



Department of Energy RD&D Appropriations, Fiscal Year 2019

BY COLIN CUNLIFF | JUNE 2018

With its FY 2019 appropriations bills, Congress is poised to sustain this year's positive trends in federal investment in energy research, development, and demonstration.

In its fiscal year (FY) 2018 budget agreement, Congress wisely rejected the extreme cuts to the U.S. Department of Energy's (DOE) research, development, and demonstration (RD&D) budget proposed by the Trump administration.¹ Congress is now poised to sustain these positive trends in federal support of energy innovation in FY 2019.

The House and Senate energy and water appropriations bills are now complete, with the House passing its version of the FY 2019 spending bill on June 8 and the Senate following suit on June 25.² The bills now head to a conference committee, where differences between the House and Senate versions will be worked out before a final version is sent to the White House for the president's signature.³ This briefing provides an update on the FY 2019 appropriations process and highlights key commonalities and differences between the Senate and House proposals.

FY 2019 APPROPRIATIONS OVERVIEW

The House and Senate appropriations bills largely sustain the federal commitment to energy RD&D embodied in the FY 2018 budget agreement, while rejecting the administration's proposed cuts. Both proposals would provide relatively flat funding of around \$7.5 billion for the energy RD&D program offices, out of a total DOE budget of about \$35 billion.⁴ Table 1 displays the DOE FY 2018 budget and the various FY 2019 proposals broken down by major function.

Beyond the top-line number, the two chambers differ in how they allocate funding across the energy RD&D programs. In a positive development, the House—which had previously sought to eliminate the highly effective Advanced Research Projects Agency-Energy (ARPA-E)—proposed funding ARPA-E, though with an 8 percent cut below FY 2018 levels. The Senate proposal would boost funding for ARPA-E by 6 percent.⁵

Both chambers also propose funding increases to energy research within the Office of Science. The House proposal provides a 5 percent increase to Basic Energy Sciences (BES),

while the Senate proposal would boost BES by 2 percent. The chambers diverge on funding for fusion research. The House would provide \$590 million for fusion, an increase of 10 percent over FY 2018 levels, compared with the Senate’s proposed 20 percent cut to \$425 million.

The largest spending difference is in the applied energy programs: the Office of Electricity (OE) and cybersecurity offices (CESER), Energy Efficiency and Renewable Energy (EERE), Fossil Energy (FE), and Nuclear Energy (NE). The House proposal would boost funding for grid modernization in OE and CESER by 29 percent, compared with the Senate’s more modest 5 percent boost. In the other applied energy offices—EERE, FE, and NE—the Senate would keep spending fixed at FY 2018 levels. In contrast, the House proposal cuts energy efficiency and renewable energy RD&D by \$243 million, or more than 10 percent, while boosting funding for fossil-fuel and nuclear programs by 8 percent and 12 percent, respectively.

Both the House and Senate have firmly rejected the administration’s focus on early-stage research, and direct DOE to support all stages of innovation, including mid- and late-stage RD&D.

In another encouraging sign, both chambers provide funding for the Title 17 and Advanced Technology Vehicle Manufacturing (ATVM) loan programs. Title 17 provides loan guarantees that help reduce financing costs for innovative clean energy technologies, while ATVM provides direct loans to automotive manufacturers for advanced fuel-efficient technologies. This is a reversal from last year, when the House supported the administration’s proposal to eliminate the two loan programs.

Rejection of Focus on Early-Stage Research

Both the House and Senate have firmly rejected the administration’s focus on early-stage research. Both chambers acknowledged that federally-supported mid- and late-stage RD&D is necessary to integrate early-stage R&D into the nation’s energy system. Variations of “research, development, demonstration, and deployment” (RDD&D) appear throughout their guidance to DOE, affirming DOE should continue to support all stages of innovation. For example, the House Appropriations Committee states:⁶

The President’s budget request proposes to refocus the Department on an early-stage research and development mission.... However, the Committee believes that a focus on only early-stage activities will forego the nation’s scientific capabilities in medium- and later-stage research and development and may not fully realize the technological advancements possible under the Department’s applied energy activities. The Committee provides funding to support a more comprehensive approach that includes medium and later-stage research, development, deployment, and demonstration activities.

This direction marks a reversal for the House, which had previously adopted the administration’s proposed direction.

