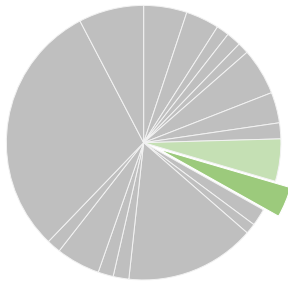




Federal Energy R&D: Building Technologies

BY COLIN CUNLIFF | APRIL 2019

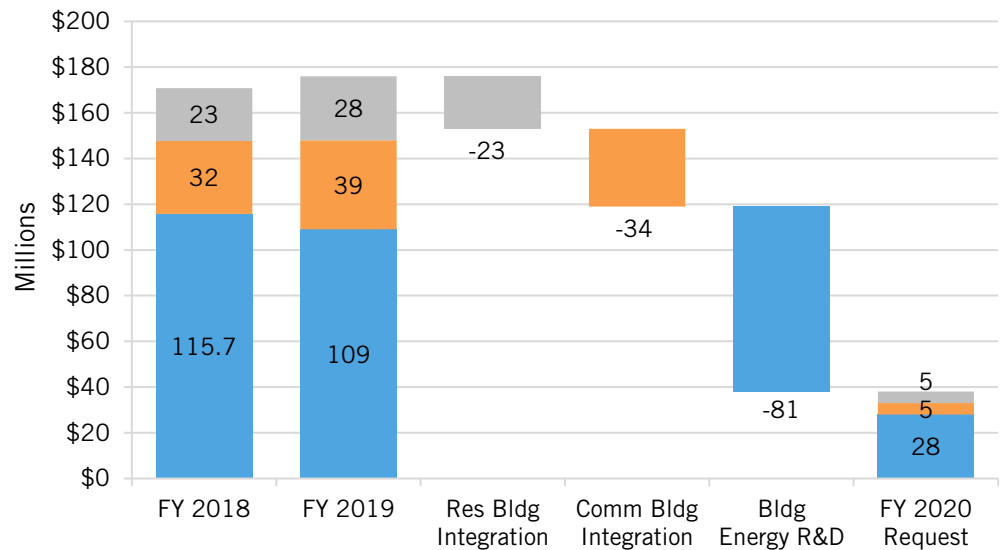
This briefing is part of a series on the U.S. energy budget. See: itif.org/energy-budget.



Buildings (green)
Other Efficiency (green)
Energy R&D (light gray)

The Department of Energy’s (DOE) Building Technologies Office (BTO) invests in research and development (R&D) of novel technologies that are designed to improve the efficiency and reduce the energy costs of the nation’s residential and commercial buildings—particularly the largest energy users therein: lighting, space conditioning and refrigeration, water heating, appliances, and miscellaneous electric loads (MELs), as well as the building envelopes themselves. BTO also works on improved energy modeling and system controls to predict and manage energy-efficient appliance/equipment, system, and whole-building energy usage.¹

Figure 1: The FY 2020 Budget Request Would Cut Building Technologies R&D by 78 Percent.²



What’s At Risk

Residential and commercial buildings are the single largest energy-consuming sector in the U.S. economy, accounting for roughly 75 percent of the nation’s electricity use and 40 percent of its total energy demand.³ As a result, Americans spend nearly \$400 billion each year to power their homes, offices, schools, hospitals, and other buildings.⁴ The Building Technologies program has established the ambitious goal of reducing the average energy use per square foot of commercial buildings by 30 percent by 2030, and that of new single-family homes by 60 percent and existing homes by 40 percent by 2020.⁵ In addition to these whole-building targets, the Building Technologies Office (BTO) is pursuing substantial improvements to the efficiency of energy services within buildings, including

lighting (65 percent improvement); water heating (35 percent); heating, ventilation, and air conditioning (HVAC) (25 percent); building envelope and windows (35 percent); appliances (30 percent); and sensors and controls (20 percent).⁶ Achieving these goals by 2030 would decrease total energy use by 5 quadrillion BTUs, cut carbon emissions by 450 million metric tons, and save consumers over \$100 billion annually in energy costs.⁷

BTO also supports collaborative partnerships through the Better Buildings Initiative (BBI) to accelerate new innovations and develop new resources to lower energy costs. Through BBI, DOE has partnered with more than 900 organizations, including businesses, schools, hospitals, state and local governments, public housing authorities, retailers and grocery stores, and residential organizations across the country. BBI partners represent 30 of the country's Fortune 100 companies, 12 of the top 25 U.S. employers, 12 percent of the U.S. manufacturing footprint, and 13 percent of total commercial building space, as well as 17 federal agencies, 28 states, and 93 local governments. As a result of innovative energy solutions developed through BBI, commercial and industrial partners have reported an estimated cost savings of \$7.3 billion in energy savings since 2011, while partnerships with other federal agencies have resulted in \$12.3 billion in cumulative energy cost savings.⁸

Building Technologies R&D Subprograms

BTO R&D activities are divided among three main subprograms:⁹

- **Building Energy R&D (BERD)** sponsors R&D in energy-efficient building technologies: Buildings-to-Grid; heating, ventilation and air-conditioning & refrigeration (HVAC&R); windows & envelope; solid-state lighting; and Building Energy Modeling (BEM).
- **Commercial Buildings Integration (CBI)** conducts R&D and analytical studies of building systems (e.g., lighting, HVAC, envelope, sensors and controls) and whole commercial buildings (e.g., office buildings, schools, hospitals, stores, warehouses, public infrastructure buildings) to assess the interactive effects of combining multiple novel technologies within a commercial building system, and also supports commercial building partnerships through the Better Buildings Initiative programs to develop and demonstrate innovative energy-saving technologies and solutions.
- **Residential Buildings Integration (RBI)** conducts R&D to identify technology areas and technical solutions that offer the potential for large energy savings in new and existing homes, and works to demonstration and validate innovative technology solutions through its Building America, Zero Energy Ready Homes, and Better Buildings Initiatives.

