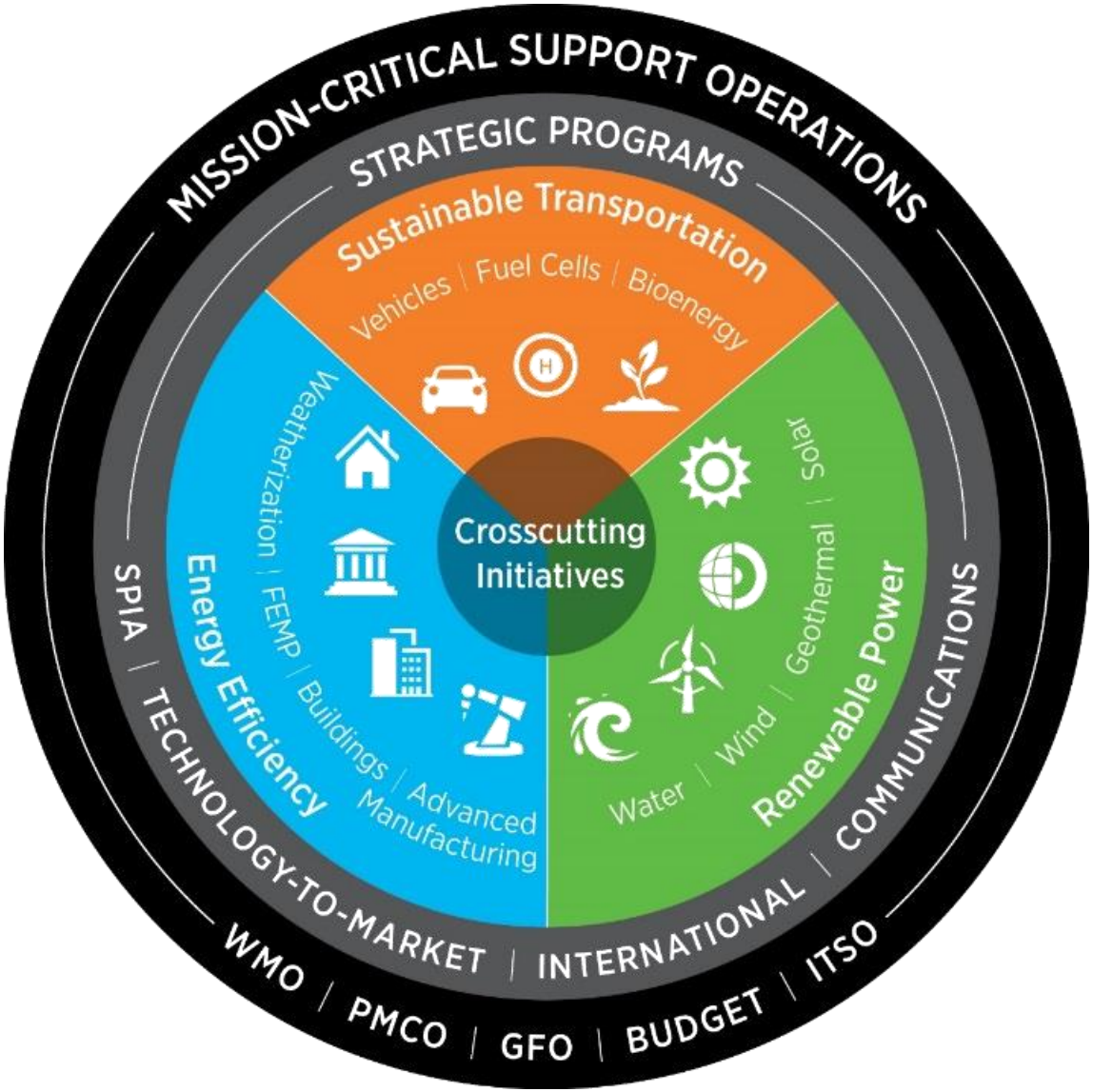
Administration Energy Goals

- Reduce GHG emissions by 17% by 2020, 26-28% by 2025, and 83% by 2050 from 2005 baseline
- By 2035, generate 80% of electricity from a diverse set of clean energy resources
- Double energy productivity by 2030
- Reduce net oil imports by half by 2020 from a 2008 baseline
- Reduce CO_2 emissions by 3 billion metric tons cumulatively by 2030 through efficiency standards set between 2009 and 2016

Strategic Plan Framework

EERE Organizational Structure



Select EERE Accomplishments

Sustainable TRANSPORTATION

- $264/kWh Modeled Li-Ion Battery Cost Achieved.
- Super Truck – demonstrated a 115% increase in Class 8 tractor-trailer freight efficiency reaching over 12 miles per gallon under real world driving conditions.
- Fourth Cellulosic Ethanol plant (world's largest) opened in Nov 2015.
- Fuel cells - 50% cost reduction, 5x platinum reduction since 2006.

