U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HEARING CHARTER

An Overview of the Budget Proposal for the Department of Energy for Fiscal Year 2017

Tuesday, March 22, 2016
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

The Committee on Science, Space, and Technology will hold a hearing titled *An Overview of the Department of Energy's Budget Proposal for Fiscal Year 2017* on Tuesday, March 22, 2016, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. With the release of the President's budget request for fiscal year (FY) 2017, the purpose of the hearing is to examine the Department of Energy's science and technology priorities and their impact on the allocation of funding within the Department's research, development, demonstration, and commercialization activities.

WITNESS LIST

- **The Honorable Ernest Moniz**, *Secretary of Energy, U.S. Department of Energy*

BACKGROUND

The Department of Energy's (DOE) primary mission is to "ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions."[1] DOE funds a wide range of research, development, demonstration, and commercial application activities under this mission, primarily executed by the Department's 17 national laboratories.

The President's FY 2017 budget request for DOE is $32.5 billion, which represents an increase of $2.9 billion or 9.8 percent over FY 2016 enacted levels.[2] Approximately one-third of this amount, $12.9 billion in the FY 2017 request, is dedicated to science and energy programs within the Committee on Science, Space, and Technology's jurisdiction. Funding for science, energy, and related programs in the request is $2.8 billion above the FY 2016 enacted level, and includes $11.3 billion in discretionary funding and $1.6 billion in proposed mandatory spending.[3]

[1] U.S. Department of Energy, "Mission Statement," Available at http://energy.gov/mission
[2] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[3] Ibid.

The following table provides a summary of the FY 2017 DOE budget request for programs within the Science Committee's jurisdiction:[4]

Department of Energy (DOE) Science and Technology Spending (dollars in millions)				
Program	**FY 2015 Enacted**	**FY 2016 Enacted**	**FY 2017 Request**	**FY 2017 vs FY 2016 (% Change)**
Office of Science (SC)	**5,067.7**	**5,350.2**	**5,572.1**	**4.2%**
Advanced Scientific Computing Research	541.0	621.0	663.2	6.8%
Basic Energy Sciences	1,733.2	1,849.0	1,936.7	4.7%
Biological and Environmental Research	592.0	609.0	662.0	8.7%
Fusion Energy Sciences	467.5	438.0	398.2	-9.1%
High Energy Physics	766.0	795.0	818.0	2.9%
Nuclear Physics	595.5	617.1	635.7	3.0%
Workforce Development for Teachers and Scientists	19.5	19.5	20.9	7.3%
Science Laboratories Infrastructure	79.6	113.6	130.0	14.4%
Safeguards and Security	93.0	103.0	103.0	N/A
Science Program Direction	183.7	185.0	204.5	10.5%
Office of Science Mandatory Funding (University Grants)			100.0	100.0%
Energy Efficiency and Renewable Energy (EERE)	**1,914.2**	**2,069.2**	**2,898.4**	**40.1%**
EERE Mandatory Funding (Clean Transportation)	**N/A**	**N/A**	**1,335.0**	**100.0%**
Electricity Delivery and Energy Reliability (OE)	**147.0**	**206.0**	**262.3**	**27.3%**
Nuclear Energy (NE)	**833.4**	**986.2**	**993.9**	**0.8%**
Fossil Energy R&D (FER&D)	**560.6**	**632.0**	**600.0**	**-5.1%**
Advanced Research Projects Agency - Energy (ARPA-E)	**280.0**	**291.0**	**350.0**	**20.3%**
ARPA-E Mandatory Funding (ARPA-E Trust Fund)	**N/A**	**N/A**	**150.0**	**100.0 %**
Title 17 – Innovative Technology Loan Guarantee Program	**17.0**	**17.0**	**10.0**	**-41.2%**
Total	**8,819.9**	**9,551.6**	**12,271.8**	**22.0%**

This budget request claims to meet the Administration's goal to "invest in all stages of innovation across a diverse portfolio of clean energy technologies" in order to "enhance economic competitiveness in a low-carbon world and secure America's long-term energy security."[5] The budget proposal also stresses continued commitment to the President's Climate Action Plan (CAP) as driving the emphasis on research, development, demonstration, and commercial application of clean energy technologies.[6] The FY 2017 budget request also includes the first plan to implement commitments made through Mission Innovation, the Obama administration's pledge to double public funding for energy research and development made in

[4] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[5] Ibid.
[6] Ibid.

conjunction with the Paris climate negotiations.[7] According to the Department, various programs throughout the DOE budget proposal contribute to nearly 80 percent of the administration's Mission Innovation commitments for FY 2017.[8]

