

Trump Budget Would Slam the Brakes on Energy Innovation

COLIN CUNLIFF | FEBRUARY 2020

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KEY TAKEAWAYS

- The Trump administration's budget request for FY 2021 would slash federal investments in the Energy Department's applied energy programs by more than 44 percent—the largest single-year cut ever—from \$5.4 billion to \$3.0 billion.
- Even more troubling, the proposed cuts come as America's international competitors are ramping up their investments in key clean energy technologies.
- The administration's budget is in tension not just with the priorities of climate-concerned Democrats but also congressional Republicans who have seized on innovation as the practical answer to climate change.
- Congress should seize the opportunity to translate bipartisan support for clean energy innovation into greater investment in strategically targeted RD&D.
- Concurrent with the appropriations process, Congress should act on a strong slate of bipartisan, bicameral authorizing bills that have passed key committees and would accelerate innovation if backed by new funding commensurate with the challenge.

OVERVIEW

As it has in the past three federal budgeting cycles, the Trump administration has once again proposed massive cuts to energy research, development, and demonstration (RD&D), placing the administration's budget request in tension with congressional Republicans' efforts to address climate change through innovation.¹ Fortunately, Congress has soundly rejected the administration's previous budget proposals in this area, instead putting forward a positive vision for American innovation that invests in a future of clean, reliable, low-cost energy. Lawmakers should do so again in fiscal year (FY) 2021.

The president's latest budget request would slash federal investments in the Department of Energy's applied energy programs—including energy efficiency, renewable energy, sustainable transportation, fossil energy, nuclear energy, and grid modernization—by more than 44 percent, from \$5.4 billion in FY 2020 to \$3.0 billion in FY 2021. Popular programs including the Advanced Research Projects Agency-Energy (ARPA-E), Title XVII loan guarantee program, and advanced vehicles manufacturing loan program would be eliminated.² Even the DOE Office of Science, which includes programs in fusion energy and basic energy sciences and falls squarely within the definition of “early stage research” that the administration claims to support, would receive a 17 percent cut, from \$7 billion in FY 2020 to \$5.8 billion. If enacted, this budget would impose the largest single-year cut to energy RD&D investments in the history of the department, bringing federal energy RD&D down to its lowest level since 2007.

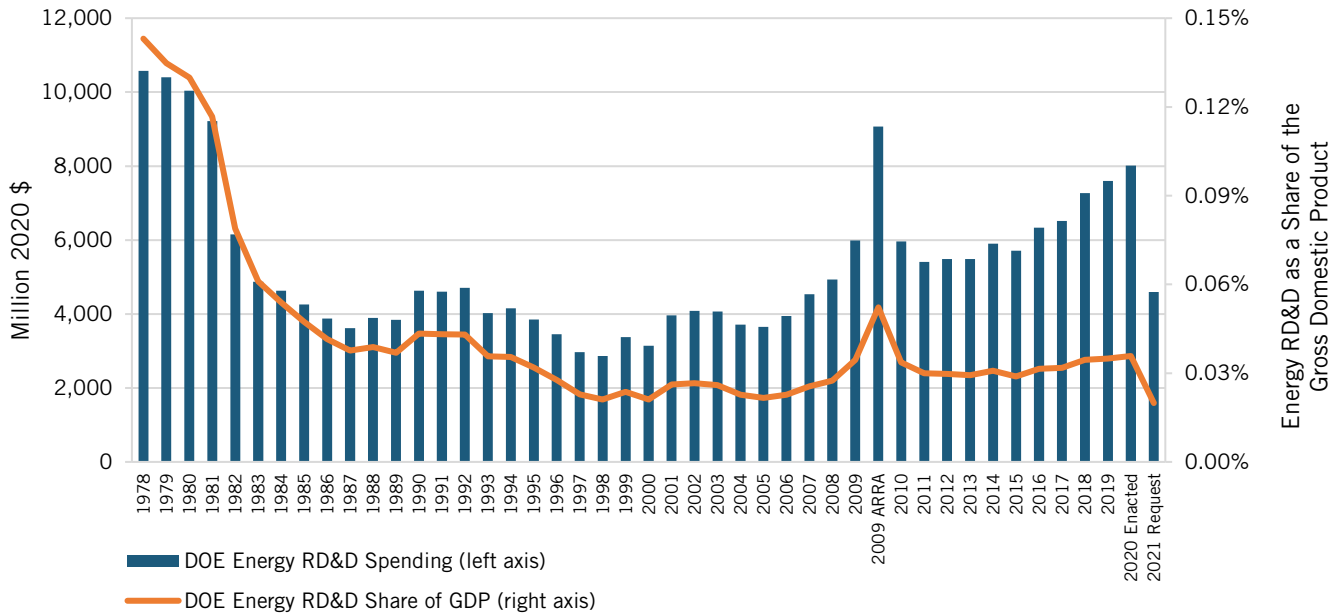
Congress should reject the administration's budget proposal, keep up the momentum of the past three fiscal years, and continue elevating innovation in clean energy as a national priority.