Key Elements of the FY 2020 Budget Proposal

- **An 87-percent reduction in the Commercial Buildings Integration subprogram**, including elimination of all later-stage development and commercialization activities, such as the High Impact Technology innovation Catalyst (HIT Catalyst) program which supports demonstration and validation of building systems optimization and advanced technology solutions.¹⁰ It is unclear whether commercial-sector partnerships through the Better Buildings Initiative would continue under the current budget proposal.
- **An 82-percent reduction in the Residential Buildings Integration subprogram**, including elimination of all later-stage development and commercialization activities such as Home Performance with ENERGY STAR, Better Buildings Residential, and demonstration efforts with industry partners. Funding for R&D on next generation retrofits of existing buildings, as well as the Solar Decathlon collegiate competition to design and build new highly-efficient solar-powered homes, would also be eliminated.
- **A 74-percent reduction in Building Energy R&D**, with substantial reductions across all technology focus areas, including lighting, HVAC and refrigeration, buildings-to-grid, building envelope and windows, and building energy modeling. Remaining funding would primarily support early-stage research at the national laboratories, while competitive funding opportunities and joint R&D partnerships with industry and university researchers would be severely curtailed or eliminated altogether.

ENDNOTES

1. Department of Energy (DOE), “FY 2020 Congressional Budget Justification” Volume 3 Part 2, 183 (DOE Chief Financial Officer DOE/CF-0153, April 2019), https://www.energy.gov/sites/prod/files/2019/04/f61/doe-fy2020-budget-volume-3-part-2_0.pdf.
2. The FY2020 budget for EERE would use \$353 million in prior year (FY 2018 and FY 2019) balances to fund FY2020 programs. Thus the numbers shown in the figure underestimate the magnitude of cuts included in the proposed budget. Department of Energy, “FY 2020 Congressional Budget Request: Budget in Brief,” (DOE CFO, March 2019), p 3, <https://www.energy.gov/sites/prod/files/2019/03/f60/doe-fy2020-budget-in-brief.pdf>; DOE, “FY 2020 Congressional Budget Justification” Volume 3 Part 2, 186 (DOE Chief Financial Officer DOE/CF-0153, April 2019), https://www.energy.gov/sites/prod/files/2019/04/f61/doe-fy2020-budget-volume-3-part-2_0.pdf.
3. Energy Information Administration (EIA), “Monthly Energy Review” Table 2.1 and 7.6, (DOE EIA, Release Date March 26, 2019), <https://www.eia.gov/totalenergy/data/monthly/>.
4. DOE, “FY 2020 Congressional Budget Justification” Volume 3 Part 2, 183.
5. Ibid, 197-201.
6. These goals were included in the FY 2017 Congressional Budget Justification and were informed by BTO’s FY 2016-FY 2020 Multi-Year Program Plan, but have not been included in subsequent

- Congressional Budget Justification documents. DOE, “FY 2017 Congressional Budget Justification” Volume 3, 217, (DOE Chief Financial Officer DOE/CF-0121, February 2016), https://www.energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf; DOE Building Technologies Office, “BTO Multi-Year Program Plan” (DOE BTO, January 2016), https://www.energy.gov/sites/prod/files/2016/02/f29/BTO_MYPP_2016.pdf.
7. DOE, “Building Technologies Office FY 2017 Budget At-A-Glance” (Washington, D.C.: Department of Energy, Energy Efficiency and Renewable Energy, March 2016), https://www.energy.gov/sites/prod/files/2016/03/f30/At_A_GLANCE%20%28BTO%29.pdf.
 8. Numbers reflect savings through the Better Buildings Challenge and Better Buildings, Better Plants programs. DOE, “2018 Better Buildings Progress Report: Innovation Through Collaboration: Securing a More Affordable and Reliable Energy Future” (DOE, 2018), 2 https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/DOE_BBI_2018_Progress_Report_051018.pdf.
 9. The Building Technologies Office also houses the Equipment and Building Standards subprogram, a regulatory program which sets energy efficiency standards for appliances, equipment, and processes. Because this program is regulatory in nature, it is not included in our assessment of federal R&D. The current administration has attempted to eliminate the Commercial and Residential Buildings Integration programs during the last two budget cycles, but this proposal has been rejected by Congressional appropriators. For more information, see DOE, “FY 2018 Congressional Budget Justification” Volume 3, 211-214 (DOE Chief Financial Officer DOE/CF-0130, May 2017) https://www.energy.gov/sites/prod/files/2017/05/f34/FY2018BudgetVolume3_0.pdf; and DOE, “BTO’s Program Areas” <https://www.energy.gov/eere/buildings/building-technologies-office>, accessed April 10, 2019.
 10. DOE, “High Impact Technology Catalyst,” <https://www.energy.gov/eere/buildings/high-impact-technology-catalyst>, accessed April 9, 2019.

ACKNOWLEDGMENTS

The author wishes to thank the David M. Hart for providing input to this report. Any errors or omissions are the author’s alone.

ABOUT THE AUTHOR

Colin Cunliff is a senior policy analyst for clean energy innovation 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 (EPSA), with a portfolio focused on energy sector resilience and emissions mitigation. 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 one of the world’s leading science and technology think tanks, 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.