In addition to continuing the reorganization of the Department into three Under Secretariats (Energy and Science, Nuclear Security, and Management and Performance) as proposed in the FY 2015 budget request, the FY 2017 request includes over $1.4 billion in crosscutting initiatives funded across the Science and Energy programs in the Department, an increase of $329 million from the FY 2016 enacted levels. Drawing funding from appropriate program offices, the crosscutting program coordinates research on technology areas with multiple energy resource applications, and are designed to institutionalize coordination between program offices and the national labs. Initiatives in the FY 2017 budget request include exascale computing, grid modernization, subsurface technology and engineering, supercritical CO2, cybersecurity, advanced materials for energy innovation, and the energy-water nexus.[9]

Important questions and key issues to be discussed at the hearing include:

- How effectively does fundamental research and development within the Department of Energy's Office of Science lead to transformative scientific breakthroughs?

- Given the emphasis on renewable energy deployment within the Department compared to basic research investments, are the strategic goals of the DOE's research programs aligned to the long-term needs of the American economy?

- How have the commitments made in conjunction with the Paris climate negotiations, including Mission Innovation, shaped the priorities outlined in the DOE FY 2017 budget request?

- How will key management, structure, and policy changes outlined in the request to Congress more efficiently and effectively advance the science and energy research and development conducted throughout DOE?

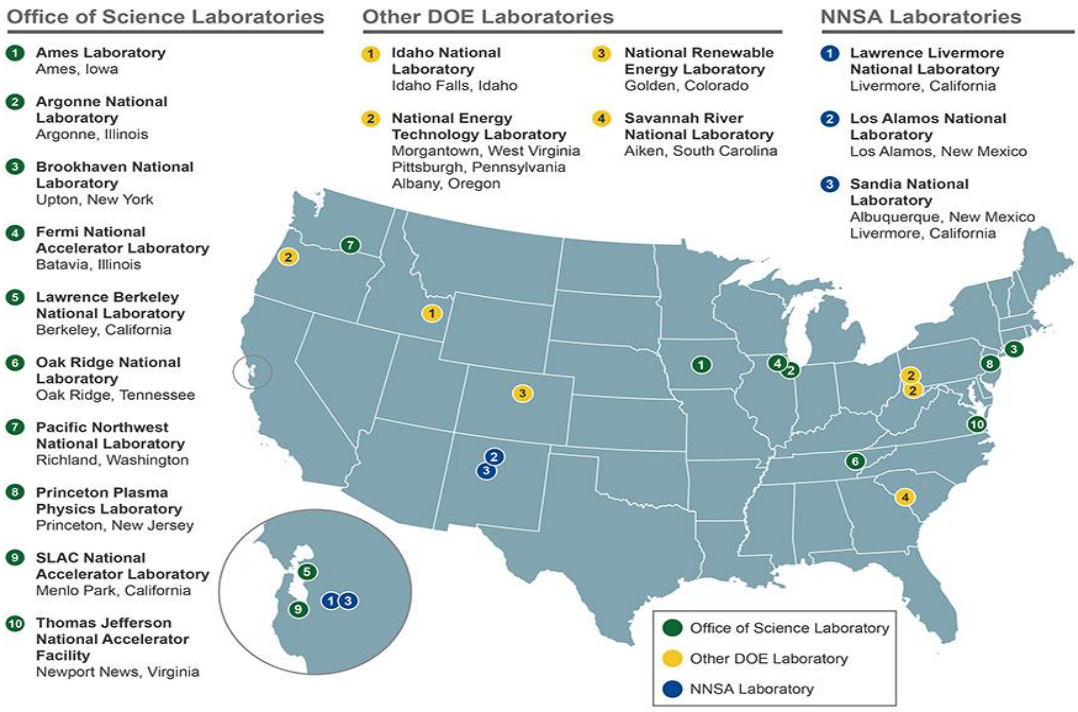
- The broader role of government in research and development, particularly the balance of investments between basic research versus applied energy development and demonstration.