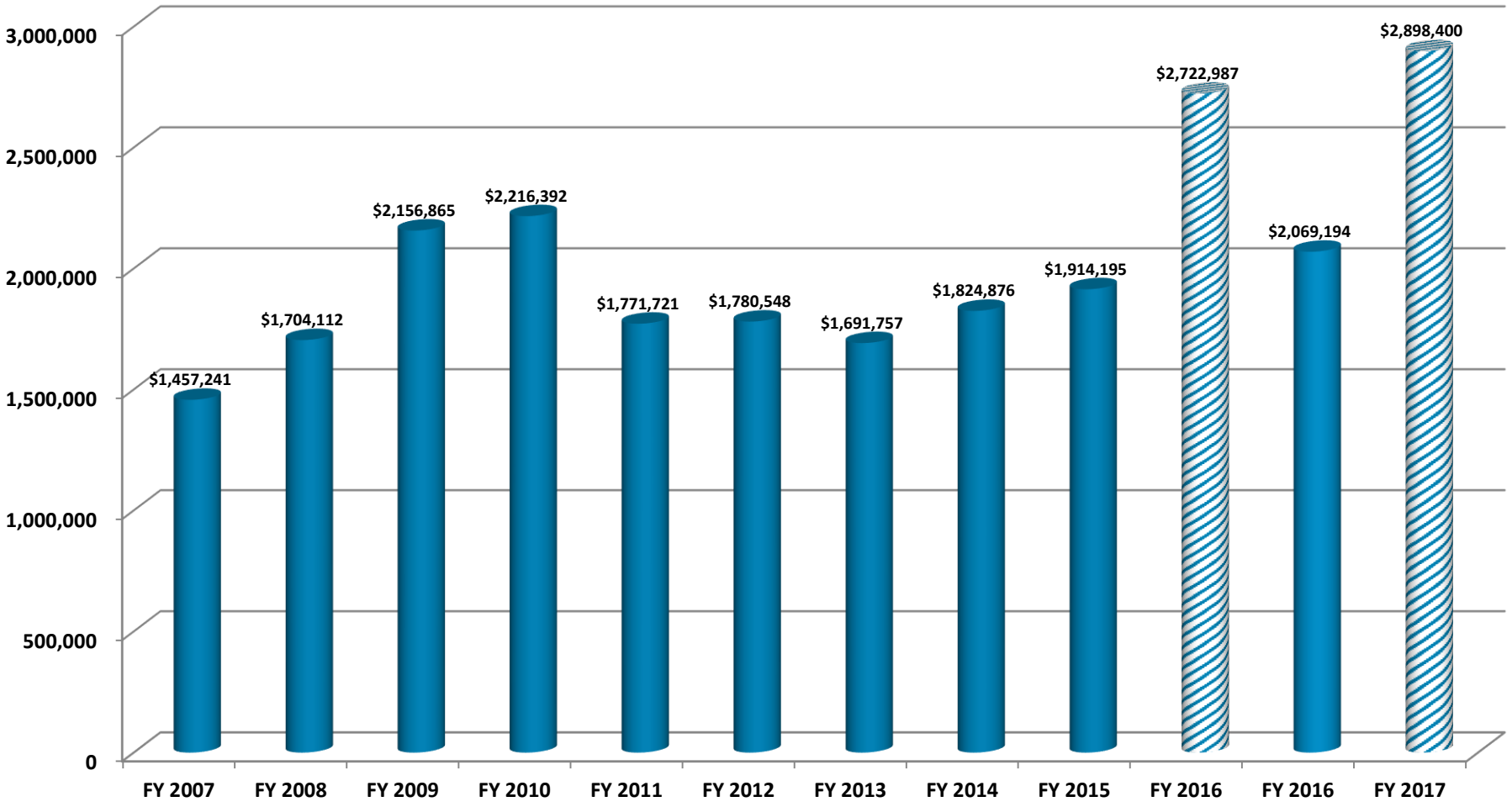
Renewable ELECTRICITY GENERATION

- Achieved 70% progress toward SunShot solar PV cost reduction in just first 4 years of 10 year initiative.
- Between 1980 and 2014, the actual market price of wind has dropped from 56.2c/kWh to 4.0c/kwh for wind plant installations beginning operations in 2014, a 93% reduction.
- Demonstrated the first ever full-scale deployment of Natel Energy's innovative HydroEngine at an irrigation canal located near Madras, OR.

Energy Saving HOMES, BUILDINGS, & MANUFACTURING

- Final rules and standards have been completed since 2009 and will save consumers over $539 billion and reduce CO_2 emissions by 2.3 billion metric tons through 2030
- More than 285 DOE partners through the Better Buildings Challenge on track to achieve average energy savings of 2% annually and saving 94 TBtus and $840 million since the Better Buildings Challenge began in 2011.
- Reduced cost of LED lighting 94% since 2008.
- Oak Ridge National Lab Manufacturing Demonstration Facility produced first ever 3D-printed car, increasing deposition rate by > 500x.

EERE Budget Trends: FY 2007 – FY 2017, ($K)



Congressional Request

FY 2017 Budget Summary Table

Dollars in Thousands	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs FY 2016	
Transportation	**602,000**	**635,950**	**852,900**	**216,950**	**34%**
- Vehicle Technologies	280,000	310,000	468,500	158,500	51%
- Bioenergy Technologies	225,000	225,000	278,900	53,900	24%
- Hydrogen and Fuel Cell Technologies	97,000	100,950	105,500	4,550	5%
Renewable Electricity	**456,000**	**478,050**	**620,600**	**142,550**	**30%**
- Solar Energy	233,000	241,600	285,100	43,500	18%
- Wind Energy	107,000	95,450	156,000	60,550	63%
- Water Power	61,000	70,000	80,000	10,000	14%
- Geothermal Technologies	55,000	71,000	99,500	28,500	40%
End-Use Efficiency	**642,000**	**721,000**	**919,000**	**198,000**	**27%**
- Advanced Manufacturing	200,000	228,500	261,000	32,500	14%
- Building Technologies	172,000	200,500	289,000	88,500	44%
- Federal Energy Management Program	27,000	27,000	43,000	16,000	59%
- Weatherization and Intergovernmental Programs	243,000	265,000	326,000	61,000	23%
Crosscutting Innovation Initiatives	**0**	**0**	**215,000**	**215,000**	
- Regional Energy Innovation Partnerships	0	0	110,000	110,000	-
- Next-Generation Innovation	0	0	60,000	60,000	-
- Small Business Partnerships	0	0	20,000	20,000	-
- Energy Technology Innovation Accelerators	0	0	25,000	25,000	-
Program Support	**237,000**	**238,000**	**290,900**	**52,900**	**22%**
Subtotal, Energy Efficiency and Renewable Energy	**1,937,000**	**2,073,000**	**2,898,400**	**825,400**	**40%**
- Use of Prior Year Balances	0			0	
- Rescission of Prior Year Balances	-22,805	-3,806		3,806	
Total, Energy Efficiency and Renewable Energy	**1,914,195**	**2,069,194**	**2,898,400**	**829,206**	**40%**