Even more troubling, the proposed cuts come amid signs of a struggling domestic clean energy industry that is at risk of falling behind international competitors. China has ramped up investments in energy RD&D and now invests far more than the United States in key technologies, including solar energy, lithium-ion batteries, advanced nuclear, carbon capture, and electric vehicles. Europe is outstripping the United States in offshore wind. And U.S. companies account for a declining share of new cleantech patents, indicating that the United States is falling behind in innovation.³

Congress has wisely taken note of these developments, providing significant boosts to federal clean energy RD&D investment in each of the last three budget cycles. Congress has also produced a strong slate of bipartisan, bicameral authorizing bills that would accelerate innovation if they are backed by significant new funding commensurate with the challenge.⁴ Support for more aggressive federal investments appears to span the political spectrum from very conservative House Republicans, who have lately touted innovation as the answer to climate change, to Green New Deal Democrats, who acknowledge that innovation will be needed to fully eliminate carbon emissions.⁵

Congress should seize the opportunity this consensus represents by rejecting the Trump administration's budget proposal, keeping up the momentum of the past three fiscal years, and continuing to elevate innovation in clean energy as a national priority.

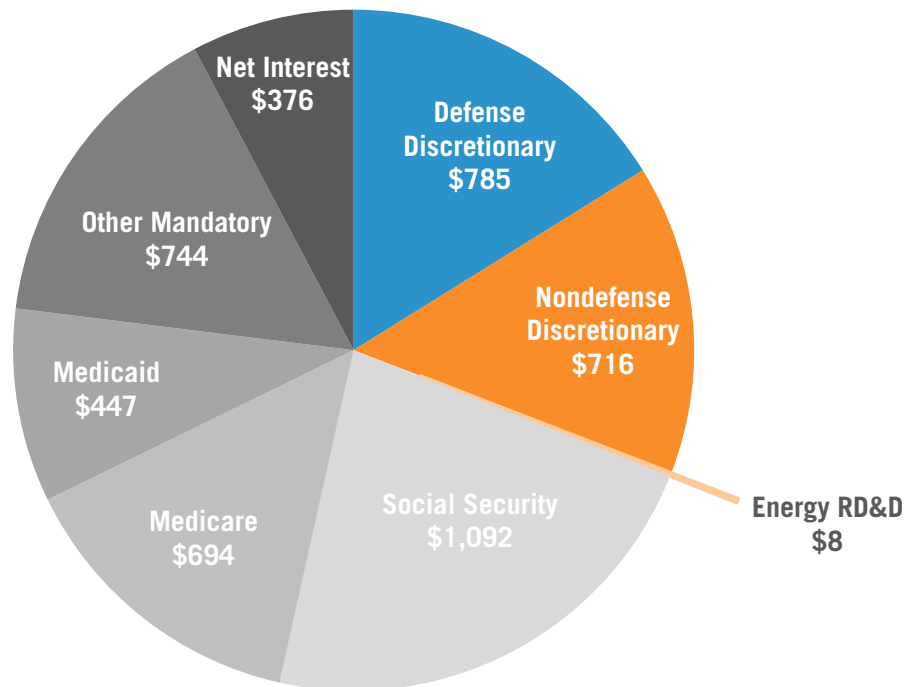
Figure 1: DOE energy RD&D spending, FY 1978 – FY 2021 request (2020 \$)⁶