[7] The White House, "Fact Sheet: Mission Innovation," November 29, 2015. Available at https://www.whitehouse.gov/the-press-office/2015/11/29/fact-sheet-mission-innovation
[8] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[9] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 2," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f30/FY2017BudgetVolume2.pdf

ADDITIONAL BACKGROUND: DOE R&D PROGRAMS AND OFFICES

Office of Science (SC)

The Office of Science is the "largest federal sponsor of basic research in the physical sciences, supporting over 24,000 investigators at over 300 U.S. academic institutions and the DOE laboratories."[10] The FY 2017 budget request for the Office of Science (SC) is s $5.57 billion, $225 million or 4.2 percent above the FY 2016 enacted level.[11] The budget request includes $100 million in proposed mandatory spending for university research grants, which would require additional authorization from Congress.[12]



The Office of Science budget is divided into six major program areas:[13]

- **Advanced Scientific Computing Research (ASCR)** supports advanced computational research, applied mathematics, computer science, and networking and the development and operation of high performance computing facilities. Funding is specifically included to accelerate development of capable exascale computing systems, including the SC component of DOE's Exascale Computing Initiative (ECI) through the Office of Science Exascale

[10] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[11] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 4," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume%204.pdf
[12] Ibid.
[13] Ibid.

Computing Project (SC-ECP). ASCR is funded at $663.2 million, an increase of $42.2 million or 6.8 percent from FY 2016 enacted levels.[14]

- **Basic Energy Sciences (BES)** supports fundamental research to understand, predict, and ultimately control matter and energy, to provide the foundations for new energy technologies, to mitigate the environmental impacts of energy use, and to support DOE missions in energy, environment, and national security. Funding for this program includes support for Energy Frontier Research Centers (EFRCs), the Energy Innovation Hubs, computational materials sciences activities, and continued funding for the construction for Linac Coherent Light Source-II (LCLS-II) and Advanced Photon Source (APS) upgrade. BES is funded at $1.94 billion in the FY 2017 request, an increase of $87.7 million or 4.7 percent from FY 2016 enacted levels.[15]

- **Biological and Environmental Research (BER)** supports scientific user facilities and fundamental research on complex biological, climatic, and environmental systems, core research in genomic science, and efforts to advance understanding of the role of atmospheric, terrestrial, ocean, and subsurface interactions, and field research and modeling to understand the dynamic physical, biogeochemical, microbial, and plant processes interactions involved in the energy-water nexus. Funding for this program supports three DOE Bioenergy Research Centers (BRC), the DOE Joint Genome Institute (JGI), the Environmental Molecular Sciences Laboratory (EMSL), and the Atmospheric Radiation Measurement Climate Research Facility (ARM). BER is funded at $661.9 million, an increase of $52.9 million or 8.7 percent above FY 2016 enacted levels.[16]

- **Fusion Energy Sciences (FES)** supports research to understand the behavior of matter at high temperatures and densities and continue to develop fusion as a future energy source. Funding is also included for the U.S. contribution to the International Thermonuclear Experimental Reactor (ITER) project and the operation of the National Spherical Torus Experiment Upgrade (NSTX-U). FES is funded at $398.18 million, a decrease of $39.8 million or 9.1 percent from FY 2016 enacted levels.[17]

- **High Energy Physics (HEP)** supports research to understand how the universe works at its most fundamental level by discovering the most elementary constituents of matter and energy, their interactions, and the basic nature of space and time. Funding for this program continues to implement activities and projects based on the strategic plan issued by the High Energy Physics Advisory Panel (HEPAP) in May 2014, including enhancing support for technical design and construction associated with the Long Baseline Neutrino Facility (LBNF)/Deep Underground Neutrino Experiment (DUNE) project, and continued construction of three MIEs for next generation dark-energy and dark-matter experiments.[18]

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[14] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 4," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume%204.pdf
[15] Ibid.
[16] Ibid.
[17] Ibid.
[18] Ibid.

HEP is funded at $817.9 million, an increase of $22.9 million or 2.9 percent above FY 2016 enacted levels.[19]

- **Nuclear Physics (NP)** supports research to discover, explore, and understand nuclear matter in a variety of different forms. Funding for this program includes continued construction of the Facility for Rare Isotope Beams (FRIB) at Michigan State University, increased operations of the Relativistic Heavy Ion Collider (RHIC) for explorations of spin physics and intriguing new phenomena observed in quark gluon plasma formation, and operations of the Argonne Tandem Linac Accelerator System (ATLAS) utilizing newly completed instrumentation. NP is funded at $635.7 million, an increase of $18.6 million or 3.0 percent relative to FY 2016 enacted levels.[20]

Energy Efficiency and Renewable Energy (EERE)

The Office of Energy Efficiency and Renewable Energy (EERE) is "the U.S. Government's primary clean energy technology organization" and supports applied research, development, demonstration, and deployment (RDD&D) activities in transportation, renewable power, and energy efficiency.[21] EERE's primary goals include "reducing U.S. reliance on oil, increasing energy affordability, ensuring environmental responsibility, enhancing energy security, offering Americans a broader range of energy choices, and creating job."[22] The FY 2017 budget request for EERE is $2.9 billion, an increase of $829 million or 40 percent over FY 2016 enacted levels.[23]