Table 1: DOE FY 2019 Spending Proposals by Function, in Millions⁷

	FY 2018 Enacted	WH Request	FY 2019 House	Senate
DOE Total Budget	\$34,520	\$30,146	\$35,494	\$34,990
Defense	15,509	15,944	16,183	15,620
Environmental Management	7,126	6,601	6,869	7,182
Basic Science Research	3,638	3,201	3,881	4,032
Other	769	561	986	648
DOE Energy RD&D Programs	7,477	4,302	7,575	7,508
ARPA-E	353	-	325	375
Electricity Delivery/CESER	248	157	321	260
Cybersecurity for Energy Systems	76	70	117	81
Transmission & Distribution R&D	125	36	151	126
Energy Efficiency & Renewable Energy	2,322	696	2,079	2,322
<i>Sustainable Transportation</i>				
Vehicle Technologies	338	69	303	338
Bioenergy Technologies	222	37	205	215
Hydrogen & Fuel Cell Tech	115	58	102	115
<i>Renewable Energy</i>				
Solar Energy	242	67	189	240
Wind Energy	92	33	84	80
Water Power	105	45	95	105
Geothermal Technology	81	30	70	85
<i>Energy Efficiency</i>				
Advanced Manufacturing	305	75	260	311
Building Technologies	221	57	180	225
Fossil Energy R&D	727	205	785	727
CCUS and Advanced Power Systems	481	343	533	463
Natural Gas Technologies	50	6	50	53
Unconventional Oil Technologies	40	14	40	54
Other R&D	51	40	53	51
Nuclear Energy	1,205	757	1,346	1,206
Reactor Concepts RD&D	237	163	370	302
Nuclear Energy Enabling Tech	159	116	164	149
Fuel Cycle R&D	260	60	255	267
Other R&D	13	3	13	8
Science	6,260	5,391	6,600	6,650
Basic Energy Sciences	2,090	1,850	2,129	2,193
Fusion Energy Sciences	532	340	590	425

FY 2019 Appropriations: RD&D Highlights

Office of Energy Efficiency and Renewable Energy (EERE):⁸

- **Natural gas vehicles.** The Senate committee recommends \$15 million “to address technical barriers to the increased use of natural gas vehicles” and directs DOE to conduct a study on natural gas vehicle deployment.
- **Solar manufacturing consortium.** The Senate committee directs DOE to create a new five-year solar manufacturing consortium to “develop a new photovoltaic U.S. manufacturing base,” and recommends \$10 million for the first year of funding.
- **Clean Energy Manufacturing Innovation (CEMI) Institutes.** Both the House and Senate bills provide funding for four CEMIs, including three existing CEMIs and a new CEMI. Neither bill provides funding for PowerAmerica or the Advanced Composites institute, which have already received five years-worth of funding in prior appropriations.⁹
- **Energy-Water Desalination Hub.** The House proposes eliminating funding for the hub, while the Senate proposes \$25 million for the hub but expresses concern over DOE’s failure to complete the award process during the previous two years.
- **Battery manufacturing demonstration facility.** The Senate proposal includes \$20 million for a new manufacturing demonstration facility to validate materials for production of energy storage and accelerate the processes needed for clean energy materials to go from discovery to scale-up.
- **Energy conservation standards.** The Senate notes that DOE has missed two deadlines for reporting on the status of energy conservation standards and directs DOE to submit a status report on how it plans to meet its statutory obligations.

Office of Fossil Energy (FE) R&D:

- **Natural gas and industrial sector carbon capture.** Both the House and Senate bills direct DOE to conduct RD&D in carbon capture, utilization, and storage (CCUS) from coal, natural gas, and industrial sources. Additionally, the Senate bill urges FE to prioritize research in carbon utilization technologies, direct air capture, and industrial source capture.
- **New coal pilots.** The House recommends \$25 million for two large-scale pilots that focus on “transformational coal technologies.”

Office of Electricity and Energy Reliability (OE):

- **Grid-scale storage.** The House bill directs the OE to launch a new initiative within the Energy Storage program office “aimed at aggressively driving down costs and improving the performance of a diverse set of grid-scale storage technologies.”