ENERGY RD&D: GENERATING HUGE RETURNS ON A MODEST BUDGET

Out of a total budget of nearly \$4.8 trillion, the federal government funded the Department of Energy (DOE) at \$38.6 billion in FY 2020. But only \$8 billion—about 21 percent of DOE’s budget—supports energy innovation, with defense, environmental cleanup, and non-energy-related basic science research accounting for the rest. As a share of the economy, federal investment in energy research is about 0.04 percent of U.S. gross domestic product (GDP).

Figure 2: Federal energy research as a share of total outlays in FY 2020 (in billions of dollars)⁷



DOE was created in the late 1970s—a time when energy demand was increasing rapidly, energy prices were high and rising, and OPEC was flexing its muscles in global oil markets. Energy innovation and the development of domestic clean energy resources were viewed as matters of economic and national security. In 1978, Congress invested more than \$10.5 billion (in 2020 dollars) in energy RD&D, or 0.14 percent of GDP. Had federal investment kept pace with growth in the economy, DOE’s RD&D budget today would be \$32 billion, on par with other national priorities such as health research.⁸

Instead, energy innovation receded as a national priority, with funding levels hovering below \$4 billion for most of the mid-1980s through the early 2000s. During the George W. Bush administration, Congress began increasing funding in response to higher energy prices and reports that the United States risked falling behind other nations in clean energy.⁹ Congress has increased budgets for DOE’s energy programs for 11 of the last 15 years, but funding has not yet returned to its initial level.

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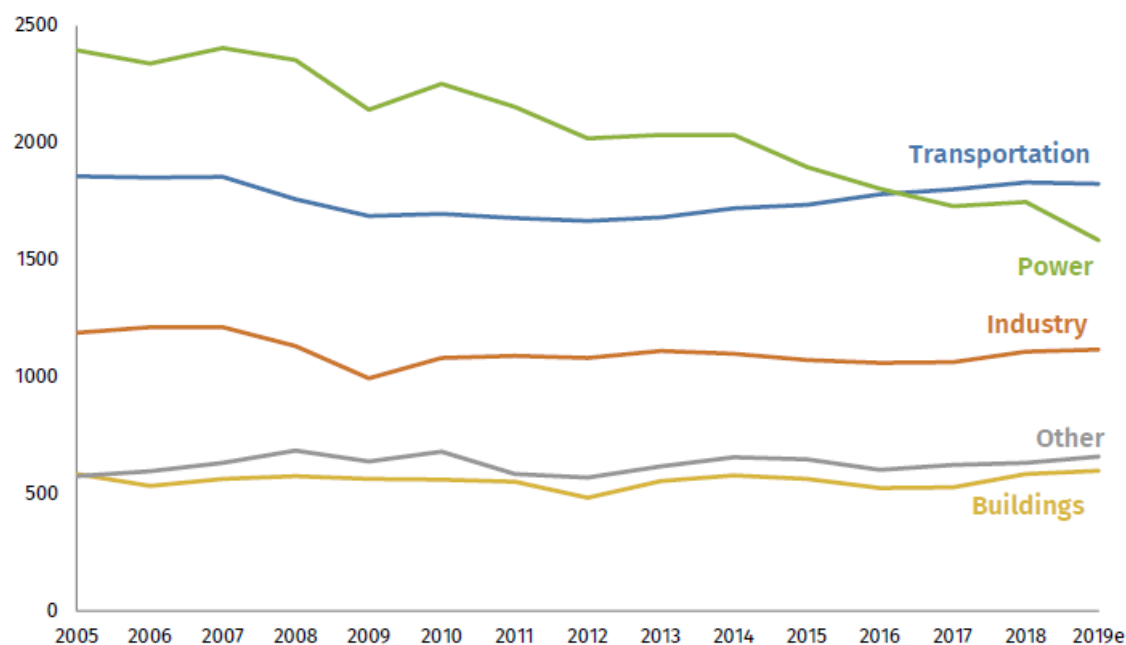
Despite a comparatively small investment, federal energy RD&D has delivered big returns for the American public and the global energy system. Federal investments were responsible for launching the private nuclear industry, which now contributes 20 percent of U.S. electricity. DOE support for shale-gas resource characterization and directional drilling in the 1970s and 80s—in tandem with a federal production tax credit—led to the shale gas revolution that turned the United States into the world’s top gas producer. In 2011, the DOE loan programs office provided loan guarantees to the first five utility-scale solar photovoltaic power plants, sparking its takeoff. In 2017, DOE funds aided the world’s largest post-combustion carbon capture system at the Petra Nova power plant in Texas.¹⁰ In 2019, DOE researchers won 41 of the 100 awards given out by R&D World Magazine.¹¹ An external review of energy efficiency and renewable energy RD&D at DOE found that a total taxpayer investment of \$12 billion between 1975 and 2015 yielded more than \$388 billion in net economic benefits, a remarkable return of over \$32 for every federal dollar invested.¹²