Sustainable TRANSPORTATION

Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Vehicle Technologies

Fiscal Year 2017 Highlights

- **EV Everywhere ($282.7M):** A DOE Grand Challenge to enable the U.S. to be the first to produce a wide array of plug-in vehicle models that are as affordable and convenient as gasoline vehicles by 2022.
- **SuperTruck II ($60M):** With an emphasis on cost-competitiveness, develop and demonstrate technologies to increase the freight hauling efficiency of heavy-duty, Class 8 trucks by greater than 100% in 2020, compared to a 2009 baseline vehicle.
- **Transportation as a System ($20M):** To explore opportunities to realize untapped energy efficiency, Transportation as a System will evaluate how transportation assets, travelers, and the transportation system interact and influence each other, with the longer-term goal of optimizing the transportation system.
- **Co-Optimization of Fuels and Engines ($15M):** Establishes a link early in the R&D cycle of both fuels and engines for a systems-based approach and to create optimized solutions for fuels and engines. Involves collaboration with Bioenergy Technologies.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Batteries and Electric Drive	103,701	141,100	0	-141,100
Battery Technology R&D	0	0	130,000	+130,000
Electric Drive Technology R&D	0	0	39,000	+39,000
Vehicle Systems	40,393	30,600	90,000	+59,400
Advanced Combustion Engines	49,000	37,141	74,800	+37,659
Materials Technology	35,602	26,959	82,700	+55,741
Fuels and Lubricant Technologies	20,000	22,500	20,500	-2,000
Outreach, Deployment and Analysis	28,304	48,400	31,500	-16,900
NREL Site Wide Facility Support	3,000	3,300	0	-3,300
Total, Vehicle Technologies	**280,000**	**310,000**	**468,500**	**+158,500**

Bioenergy Technologies

Fiscal Year 2017 Highlights

- **Synthetic Biology Foundry ($35M):** A multi-lab Foundry to apply synthetic biology tools to modify organisms, and develop robust processing capabilities, and scale-up, which can be easily transferred to industry.
- **Integrated Biorefinery (IBR) ($60M):** Phase II of the IBR FOA will down-select for the construction of one demonstration-scale and one pilot-scale facility or three pilot-scale facilities to produce drop-in hydrocarbon fuels.
- **Energy Materials Network - Catalysis ($30M)**: Using accelerated approaches to advanced materials R&D, develop more robust catalysts with increased conversion efficiencies for more cost competitive biofuels and bioproducts.
- **Advanced Feedstocks Supply Systems ($10M):** New FOA to develop integrated, preprocessing technologies at scale, which reduce feedstock costs and variability.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Feedstocks	32,000	46,500	0	-46,500
Feedstock Supply and Logistics	0	0	22,000	+22,000
Advanced Algal Systems	0	0	30,000	+30,000
Conversion Technologies	95,800	85,500	140,900	+55,400
Demonstration and Market Transformation	79,700	75,100	75,000	-100
Strategic Analysis and Cross-Cutting Sustainability	11,000	11,000	11,000	0
NREL Site-Wide Facility Support	6,500	6,900	0	-6,900
Total, Bioenergy Technologies	**225,000**	**225,000**	**278,900**	**+53,900**

Hydrogen and Fuel Cell Technologies

Fiscal Year 2017 Highlights

- **Fuel Cell R&D ($35M):** Develop innovative technologies to reduce cost and improve durability: Increasing Proton Exchange Membrane (PEM) fuel cell power output per gram of platinum-group metal (PGM) catalyst to 7.2kW/g from 2.8kW/g in 2008. (2020 goal: 8 kW/g PGM).
    - **Energy Materials Network - Electrocatalysis ($10M):** Supports Next generation advanced materials manufacturing R&D effort focused on high throughput combinatorial and computational approaches to develop PGM-free catalysts, electrodes, and interfaces and Membrane Electrode Assembly (MEA) optimization.
- **Hydrogen Fuel R&D ($44.5M):** Ramp up R&D and pioneering technologies in materials, components, and processes to enable low cost hydrogen from renewables through integrated national lab, industry and university collaboration. Reduce the cost of hydrogen storage systems by 25% compared to the 2013 baseline of $17/kWh. (2020 goals: $4/gge – high volume, $7/gge – low volume, $10/kWh).