The FY 2017 request also includes a proposal for an additional $1.34 billion in mandatory funding for the administration's "21st Century Clean Transportation Plan."[24] This proposed mandatory funding would provide for expanded investment in advanced transportation technologies, establish regional fueling infrastructure for "low-carbon fuels," and encourage state and local governments to transition to alternative fuel or electric vehicle fleets.[25] Mandatory funding for EERE would require additional Congressional authorization. Including proposed mandatory spending, the FY 2017 budget request includes $4.23 billion, an increase of 2.16 billion or 104.6 percent.

EERE RDD&D is organized into three primary program areas: sustainable transportation ($853 million, an increase of 34 percent), renewable power ($620 million, an increase of 30 percent), and energy efficiency in buildings and manufacturing ($919 million, an increase of 27

[19] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 4," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume%204.pdf
[20] Ibid.
[21] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf
[22] Ibid.
[23] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[24] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf
[25] Ibid.

percent).[26] EERE programs are also major contributors for five out of seven cross-cutting initiatives in the budget proposal, including Energy-Water Nexus, Grid Modernization, Subsurface Technology and Engineering, Supercritical CO_2, Advanced Materials, and Cybersecurity.[27]

Fossil Energy R&D (FER&D)

The DOE Office of Fossil Energy (FE) supports research, development, and demonstration focused on coal, oil, and gas, as well as the Federal Government's Strategic Petroleum Reserve. Within the Office of Fossil Energy, Fossil Energy Research and Development (FER&D) "advances technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels that are important to our Nation's security and economic prosperity."[28] The FY 2017 budget request for Fossil Energy R&D (FER&D) activities is $600 million, a decrease of $32 million or 5.1 percent from FY 2016 enacted levels.[29] The Department requested $360 million in the FY 2017 request, funding the rest of their budget proposal by deobligating $240 million from CCPI projects that have not reached financial close.[30]

In the FY 2017 budget request, DOE outlines a significant restructuring in FER&D programs, proposing to restructure the FER&D budget to eliminate the categorization of research and development by fuel type.[31] This reorganization would be unique to FER&D programs, as research programs in EERE remain divided by fuel type.

According to the budget request, the CCS and Advanced Power Systems program, formerly the Coal/CCS and Power Systems program, ($368 million, a decrease of 2.5 percent) would conduct research and development to advance carbon capture and storage technology for coal and natural gas power generation and power systems.[32] The Fuel Supply Impact Mitigation program, formerly the Natural Gas Technologies program, ($27 million, a decrease of 38.4 percent) would focus on research and development to reduce emissions and on water use in unconventional oil and gas development.[33]

FER&D programs are also major contributors to five cross-cutting initiatives in the budget proposal: Energy-Water Nexus, Subsurface Technology and Engineering, Supercritical CO_2, Cybersecurity, and Advanced Materials.[34]

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[26] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf
[27] Ibid.
[28] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf
[29] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[30] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf
[31] Ibid.
[32] Ibid.
[33] Ibid.
[34] Ibid.

Nuclear Energy (NE)

The Office of Nuclear Energy (NE) supports the diverse civilian nuclear energy programs of the U.S. Government, including federal research, development, and demonstration efforts "to advance nuclear power as a resource capable of contributing toward the Nation's energy supply, environmental, and national security needs."[35] The FY 2017 request for Nuclear Energy RD&D is $542.31 million, an increase of $9.69 million or approximately 1.82 percent above FY 2016 enacted levels.[36]

Nuclear energy R&D is primarily divided into four subprograms: Small Modular Reactor Licensing Technical Support ($89.60 million, an increase of 43.36 percent), Reactor Concepts Research, Development and Demonstration ($108.76 million, a decrease of 23.26 percent), Fuel Cycle Research and Development ($249.94 million, an increase of 22.64 percent), and Nuclear Energy Enabling Technologies ($89.51 million, a decrease of 19.79 percent).[37] The Reactor Concepts RD&D program will support implementation of the Civil Nuclear Cooperation aspects of the Iran Joint Comprehensive Plan of Action (JCPOA) to ensure that Iran's nuclear program will be exclusively peaceful.