Office of Nuclear Energy (NE):

- **Non-light water nuclear reactor demonstration.** Both the House and Senate bills encourage DOE to support non-light water reactor demonstrations by the mid to late 2020s. The Senate also directs DOE to provide a report that develops “aggressive, but achievable goals” in support of such a demonstration.
- **Advanced nuclear fuel.** The Senate bill notes the lack of domestic process to make high-assay low-enriched uranium (HALEU) for use in advanced reactor designs and recommends \$10 million for DOE to design and build a demonstration facility to produce HALEU from naval spent nuclear fuel or other available uranium from DOE’s inventory.

Office of Science (SC):

- **Energy Frontier Research Centers (EFRCs) and Energy Innovation Hubs.** Both the House and Senate bills provide \$110 million for the EFRCs, \$24 million for the Batteries and Energy Storage Innovation Hub, and \$15 million for the Fuels from Sunlight Innovation Hub.
- **Bioenergy Research Centers.** Both the House and Senate bills provide \$100 million for four Bioenergy Research Centers.

Crosscutting initiatives are important tools for breaking out of the technology silos of the applied energy program offices. Congress has included express directions for several crosscutting initiatives.

Division of the Office of Electricity Delivery and Energy Reliability

The administration has taken administrative action to split the Office of Electricity Delivery and Energy Reliability (OE) into two offices. The Office of Electricity Delivery (OE) retains RD&D programs in transmission, distribution, energy storage, and transformers, along with the transmission permitting and technical assistance program. The new Cybersecurity, Energy Security, and Emergency Response (CESER) office houses the Cybersecurity for Energy Delivery Systems (CEDs) R&D program, as well as the Infrastructure Security and Energy Restoration (ISER) program.

The House supports the administration’s approach. The Senate accepts the administration’s preferred name CESER but retains the existing structure in which all grid-related programs are aggregated in a single program office. In other words, the Senate would simply rename OE as CESER.

Crosscutting Initiatives

Crosscutting initiatives are important mechanisms for breaking out of the technology silos of the applied energy program offices and drawing on expertise and perspectives from across the Department. Crosscutting initiatives do not have a separate control point in appropriations bills, and in the past have been largely driven by the Executive branch with limited Congressional input. But many crosscutting initiatives that are popular with Congress were not included in the administration’s FY 2019 budget request. The Senate

and House appropriations reports therefore include express directions regarding several crosscutting initiatives:

- **Energy-Water Nexus.** Both the House and Senate recognize the linkages between energy and water systems and support continued efforts to address energy and water resource challenges. In addition, the House encourages DOE to collaborate with USDA's Agricultural Research Service "to develop effective, deployable, energy- and water-efficient food production platforms." The agreement would expand DOE's Energy-Water Nexus activities to include food production.
- **Grid Modernization Initiative.** Both House and Senate appropriators support the strategic goals of the Grid Modernization Initiative (GMI). The Senate recognizes that the GMI initially funded three-year projects to be concluded in 2019, and directs DOE to provide a plan to Congress to extend GMI "to include priorities for field validation of the most successful research outcomes... to accelerate adoption of the key Department results."
- **Beyond Batteries.** The Senate supports the administration's Beyond Batteries initiative and includes specific technology and cost targets: "The Department is encouraged to prioritize achieving a long-term goal of deploying technologies at \$100/kWh or less cost installed while being able to cycle twice per day, discharging for at least 4 hours, with a lifetime of roughly 20 years or at least 8,000 cycles."
- **Materials Working Group.** The Senate recognizes that many technology program offices have standalone materials programs, and directs DOE to support formal coordination across offices through an intra-agency Materials Working Group. Materials discovery is a key element in energy innovation and has applications in a wide range of clean energy technologies, including advanced batteries and solar cells, low-energy semiconductors, thermal storage, catalysts, and materials in extreme environments.

Reports, Studies, and Strategic Plans

The House and Senate bills also direct DOE to produce a number of reports, studies, and strategic plans on topics including:

- **Zero Emissions Energy Credit.** The House report includes a reminder that it directed DOE to evaluate the effects of a Zero Emissions Energy Credit in the FY 2018 bill, and it expects timely delivery of the report.
- **Batteries' contribution to grid resilience.** The House directs OE to provide a report on the use of batteries "for increased energy resilience in the face of adverse events and increasing deployments of intermittent technologies."
- **Electrification Futures Study.** The Senate directs EERE and OE to evaluate the impacts of mass electrification on the utility business model and the electricity distribution system.