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Fuel Cell R&D	33,000	35,000	35,000	0
Hydrogen Fuel R&D	35,200	41,050	44,500	3,450
Systems Analysis	3,000	3,000	3,000	0
Safety, Codes and Standards	7,000	7,000	10,000	3,000
Technology Acceleration	0	0	13,000	13,000
Technology Validation, Market Transformation, Manufacturing R&D	17,000	13,000	0	-13,000
NREL Site Wide Facility Support	1,800	1,900	0	-1,900
Total, Hydrogen and Fuel Cell Technologies	**97,000**	**100,950**	**105,500**	**4,550**

Renewable ELECTRICITY GENERATION

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Solar Energy Technologies

Fiscal Year 2017 Highlights

- **Advanced Power Electronics Solutions for Distributed PV ($20M):** Supports development of cutting-edge approaches to reduce the cost and improve the reliability and functionality of power electronics associated with solar energy systems.
- **Next Generation PV Modules ($18M):** R&D focused on non-cell module components and design, which comprise 40 percent of typical module cost and have the potential to significantly impact PV performance as well as installation cost.
- **Bridging Research Interactions Cooperative Grants (BRIDGE) ($15M):** Partnerships with basic science researchers to understand degradation modes that limit PV reliability and to develop new PV characterization techniques.
- **Concentrating Solar Power Desalination ($15M):** R&D to explore using thermal energy systems for cost-effective water purification and desalination strategies, in support of the DOE Energy-Water Nexus Crosscut.
- **Next Generation Renewable Fuels and Chemicals ($10M):** New subprogram to support the transition to a clean energy economy through innovative approaches of converting and storing solar power into usable fuels.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Concentrating Solar Power	46,400	48,400	43,000	-5,400
Photovoltaic R&D	35,300	53,152	64,000	+10,848
System Integration	43,700	52,447	83,000	+30,553
Balance of Systems Soft Cost Reduction	40,700	34,913	23,100	-11,813
Innovations in Manufacturing Competitiveness	57,800	43,488	62,000	+18,512
Next Generation Renewable Fuels and Chemicals R&D	0	0	10,000	+10,000
NREL Site-Wide Facility Support	9,100	9,200	0	-9,200
Total, Solar Energy Technologies Office	**233,000**	**241,600**	**285,100**	**+43,500**

Wind Power Technologies

Fiscal Year 2017 Highlights

- **Offshore Wind R&D Consortium Competitive Solicitation ($25M):** Accelerate fundamental R&D targeted at U.S.-specific challenges. The four-year, joint industry, academia and National laboratories consortia will address unique resource and operating conditions, innovative platforms designs for deeper water, installation, operations and maintenance, and fundamental research needs to enable a domestic offshore industry.
- **Offshore Wind Demonstration Projects ($30M):** Year six of seven of the Offshore Wind Advanced Technology Demonstration program to support the establishment of a competitive U.S. offshore wind industry through offshore system development and demonstration.
- **"Tall Wind" Competitive Solicitation ($22.5M):** Enable domestic manufacturing of larger wind turbine components enabling cost-effective access to resources throughout all 50 states (~140 meters).
- **Atmosphere to Electrons Initiative (A2e) ($22.4M):** The initiative will include comprehensive field experiments to develop and validate high-fidelity wind inflow and wake models, and to develop and demonstrate innovative wind-plant flow control strategies for land and offshore wind applications. It will also leverage DOE high-performance computing (HPC) assets at the National Laboratories, and simulation toolsets to develop wind application-focused, high-fidelity, and computational simulations capable of modeling the relevant physical processes critical to predicting wind plant performance as well as turbine loads.
- **Advanced Grid Integration ($12.7M):** Supports DOE's Grid Modernization Initiative efforts to create tools and technologies that measure, analyze, predict, and control the grid of the future; focus on key policy questions related to regulatory practices, market designs, and business models; and collaborate with stakeholders to test and demonstrate combinations of promising new technologies.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Technology RD&T and Resource Characterization	34,658	24,789	87,500	+62,711
Technology Validation and Market Transformation	46,250	47,650	30,200	-17,450
Mitigate Market Barriers	11,207	12,395	34,000	+21,605
Modeling and Analysis	10,185	8,166	4,300	-3,866
NREL Site Wide Facility Support	4,700	2,450	0	-2,450
Total, Wind Power Technologies	**107,000**	**95,450**	**156,000**	**+60,550**

Water Power Technologies

Fiscal Year 2017 Highlights

- **HydroNEXT - New Stream Reach Development ($7.8M):** Issue a competitive solicitation for new stream reach development (NSD) to develop new strategies including more innovative water diversion techniques (no-dam hydropower) and advanced tunneling methods that would allow development of areas where hydropower projects cannot be built using traditional construction methods.
- **Energy-Water Nexus ($6M):** Support the DOE Energy-Water Nexus Crosscut by funding demonstrations and performance/reliability testing, in partnership with water utilities, of different small, modular hydropower systems to recover excess energy at municipal water supply and treatment systems and continue the second year of a 4-year effort to improve accurate representation of hydropower systems in integrated energy assessment models to help identify any significant future water and energy systems-level risks.
- **Revolutionary Wave Energy Conversion (WEC) System Performance Demonstration ($10.3M):** Competitive solicitation to fund sub-scale Wave Energy Converter (WEC) system design, prototype development, deployment, and operation to achieve system performance at a relevant scale. Builds on the FY 2015 Wave Energy Prize and FY 2014 WEC demonstrations at the Navy's Wave Energy Test Site.
- **Open Water Wave Test Facility ($20M):** Commence procurement for and construction of the critical infrastructure needed for an open water, fully energetic, grid-connected wave energy test facility. Commissioning of this multiple-berth wave energy test facility will provide affordable access to world-class test facilities for emerging MHK components and systems to accelerate development and deployment of U.S.-developed technologies through reductions in technical and financial risk, testing cost, and time-to-market.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Marine and Hydrokinetic Technologies	41,100	44,250	55,000	+10,750
Hydropower Technologies	19,200	24,750	25,000	+250
NREL Site Wide Facility Support	700	1,000	0	-1,000
Total, Water Power Technologies	**61,000**	**70,000**	**80,000**	**+10,000**