DOE is now preparing to launch new programs to address new challenges. The Office of Fossil Energy (FE) is beginning to research technologies that can remove carbon dioxide directly from the atmosphere. The Geothermal Technologies Office is building a field laboratory in Milford, Utah, to research systems that may ultimately provide clean baseload power.¹³ The Nuclear Energy (NE) office is planning a versatile test reactor user facility in Idaho to jumpstart innovation in advanced non-light-water nuclear reactors.¹⁴ The Solar Energy program just released a new funding opportunity announcement that aims to demonstrate concentrating solar power with a supercritical Brayton cycle, improve efficiencies of solar photovoltaics, and develop innovative solar PV manufacturing technologies and processes.¹⁵

Such initiatives are promising but fall far short of accelerating the pace of innovation sufficiently to meet the climate challenge. While emissions in the electricity sector have declined due to cheap natural gas and subsidized renewables, emissions from the industrial sector have barely budged in recent years, and emissions from transportation are increasing (figure 3). ITIF analysis

has identified significant gaps in the federal energy RD&D portfolio, particularly from harder-to-abate sources of carbon pollution.¹⁶

Figure 3. Net U.S. GHG emissions by sector¹⁷



Source: Rhodium Climate Service

Additionally, there are warning signs that U.S. competitiveness is at risk in the growing global clean energy industry. Nine other countries invest more in energy RD&D as a share of their economies than the United States.¹⁸ China invests 0.1 percent of its GDP in energy RD&D, far outpacing U.S. investment of 0.04 percent.¹⁹ This underinvestment defies the wishes of large majorities of voters across the political spectrum who support increased funding for research into clean energy technologies.

An independent review of DOE's programs found that every \$1 invested in energy efficiency and renewable energy RD&D returned an average \$32 in economic benefits.