- **Cybersecurity for distributed energy resources.** The Senate directs EERE to develop a multi-year program plan for addressing cybersecurity vulnerabilities in distributed generators and behind-the-substation generators, storage, smart buildings technologies, and electric vehicles.
- **National Smart Manufacturing Plan.** The Senate directs DOE to develop a national smart manufacturing plan that will identify areas where DOE can facilitate more rapid development, deployment, and adoption of smart manufacturing technologies.¹⁰

Current Status and Next Steps

On June 8, 2018, the House passed its DOE appropriations as part of a package of three spending bills on a largely partisan vote of 235–179. The Democrat’s main opposition was over the bill’s inclusion of policy riders—unrelated to energy innovation—as well as their perception that funding for applied energy programs is “skewed too heavily toward nuclear and fossil fuels” at the expense of renewable energy and energy efficiency. However, they acknowledge that “much of the funding reflects some priorities from both sides of the aisle” and specifically commend the bill’s 5 percent increase for the Office of Science as being essential to support U.S. innovation.

The Senate Committee on Appropriations passed its version of the DOE spending bill by a margin of 30–1, and the full chamber is expected to pass the bill on a similar bipartisan basis at the time of writing. The bills now head to a conference committee, where differences between the House and Senate versions will be worked out before a final version is reported back to both chambers for final passage. If a final spending bill is not passed before the end of the fiscal year on September 30, Congress is likely to pass a short-term continuing resolution.

RESCISSION

On May 9, 2018, the White House proposed a rescission package that would revoke lending authority under two of DOE’s energy technology loan programs, including \$4.3 billion from the Advanced Technology Vehicles Manufacturing Loan Program and \$684 million from the Title 17 Innovative Technology Loan Guarantee Program.¹¹ Because any loans entered into under these programs must be paid back, a rescission of these programs would not actually reduce federal spending. The House passed the rescission package on June 11, 2018, while the Senate has until June 22 to pass the rescission package with a simple majority, after which a 60-vote threshold will be required.¹² The rescission package expires if not approved by both chambers within 45 days of “continuous session.”¹³

APPROPRIATIONS OUTLOOK: FY 2020 AND BEYOND

The budget agreement in February 2018 resulted in a two-year abeyance of the budget caps imposed under sequestration, allowing lawmakers to give DOE’s energy RD&D programs double-digit increases in FY 2018. Both the House and Senate FY 2019 spending proposals would largely lock in the FY 2018 funding gains, albeit with some of the differences highlighted above. However, funding for energy RD&D is still below the level envisioned

under Mission Innovation, which proposed a five-year doubling trajectory from an FY 2016 baseline level.¹⁴

In addition, the budget caps come back into effect for FY 2020 and FY 2021, which could set up DOE's programs for a sharp funding drop in FY 2020. The American Association for the Advancement of Science (AAAS) believes a more likely scenario is Congress will reach an agreement that avoids deep cuts to energy RD&D—though the prospect for future increases in energy RD&D funding is uncertain.¹⁵ Despite these challenges, federal investment in clean energy RD&D will continue to be an important tool for lowering energy costs, addressing climate change, and supporting U.S. competitiveness in energy technologies.¹⁶