Geothermal Technologies

Fiscal Year 2017 Highlights

- **Frontier Observatory for Research in Geothermal Energy (FORGE) ($35M):** Continue full implementation of FORGE field operations. Activities include commencement of drilling, continuation of site characterization, and advancement of a competitive solicitation for R&D projects focusing on reservoir creation technologies.
- **Subsurface Technology and Engineering R&D (Subsurface Crosscut) ($33M)**: Innovative research and development in key areas — wellbore integrity, subsurface stress and induced seismicity, permeability manipulation and new subsurface signals, and advanced imaging of geophysical and geochemical signals in the subsurface — to reduce the cost and risk of geothermal exploration and development.
- **Play Fairway Analysis ($5M):** Conduct temperature gradient well drilling at targeted areas of hydrothermal potential, culminating in a comprehensive economic and uncertainty analysis of each play fairway to spur future exploration activities and potential development by the geothermal industry.
- **Deep Direct Use ($4M):** Conduct feasibility studies of low-temperature deep-well geothermal systems coupled with advanced direct use applications and cascaded surface technologies, whose applications extend the reach of geothermal beyond the western U.S. These efforts will support identification of potential sites and assess new geothermal resource opportunities.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Enhanced Geothermal Systems	32,100	45,000	45,000	0
Hydrothermal	12,500	13,800	40,500	+26,700
Low Temperature and Coproduced Resources	6,000	8,000	10,000	+2,000
Systems Analysis	3,900	3,700	4,000	+300
NREL Site-Wide Facility Support	500	500	0	-500
Total, Geothermal Technologies	**55,000**	**71,000**	**99,500**	**+28,500**

Energy Saving
HOMES, BUILDINGS, & MANUFACTURING

Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Building Technologies

Fiscal Year 2017 Highlights

- **Low-GWP Advanced Cooling (HVAC) R&D ($40M):** Initiate new multi-year with the goal to enable a paradigm shift in HVAC technologies, moving beyond today's refrigerants.
- **Miscellaneous Electric Loads (MELs) ($20M):** Support R&D initiative to reduce the rapidly growing fraction of building energy usage coming from miscellaneous electrical loads.
- **Buildings Energy Efficiency Frontier and Innovation Technologies (BENEFIT) FOA ($29M):** Focus on building envelope materials for retrofit applications, highly insulating windows, and advanced building sensors, and includes an open topic to address off-roadmap technology R&D.
- **Appliance Standards ($54M):** Continue to meet all of its mandated deadlines for covered products and enforce its existing standards; Issue eight Test Procedure Final Rules for 8 products (8 rulemaking), and complete testing of more than 100 products for compliance with Federal minimum efficiency standards or the ENERGY STAR program.
- **Metropolitan Systems ($15M):** Enable the use of new sensing, communication, and computational capabilities that integrate measurement and data sources with advanced analytics to create actionable information for decision-makers.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Commercial Buildings Integration (CBI)	27,643	32,000	28,000	-4,000
Emerging Technologies (ET)	55,740	85,915	169,000	+83,085
Penn State Consortium for Building Energy Innovation	10,000	0	0	0
Equipment and Buildings Standards	53,359	57,485	54,000	-3,485
Residential Buildings Integration (RBI)	22,758	23,000	23,000	0
Metropolitan Systems	0	0	15,000	+15,000
NREL Site-Wide Facility Support	2,500	2,100	0	-2,100
Total, Building Technologies	**172,000**	**200,500**	**289,000**	**+88,500**

Advanced Manufacturing Technologies

Fiscal Year 2017 Highlights

- **Clean Energy Manufacturing Innovation Institutes ($84M):**
  - Support five existing Institutes ($70M) for Power Electronics/ WBG, Advanced Composites, Smart Manufacturing, and two to-be-announced Institutes from prior year FOAs. Establish one new Institute ($14M) in FY 2017 focused on one of the advanced manufacturing challenges identified in the DOE Quadrennial Technology Review (QTR) published in 2015, not previously addressed in existing institutes.
- **Energy Innovation Hubs ($45M):**
  - **Energy-Water Desalination Hub ($25M):** Establish Hub to conduct first-of-a-kind centralized critical-mass RD&D effort on desalination for de-energizing, de-carbonizing, and reducing the cost of desalination to provide clean and safe water. FY 2017 is the first year funding.
  - **Critical Materials Institute ($20M):** Continue to focus on technologies that will enable American manufacturers to make better use of the critical materials to which they have access, as well as to reduce or eliminate the need for materials that are subject to supply disruptions. FY2017 is the first year of renewed support of a second five-year phase.
- **Manufacturing Demonstration Facility/Carbon Fiber Test Facility ($10M):** Supports industrial research partnerships related to additive manufacturing and carbon fiber materials, including a specific focus on materials and structures used in extreme environments.
- **Advanced Manufacturing Incubator ($20M):** Provides incentives for small- and medium-size manufacturing companies to pursue emerging high-risk, high-impact advanced manufacturing technology developments that they otherwise would not pursue.
- **High-Performance Computing 4 Manufacturing ($7.5M):** Helps U.S. industry tackle some of their most challenging problems by partnering world-class experts at the Nationals Labs with corporate researchers to model their technologies on some of the world's fastest supercomputers.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Advanced Manufacturing R&D Projects	84,000	101,500	102,500	+1,000
Advanced Manufacturing R&D Facilities	92,500	98,500	129,000	+30,500
Industrial Technical Assistance	23,500	28,500	29,500	+1,000
Total, Advanced Manufacturing	**200,000**	**228,500**	**261,000**	**+32,500**

Federal Energy Management Program

Fiscal Year 2017 Highlights

- **Federal Energy Efficiency Fund ($15M):** Continuing successful approach (FEEF 1.0) to implement commercially available technologies but not deployed at Federal Facilities, and increase funding for new program (FEEF 2.0) to expand the use of deep energy efficiency retrofits in Federal facilities - ~40% energy reduction vs maximum of ~20% typically achieved.