NE R&D programs are also major contributors to four cross-cutting initiatives in the budget proposal, including Advanced Materials, Subsurface Technology and Engineering RD&D, Supercritical CO2, and Cybersecurity.[38]

Electricity Delivery and Energy Reliability (OE)

The mission of the Office of Electricity Delivery and Energy Reliability (OE) is driving "electric grid modernization and resiliency in the energy infrastructure" and leading efforts to "ensure a resilient, reliable, and flexible electricity system."[39] OE is also the federal government's energy sector-specific lead in responding to both physical and cyber emergencies to energy infrastructure. The FY 2017 budget request for OE is $262.3 million, an increase of $56.3 million or 27 percent from FY 2016 enacted levels.[40]

OE research and development is primarily divided between four program areas: Clean Energy Transmission and Reliability ($30.3 million, a decrease of 22 percent), Smart Grid Research and Development ($30 million, a decrease of 14 percent), Cybersecurity and Energy Delivery Systems ($45.5 million, a decrease of 27 percent), and Energy Storage ($44.5 million, an increase of 117 percent).[41] The FY 2017 budget request also proposes $15 million under a

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[35] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf
[36] Ibid.
[37] Ibid.
[38] Ibid.
[39] U.S. Department of Energy, "Office of Electricity Delivery and Energy Reliability Mission Statement." Available at http://energy.gov/oe/mission
[40] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[41] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf

new program for Transformer Resilience and Advanced Components, which received an appropriation of $5 million in FY 2016.[42]

OE R&D programs are also major contributors to two cross-cutting initiatives in the budget proposal, including Grid Modernization, and Cybersecurity.[43]

The Advanced Research Projects Agency –Energy (ARPA-E)

The Advanced Research Projects Agency – Energy (ARPA-E) was established in 2007 by the America COMPETES Act (P.L.110-69), and was designed to develop energy technologies that result in "(i) reductions of imports of energy from foreign sources; (ii) reductions of energy-related emissions, including greenhouse gases; and (iii) improvement in the energy efficiency of all economic sectors."[44] ARPA-E funds potentially high-risk, high-impact projects that explore the development of transformational technologies that enhance economic and energy security, reduce energy imports, improve energy efficiency, and reduce emissions.[45] The FY 2017 budget request for ARPA-E is $350 million in discretionary funds, an increase of $59 million or 20.2 percent above FY 2016 enacted levels.[46]

The FY 2017 budget also includes an additional $150 million in mandatory funding for a proposed ARPA-E Trust, which would be focused on "larger scale, more complex energy challenges" than projects supported by the core ARPA-E program, including scale-up of technology and integration of multiple technical advances for energy system functionality.[47] Mandatory funding for ARPA-E would require additional authorization by Congress.

DOE Loan Program Office (Title XVII and ATVM)

The Department of Energy (DOE) Loan Program Office (LPO) manages the Title XVII (Section 1703) innovative clean energy projects loan guarantee program and the Advanced Technology Vehicles Manufacturing (ATVM) direct loan program.[48] The LPO also monitors loan guarantees authorized under the Section 1705 loan guarantee program, a temporary loan guarantee program created by the American Recovery and Reinvestment Act of 2009.[49] The DOE LPO maintains a portfolio of loans for clean energy projects and advanced technology

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[42] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf
[43] Ibid.
[44] America COMPETES Act, Title V, Section 5102. August 9, 2007. Available at http://arpa-e.energy.gov/arpa-e-site-page/authorization
[45] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 4," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume%204.pdf
[46] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016, Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[47] Ibid.
[48] Loan Program Office. "LPO Portfolio Overview." U.S. Department of Energy. Available at http://energy.gov/lpo/portfolio
[49] Loan Program Office. "Section 1705 Loan Program." U.S. Department of Energy. Available at http://energy.gov/lpo/services/section-1705-loan-program

vehicle manufacturing facilities through these programs, as well as issuing solicitations for future loans and loan guarantees under existing authority in the Section 1703 and ATVM program.[50]

In the FY 2017 budget request, DOE proposes $37 million for continued operation of the Title XVII program, offset by an expected $27 million in projected off-setting fees collected by recipients or applications for loan guarantees.[51] Including off-setting fees, the request outlines a decrease of $7 million or 41 percent from FY 2016 enacted levels.[52] In the ATVM program, DOE requests $5 million in FY 2017 for administrative expenses and to continue monitoring the existing portfolio of ATVM loans.[53] This is a decrease of $1 million or 16.7 percent from FY 2016 enacted levels.[54]

[50] Loan Program Office. "LPO Portfolio Overview." U.S. Department of Energy. Available at http://energy.gov/lpo/portfolio
[51] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016, Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf
[52] Ibid.
[53] Ibid.
[54] Ibid.