ENDNOTES

1. David M. Hart and Colin Cunliff, “Federal Energy RD&D: Building on Momentum in Fiscal Year 2019” (Washington, D.C.: Information Technology and Innovation Foundation, 2018), <http://itif.org/energy-budget>.
2. H.R. 5895 – Energy and Water, Legislative Branch, and Military Construction and Veterans Affairs Appropriations Act, 2019, retrieved from <https://www.congress.gov/bill/115th-congress/house-bill/5895/>. Additional information, including committee reports, can be found at <https://www.congress.gov/resources/display/content/Appropriations+for+Fiscal+Year+2019>.
3. For more information on the budget process, see Matt Hourihan, “The Federal Budget Process 101” (Washington, D.C.: American Association for the Advancement of Science, 2014).
4. The energy RD&D program offices include the applied energy technology offices—EERE, FE, NE, OE, and ARPA-E—as well as the Basic Energy Sciences (BES) and Fusion Energy Sciences (FES) offices within the DOE Office of Science (SC). Note that program office funding levels include some non-RD&D functions (e.g., the weatherization programs in EERE), which tends to overstate total spending on energy RD&D. However, some energy RD&D is conducted in other offices in SC. Notably, the Bioenergy Research Centers are housed in the SC office of Biological and Environment Research (BER).
5. For more information about ARPA-E and its role in the energy innovation ecosystem, see David M. Hart and Michael Kearney, “ARPA-E: Versatile Catalyst for U.S. Energy Innovation,” (Washington, D.C.: Information Technology and Innovation Foundation, November 2017).
6. House Report 115-697 at 77.
7. Defense includes the National Nuclear Security Administration and Other Defense Activities. Energy RD&D Programs includes ARPA-E, EERE, OE, CESER, FE, NE, SC-BES, and SC-FES. Environmental Management includes Defense Environmental Cleanup, Non-Defense Environmental Cleanup, and Uranium Enrichment Decontamination and Decommissioning Fund. Basic Science Research includes the Office of Science (SC) minus BES and FES. All other appropriations line items (EIA, DA, IG, PMAs, etc.) are included in Other.
8. The appropriations bills provide top-line funding numbers only (e.g., for the DOE Office of Energy Efficiency and Renewable Energy, EERE). Both House and Senate Appropriations committees also produce committee reports that provide recommended funding levels with greater granularity (e.g., the Solar Energy office within EERE), as well as additional guidance directing DOE spending.
9. For recent analysis on the impacts of DOE’s manufacturing institutes, see David M. Hart and Peter L. Singer, “Manufacturing USA at DOE: Supporting Energy Innovation,” (Washington, D.C.: Information Technology and Innovation Foundation, 2018), <http://www2.itif.org/2018-doe-musa-institutes.pdf>.
10. For information on smart manufacturing, see Stephen Ezell, “Why ‘Smart’ Manufacturing Matters and How Countries Are Supporting It,” (Washington, D.C.: Information Technology and Innovation Foundation, April 2018), <https://itif.org/publications/2018/04/12/why-smart-manufacturing-matters-and-how-countries-are-supporting-it>.
11. Congressional Budget Office, “H.R. 3, Spending Cuts to Expired and Unnecessary Programs Act,” (Washington, D.C.: CBO, May 11, 2018), <https://www.cbo.gov/publication/53865>.
12. Geof Koss and George Cahlink, “Senate Faces Test as Energy-Water, Rescission Bills Hit Floor,” *E&E Daily*, (June 18, 2018), <https://www.eenews.net/stories/1060084745>.
13. Congressional Research Service, “Rescission Actions Since 1974: Review and Assessment of the Record,” (Washington, D.C.: Congressional Research Service, 2010) RL33869.
14. In conjunction with the Paris climate agreement, the United States and 24 other nations joined the Mission Innovation initiative, promising to double their clean energy research, development, and

demonstration investments by 2021. For more information, see Colin Cunliff, “Mission Innovation: Despite Trump, America Is Still In,” (Washington, D.C.: Information Technology and Innovation Foundation, May 2018), <https://itif.org/publications/2018/05/22/mission-innovation-despite-trump-america-still>.

15. Matt Hourihan and David Parkes, “Congress Budget Deal Would Raise Spending Caps,” (Washington, D.C.: American Association for the Advancement of Science, February 8, 2018), <https://www.aaas.org/news/congress-budget-deal-would-raise-spending-caps>.
16. Department of Energy, “Energy CO2 Emissions Impacts of Clean Energy Technology Innovation and Policy,” (Washington, D.C.: DOE Office of Energy Policy and Systems Analysis, January 2017).

ACKNOWLEDGMENTS

The author wishes to thank Spencer Nelson for providing helpful comments, as well as David Hart and ITIF President Rob Atkinson for providing input and support for this report. Any errors or omissions are the author’s alone.

ABOUT THE AUTHOR

Colin Cunliff is a clean energy policy analyst with the Information Technology and Innovation Foundation. He previously worked at the U.S. Department of Energy (DOE) Office of Energy Policy and Systems Analysis as a AAAS Science & Technology Policy Fellow, and as an AIP/AAAS Fellow in the Office of Senator Dianne Feinstein. He holds a Ph.D. in physics from the University of California, Davis.

ABOUT ITIF

The Information Technology and Innovation Foundation (ITIF) is a nonprofit, nonpartisan research and educational institute focusing on the intersection of technological innovation and public policy. Recognized as the world’s leading science and technology think tank, ITIF’s mission is to formulate and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress.

FOR MORE INFORMATION, VISIT US AT WWW.ITIF.ORG.