- **Federal Energy Management Core Activities ($28M):** Making Performance Contracting Business as Usual and support agencies to successfully meet the President's Performance Contracting Challenge of $4 billion for investing in energy efficiency and renewable energy projects, support agencies with technical guidance and assistance, planning, reporting, and evaluation. Launch Energy Savings Performance Contract Pilot.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Federal Energy Efficiency Fund	2,850	3,000	15,000	12,000
Federal Energy Management	0	23,100	28,000	4,900
Project Financing, Technical Guidance and Assistance, Planning, Reporting and Evaluation, and Federal Fleet	21,190	0	0	0
DOE Specific Investments	2,160	0	0	0
NREL Site-Wide Facility Support	800	900	0	-900
Total, Federal Energy Management Program	**27,000**	**27,000**	**43,000**	**16,000**

Weatherization and Intergovernmental Program

Fiscal Year 2017 Highlights

- **Weatherization Assistance Formula Grants ($225M):** Award and actively manage 59 weatherization formula grants that will support critical infrastructure and a level of operations to provide weatherization retrofits for approximately 35,700 low-income families across the country.
- **Weatherization Training and Technical Assistance ($5M):** Upgrade the existing resources (workforce training and audit processes) as well as developing best practice guidance on their use.
- **State Energy Formula Grants ($45M):** Award and actively manage 56 formula grants to advance deployment of effective energy efficiency and renewable energy policies and technologies by state governments and expand state-led comprehensive clean energy and emergency energy planning capabilities.
- **State Competitive Energy Projects ($15M):** Competitively select and manage 20-30 multi-jurisdictional energy efficiency and clean energy technology projects that have high impact/high-visibility and replicability to other state and local entities.
- **State Energy Program Technical Assistance ($10M):** Expand best practices tools, models, and strategies in partnership with state energy offices, national state associations and regional organizations including the public sector Better Buildings Challenge participants.
- **Cities, Counties & Communities Energy Program ($26M):** Launch new initiative to provide competitive technical assistance and competitively-awarded funds to local governments, public housing authorities, non-profits [and other stakeholders] to catalyze more extensive clean energy solutions in community development and revitalization efforts.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017vs. FY 2016
Weatherization Assistance Program	193,000	215,000	230,000	+15,000
State Energy Program	50,000	50,000	70,000	+20,000
Cities, Counties & Communities Energy Program	0	0	26,000	+26,000
Total, Weatherization and Intergovernmental	**243,000**	**265,000**	**326,000**	**+61,000**

Mission-Critical Support

OPERATIONS

Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Strategic Programs, Facilities, and Program Direction

Fiscal Year 2017 Highlights

Strategic Programs:

- **Technology-to-Market ($11.5M):** Encourage the growth of a flourishing U.S. innovation ecosystem, in which technology developers (at startups, small businesses, universities, and National Laboratories) collaborate directly and effectively with investors, industry, and technology development and manufacturing resources. Expand Lab Corps pilot to a broader effort that includes additional National Laboratories.
- **International ($6M):** Supports the development of markets for U.S. clean energy product manufacturers with partnership activities with up to 10 partner countries, and notably will continue to support bilateral clean energy R&D with Israel.

Facilities & Infrastructure:

- **Energy Systems Integration Facility (ESIF) ($36M):** Completes doubling of HPC capability to simulate energy systems, provides additional 1MW testing capability, and integrates environmental test chamber.
- **NREL Site-Wide Support ($30M):** Consolidates funding in the Facilities and Infrastructure Program ($30M). This transfers NREL Site-Wide funding from individual EERE technology programs and is a net-zero change within EERE's overall budget request.

Program Direction:

- Support Active Project Management across the full EERE portfolio, including creation and enforcement of rigorous "Go/No-Go" milestones, regular in-depth project site visits and reviews, and termination of under-performing projects.
- Build on previous efforts to maximize the efficient and effective use of resources by continually re-engineering operations to reduce expenses and improve service delivery.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Strategic Programs	21,000	21,000	28,000	+7,000
Facilities & Infrastructure	56,000	62,000	92,000	+30,000
Program Direction	160,000	155,000	170,900	+15,900
Total, Corporate Support	**237,000**	**238,000**	**290,900**	**+52,900**

EERE
Crosscutting Innovation Initiatives

Crosscutting Innovation Initiatives

- **Regional Energy Innovation Partnerships ($110M)**: Supports regionally relevant technology neutral clean energy research, development and demonstration (RD&D) needs and opportunities to support accelerated clean energy technology commercialization, economic development, and manufacturing.

- **Next Generation Innovation ($60M)**: Funds off-roadmap RD&D projects with the greatest potential to change the trajectory of EERE core program technology pathways.