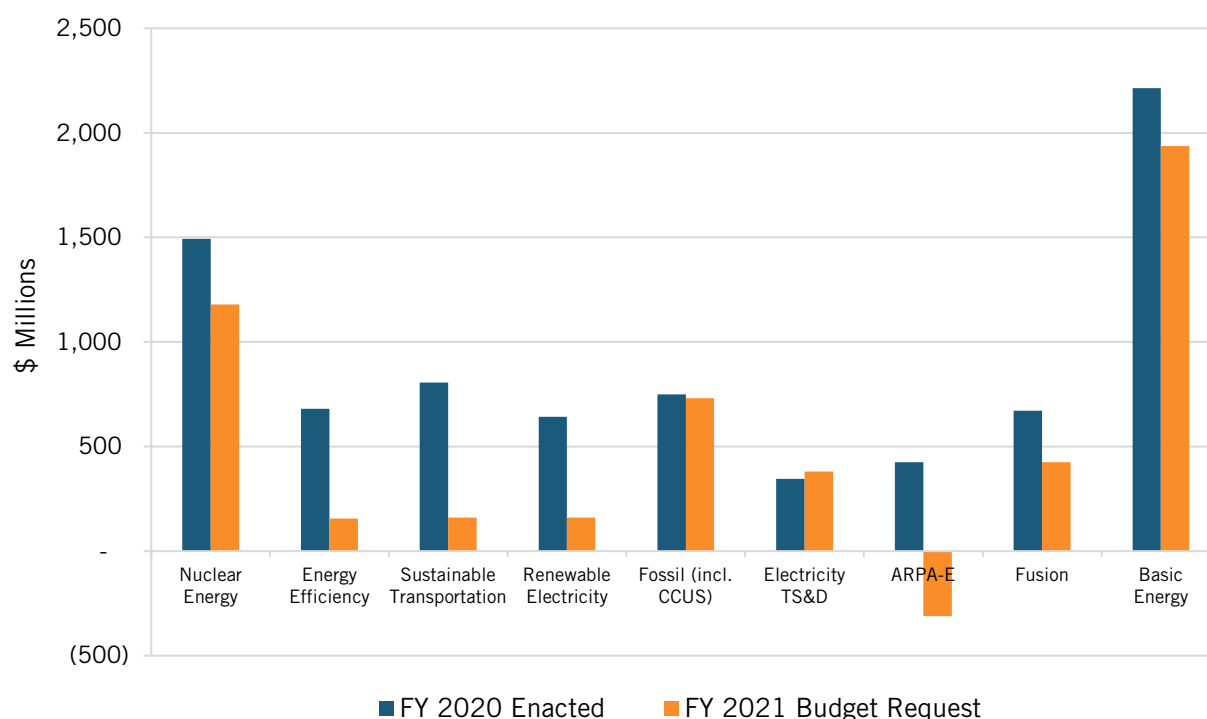
THE TRUMP BUDGET: A DRAG ON INNOVATION

The administration's FY 2021 budget request, if enacted, would result in the largest single-year decrease in energy RD&D in DOE's history. It reflects a fundamental misunderstanding of the importance of energy innovation and the federal role in it.

The proposed cuts would hit the most important energy RD&D programs hardest. ARPA-E would be completely eliminated, and \$311 million in previously appropriated funding would be rescinded. But ARPA-E has proven to be a remarkably versatile catalyst for U.S. energy innovation, funding a wide range of innovative projects outside the technology-specific silos of other program offices. Projects funded by ARPA-E are five times more likely to produce a patent and scientific publication than projects funded by other research programs—one reason why Congress has continued boosting its budget every year since 2013.²⁰ The Senate Energy and

Natural Resources committee and the House Science, Space and Technology committee have both advanced legislation reauthorizing ARPA-E and increasing its budget to \$750 million by 2024, nearing the \$1 billion level that the Information Technology and Innovation Foundation (ITIF) and many others have called for.²¹

Figure 4: Proposed changes in the DOE energy budget by program office



Within the applied energy programs, the largest cuts are reserved for the Energy Efficiency, Renewable Power, and Sustainable Transportation programs within the DOE Office of Energy Efficiency and Renewable Energy (EERE). Proposed cuts to these programs range from 70 percent for water-power technologies to 83 percent for bioenergy technologies. The State Energy Program, which provides funding and technical assistance for state energy offices, would be eliminated. The total budget for EERE would be cut by an astounding 74 percent, from \$2.8 billion to \$720 million.

The Office of Nuclear Energy also fares badly, notwithstanding recent congressional efforts to jumpstart RD&D in advanced nuclear technologies, receiving a 21 percent cut. One bright spot is the inclusion of \$295 million to build a versatile test reactor—a user facility that would enable testing of materials and fuel designs in a fast-neutron environment.²² However, this significant boost comes at the expense of other advanced nuclear innovation priorities. In particular, the Advanced Reactor Demonstrations program, which was just added this year, would be cut from \$230 million to \$20 million.

