Federal Energy R&D: Hydrogen & Fuel Cells

BY DAVID M. HART AND COLIN CUNLIFF | APRIL 2018

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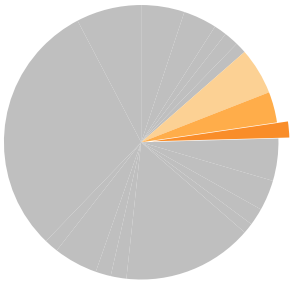
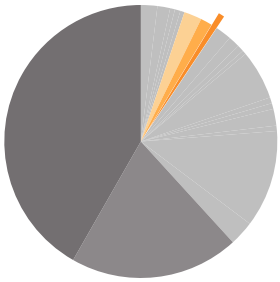
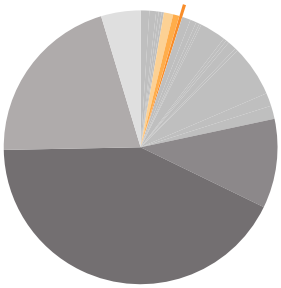


H2 and Fuels (orange)
Other Transportation (orange)
Energy R&D (light gray)



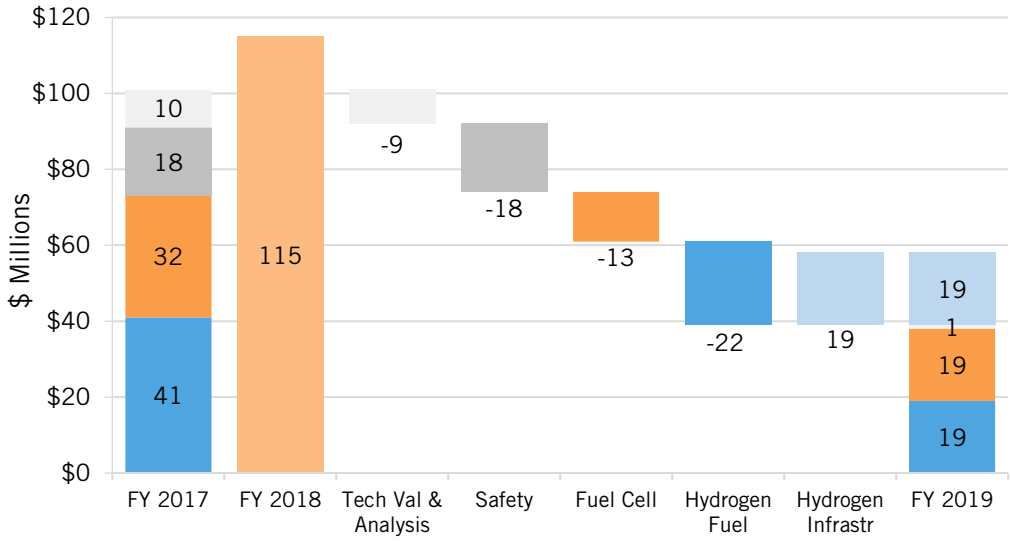
H2 and Fuels & Energy R&D
Basic Science R&D
Defense R&D



H2 and Fuels & Energy
Basic Science
Defense
Environ Mngmt
Other DOE

Fuel cells use the chemical energy of hydrogen or similar fuel to cleanly and efficiently produce electricity. When hydrogen is the fuel, electricity, water, and heat are the only resulting products, with none of the carbon emissions or pollution emitted by conventional internal combustion engines. The Hydrogen & Fuel Cells program conducts R&D on three complementary technologies: low-cost hydrogen production from domestic resources; infrastructure for hydrogen compression, transmission, storage, and delivery; and fuel-cell technologies that can be used in electric vehicles and other applications.

Figure 1: The FY 2019 Budget Request Would Cut Hydrogen and Fuel-cell R&D by 50 Percent



What's At Risk

Innovations resulting from DOE R&D over the past decade have facilitated a more than 50 percent cost reduction in fuel cells. However, further reductions are necessary for fuel cells to become cost-competitive with internal combustion engine vehicles. DOE's goals include decreasing the modeled high-volume cost of automotive fuel cells to $30 per kilowatt ($30/kW) and improving fuel cell durability to 8,000 hours (approximately 240,000 miles of driving) by 2030.[1] While the program's focus is on transportation, its R&D also benefits stationary fuel cells (such as those used to provide backup power), reversible fuel cells, and small-scale cells for tri-generation of fuel, heat, and power that may provide resilience and flexibility to multiple sectors. Reductions in R&D funding threaten to delay DOE progress toward cost-competitive fuel cells.

DOE is also targeting a hydrogen production cost of $2 per gallon gasoline equivalent ($2/gge), with a system-wide cost (hydrogen production plus delivery) of $4/gge in order to be cost competitive with gasoline on a cents-per-mile driven basis.[2] Meeting this target will require continued R&D in different hydrogen production methods.

Hydrogen & Fuel Cells R&D Subprograms

R&D in the Hydrogen & Fuel Cells program is distributed across five subprograms:

- **Fuel Cell** supports R&D to develop technologies that enhance the durability, reduce the cost, and improve the performance of fuel cells, including the discovery and development of catalysts and electrodes that do not use platinum-group metals (i.e., PGM-free catalysts), which could reduce fuel-cell stack costs by up to 40 percent.
- **Hydrogen Fuel R&D** focuses on the development of novel hydrogen production, delivery, and storage technologies, including hydrogen production from domestic sources such as natural gas, oil, coal, and biomass, as well as from nuclear and renewable energy by electrically splitting water.
- **Systems Analysis** performs analytical research that provides a technical basis for informed decision-making for the program's R&D direction and prioritization.
- **Safety, Codes, and Standards** collaborates with government, industry, standards-development organizations, universities, and National Laboratories to harmonize regulations, codes, and standards (RCS), and develop best practices to ensure safety in the operation, handling, and use of hydrogen and fuel-cell technologies.
- **Technology Acceleration** supports technology transition from R&D to commercial viability through validation, evaluation, and testing of advanced hydrogen and fuel-cell technologies under real-world conditions.

Key Elements of the FY 2019 Budget Proposal

- **Elimination of the Safety, Codes, and Standards subprogram**, including R&D to develop domestic supply-chain safety codes and standards for hydrogen and fuel-cell components, as well as education and training programs for first responders and code officials.
- **Elimination of the Technology Acceleration subprogram**, including a first-of-a-kind demonstration of hydrogen-distribution pipelines, field demonstrations of electric parcel-delivery trucks, hydrogen refueling stations, and other activities.
- **A 41-percent reduction in Fuel Cell R&D**, including termination of low platinum-group metal catalyst and electrode R&D, as well as reduced funding for the Fuel Cell Performance and Durability (FC-PAD) consortium, which brings

together multiple national laboratories with industry partners to enhance the performance and durability of polymer electrolyte membrane fuel cells, while also reducing their cost.

- **Splitting the Hydrogen R&D subprogram** into two separate subprograms: one that focuses on hydrogen production, and another that concentrates on hydrogen infrastructure (e.g., storage). Combined funding for the two is 7 percent below 2017 funding levels.

ENDNOTES

1. DOE, "FY 2019 Congressional Budget Justification," volume 3 part 2, DOE/CF-0141 (Washington, D.C.: DOE/CFO, March 2018) https://www.energy.gov/sites/prod/files/2018/03/f49/FY-2019-Volume-3-Part-2.pdf.
2. Ibid.

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