- **Energy Technology Innovation Accelerators ($25M)**: Couple the talent and commitment of early-stage clean energy technology entrepreneurs with the world-class tools and expertise of the National Labs through RD&D projects that encourage mentorship and network support leading to new company creation and the development of successful commercialization strategies.

- **Small Business Partnerships ($20M)**: Enables National Laboratories to partner with small businesses to address their critical clean energy RD&D challenges and opportunities in the sustainable transportation, renewable power, and energy efficiency space.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Regional Energy Innovation Partnerships	0	0	110,000	+110,000
Next Generation Innovation	0	0	60,000	+60,000
Energy Technology Innovation Accelerators	0	0	25,000	+25,000
Small Business Partnerships	0	0	20,000	+20,000
Total, Crosscutting Innovation Initiatives	**0**	**0**	**215,000**	**+215,000**

DOE Crosscuts

Grid Modernization Initiative (EERE $190M; DOE $379M)

Changing Electricity Supply Mix	Threats to Resilience and Reliability	New Market Opportunities for Consumers	Information and Control Technologies	Aging Infrastructure

Grid Modernization Multi-Year Program Plan

Devices and Integrated System Testing ($74.6M)	• Develops devices and integrated systems, coordinates integration standards and test procedures, and evaluates the grid characteristics of both individual devices and integrated systems to provide grid-friendly energy services
Sensing and Measurement ($34.3M)	• Focuses on tools and strategies to determine the type, number, and placement of sensors to improve system visibility
System Operations, Power Flow, and Control ($23.1M)	• Focuses on new control technologies to support new generation, load, and storage technologies
Design and Planning Tools ($17.7M)	• Develops the next generation of modeling and simulation tools needed for power system planning
Security and Resilience ($11.5M)	• Addresses physical and cybersecurity challenges and assesses ways to minimize risk and provide situational awareness during energy-related emergencies
Institutional Support ($28.5M)	• Provides technical assistance to key decision-makers so they can address the high priority grid modernization challenges and needs identified by electric power industry stakeholders

Regional Demonstrations

- Low Reserve Margin Demo
- Clean Distribution Feeder
- Grid Analytics Platform

Our path to a modernized grid to power American leadership in the 21st Century

Subsurface Crosscut (EERE $81M; DOE $258M)

Adaptive Control of Subsurface Fractures and Fluid Flow

Wellbore Integrity $8M	Subsurface Stress & Induced Seismicity $9M	Permeability Manipulation $4M	New Subsurface Signals $12M
Materials: adaptive cements, muds, casing	Stress state beyond the borehole	Physicochemical rock physics, including fluid-rock interactions	Diagnostic signatures of system behavior and critical thresholds
Real time, in-situ data acquisition and transmission system		New approaches to remotely characterize in-situ fractures and to monitor fracture initiation/branching and fluid flow	Autonomous acquisition, processing and assimilation approaches
Diagnostics tools, remediation tools and techniques	Signal acquisition and processing and inversion		
Quantification of material/seal fatigue and failure		Manipulating (enhancing, reducing and eliminating) flow paths	Integration of different measurements collected over different scales to quantify critical parameters and improve spatial and temporal resolutions
Advanced drilling and completion tools (e.g., anticipative drilling & centralizers)	Localized manipulation of subsurface stress		
Well abandonment analysis/ R&D		Novel stimulation methods	Advanced Imaging of Geophysical &Geochemical Signals in the Subsurface

Energy Field Observatories

Risk Assessment Tools and Methodologies

Ongoing Subsurface Related R&D $47.6M

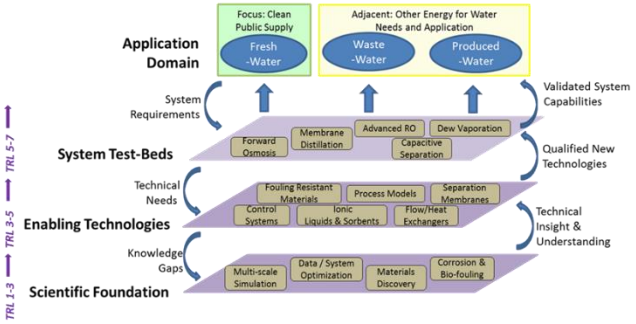
Energy-Water Nexus and Advanced Materials

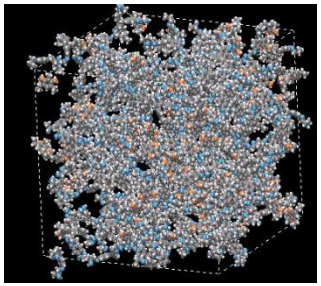
Collaboration Across DOE

Energy-Water Nexus EERE: $52M DOE: $96M	Advanced Materials Manufacturing for Clean Energy EERE: $63M DOE: $113M
Leverage integrated analysis, innovation and outreach to accelerate Nation's transition to more resilient coupled energy-water systems	Enduring public-private partnership that accelerates material development for energy from discovery through deployment twice as fast as today, building capabilities to focus on processing and end use performance

EERE RD&D Focus

AMO ($25.0M):	Low-Energy, Low-Carbon, Low-Cost Desalination Hub
BETO ($4.0M):	Conversion technologies
GTO ($2.0M):	Desalination from geothermal brines
SETO ($15.0M):	Concentrating Solar Power desalination
Water ($6.0M):	Water supply system energy recovery and integrated energy assessment modeling
VTO ($34.0M):	Lightweight materials polymer composites and manufacturing FOA and Lab consortium.
VTO ($5.3M):	Materials under extreme environments
AMO ($10.0M):	Additive Manufacturing and Carbon Fiber (within MDF project support).
AMO ($14.0M):	National Network for Manufacturing Institute for Innovative Advanced Composites