The Office of Fossil Energy (FE) would receive only a 3 percent cut to \$731 million, but that comparatively generous treatment hides damaging priorities. The administration proposes combining the Carbon Capture and Carbon Storage subprograms into a single Carbon Capture, Utilization, and Storage subprogram, while cutting combined funding by 43 percent from \$218

million in FY 2020 to \$123 million in FY 2021. The Natural Gas Technologies program, which houses the methane emissions quantification and mitigation research activities, would see a 71 percent reduction in funding. Cuts in these emissions-reduction programs offset increased funding for the administration's Coal FIRST (Flexible, Innovative, Resilient, Small, Transformative) initiative, which seek to increase coal exports.

Among the applied energy programs, the Offices of Electricity (OE) and Cybersecurity, Energy Security, and Emergency Response (CESER) are the only winners. OE would get a 3 percent increase, which would cover a 50 percent increase in the Energy Storage subprogram to \$84 million, highlighted by a \$40 million grid-storage launchpad at the Pacific Northwest National Laboratory.²³ However, the boost in energy storage funding comes at the expense of research in resilient electricity distribution systems, which would get a 60 percent cut. CESER, which includes RD&D in cybersecurity for energy delivery systems—essential for enabling grid modernization—would get a 19 percent boost.

Bright spots in the budget include \$40 million for construction for a new Energy Storage Launchpad, and \$295 million to build the Versatile Test Reactor.

Basic science research at DOE faces cuts as well. The Office of Science (SC) would be slashed by 17 percent, from \$7 billion to \$5.8 billion. The energy-related programs in SC, Basic Energy Sciences (BES) and Fusion Energy Sciences (FES), would be cut by 13 percent and 37 percent, respectively.

The administration's budget again proposes eliminating the Title 17 loan guarantee program for innovative clean energy technologies and the Advanced Technology Vehicles Manufacturing loan program. Under Title 17, DOE issued a loan guarantee in 2016 for the Lake Charles Methanol facility in Louisiana, which will be the world's first methanol production facility to use carbon capture technologies.²⁴ And in March 2019—a few weeks after last year's FY 2020 budget also proposed eliminating Title 17—DOE announced a new loan guarantee for the Vogtle advanced nuclear reactor construction project in Georgia.²⁵ Congress' rejection of prior requests for the loan programs' elimination demonstrates its support for favored energy technologies.

NEXT STEP: CONGRESSIONAL APPROPRIATIONS

Congress is unlikely to give this year's budget request any more credence than it did the last three. Similar proposals in the prior three budget cycles were soundly rejected by both parties and both chambers. Rather than adopting the administration's proposals, Congress boosted energy RD&D programs by 14 percent in FY 2018, 5 percent in FY 2019, 11 percent in FY 2020. Senate Budget Committee Chairman Mike Enzi (R-WY) has already said he will not hold a hearing on the president's proposed budget, declaring "Congress doesn't pay attention to the president's budget exercise."²⁶

However, Congress will have to make more difficult choices this year than the past three. Top-line spending is bound under the agreement reached between Congress and the White House last July that caps non-defense discretionary spending to a 1 percent increase, and congressional leaders have said they do not intend to revisit that agreement.²⁷

The next step is for the House and Senate Appropriations Committees to apportion the overall discretionary budget to the subcommittees, setting what are referred to as the 302(b) allocations for each of the 12 bills that fund the government. DOE, along with the Army Corps of Engineers, Department of Interior, and other related agencies, is funded through the Energy and Water Development (E&W) appropriations bill.

Large increases in federal investments in energy innovation could, in principle, be accommodated within the budget agreement. Because federal energy RD&D accounts for such a small share of the budget (see figure 2), double-digit increases could be offset elsewhere without breaching the cap.