21st Century Clean Transportation Plan Investment

21st Century Clean Transportation Plan Investment

Mandatory Budget Authority

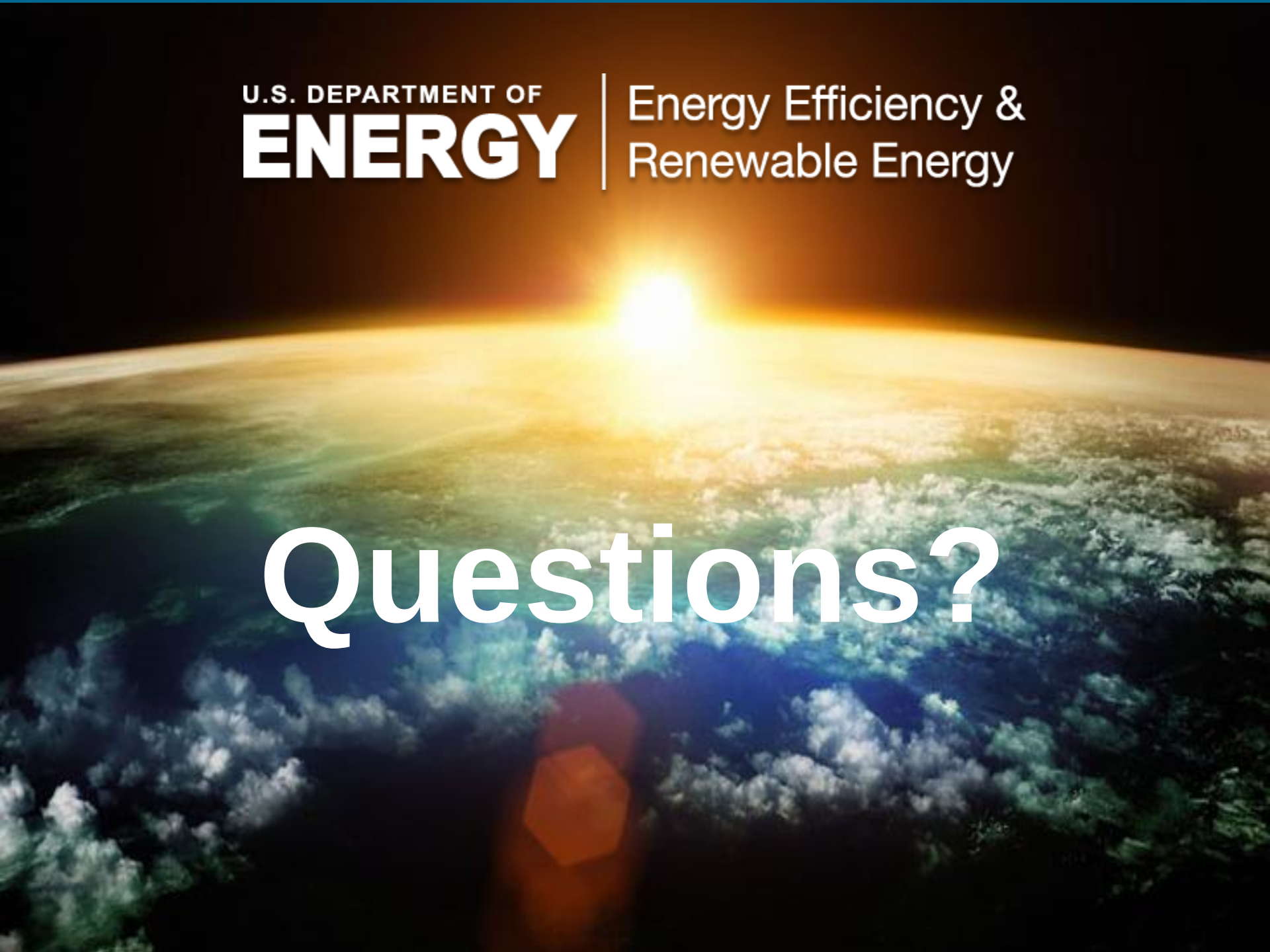
- As part of the 21st Century Clean Transportation Plan, the Department of Energy will:

1. Scale-up **Clean transportation R&D** to accelerate:
   - Cutting battery costs ($200M)
   - Developing next-generation of low carbon fuels such as biofuels ($100M)
   - Researching the intersection of information & communication technologies (ICT), vehicle technologies, low carbon fuels, and disruptive transportation business models ($200M)

2. Develop **Regional Low-carbon Fueling** infrastructure and launch an Electric Vehicle Accelerators Communities program with the goal of deploying 10,000 new grid connected solar powered fast charge stations or renewable hydrogen refueling stations by 2025 through public-private partnerships ($750M)

3. Launch the **Clean Fleets Competition** program that will use challenge grants to drive state, tribal, and local government vehicle fleets to purchase clean transportation options and operate them on low-carbon fuels, including those for first responders ($85M)

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Request	FY 2017 vs. FY 2016
Clean Transportation R&D	0	0	200,000	+200,000
Next-Generation Biofuels R&D	0	0	100,000	+100,000
Smart Mobility Research Center	0	0	200,000	+200,000
Clean Fleets Competition – Municipalities and First-Responders	0	0	85,000	+85,000
Low-Carbon Fueling Infrastructure Development	0	0	750,000	+750,000
Total, 21st Century Clean Transportation	**0**	**0**	**1,335,000**	**+1,335,000**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Energy Efficiency &
Renewable Energy
Questions?