In practice, however, appropriators' ability to increase funding will be limited by each chamber's leadership, which will determine how much money will be allocated to the E&W bill and the 11 others that comprise the budget. Funding levels for most of DOE's programs will likely remain flat or receive only modest increases. Expectations set by the E&W subcommittee chair Sen. Lamar Alexander (R-TN), who called for a "New Manhattan Project for Clean Energy" last April, will undoubtedly be disappointed.

The House and Senate Appropriations committees will likely hold hearings on the budget in March and April, with each chamber producing its own Energy & Water bill as early as May. Ultimately, an appropriations bill must pass both chambers of Congress and be signed by the president before the next fiscal year begins on October 1.

Concurrent with the appropriations process, the House and Senate may soon take up bipartisan legislation authorizing a diverse array of new RD&D programs and updating the authorizations for many existing programs. Although these discussions may not impact the current appropriations cycle, future legislatures must scale up federal energy RD&D spending if they are to realize the goals that these prospective new laws will set.

CONCLUSION

Congress has taken the reins of energy innovation policy and has a tremendous opportunity to accelerate clean energy and shape the U.S. response to the climate and competitiveness challenges of the 21st century with the decisions it makes in the coming year. It should reject the administration's budget proposal and continue to elevate energy innovation as a national priority.

APPENDIX: BUDGET TABLE

Table 1: DOE FY 2021 spending proposal by function, in millions (\$)²⁸

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 WH Request	% Change
DOE Total Budget	35,685	38,586	35,362	-8%
Defense	16,089	17,611	20,855	30%
Environmental Management	7,175	7,425	6,066	-15%
Basic Science Research	3,548	4,016	3,377	-10%
DOE Energy RD&D Programs*	7,917	8,788	5,311	-40%
ARPA-E	366	425	-311	-173%
Energy Efficiency & Renewable Energy	2,379	2,790	720	-74%
<i>Sustainable Transportation</i>				
Vehicle Technologies	344	396	74	-81%
Bioenergy Technologies	226	260	45	-83%
Hydrogen & Fuel Cell Tech	120	150	42	-72%
<i>Renewable Energy</i>				
Solar Energy	247	280	67	-76%
Wind Energy	92	104	22	-79%
Water Power	105	148	45	-70%
Geothermal Technology	84	110	26	-76%
<i>Energy Efficiency</i>				
Advanced Manufacturing	320	395	95	-76%
Building Technologies	226	285	61	-79%
Fossil Energy R&D	740	750	731	-3%
CCUS and Advanced Power Systems	486	491	546	11%
Natural Gas Technologies	51	51	15	-71%
Unconventional Oil Technologies	46	46	17	-63%
NETL Research	50	50	46	-8%
Nuclear Energy	1,326	1,493	1,180	-21%
Reactor Concepts RD&D	324	267	112	-58%
Nuclear Energy Enabling Tech	153	113	116	2%
Fuel Cycle R&D	264	305	187	-39%
Advanced Reactor Demonstrations**	--	230	20	-91%
Versatile Test Reactor***	--	--	295	n/a
Electricity Delivery	156	190	195	3%
Cybersecurity (CESER)	120	156	185	19%
Science	6,585	7,000	5,838	-17%
Basic Energy Sciences	2,166	2,213	1,936	-13%
Fusion Energy Sciences	564	671	425	-37%
BER Bioenergy Research Centers	100	100	100	0%

* Energy RD&D program office funding levels include some non-RD&D functions (e.g. the Weatherization Assistance Program in EERE). ITIF estimates total energy RD&D in FY 2020 to be \$8 billion, slightly less than the sum of funding for all energy RD&D program offices.

** Advanced Reactor Demonstrations was added as a control point in the FY 2020 appropriations bill.

*** The Versatile Test Reactor was previously funded in FY 2018 and FY 2019 out of the Reactor Concepts RD&D subprogram.

Acknowledgments

The author wishes to thank David M. Hart, Robert Rozansky, and Batt Odgerel for providing input to this brief. Any errors or omissions are the author's alone.

About the Author

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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.

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ENDNOTES

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