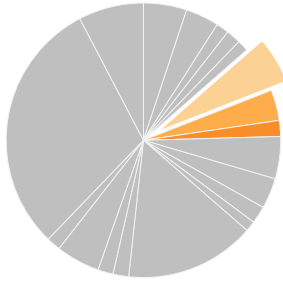




# Federal Energy R&D: Vehicle Technologies

BY COLIN CUNLIFF AND BATT ODGEREL | MARCH 2020

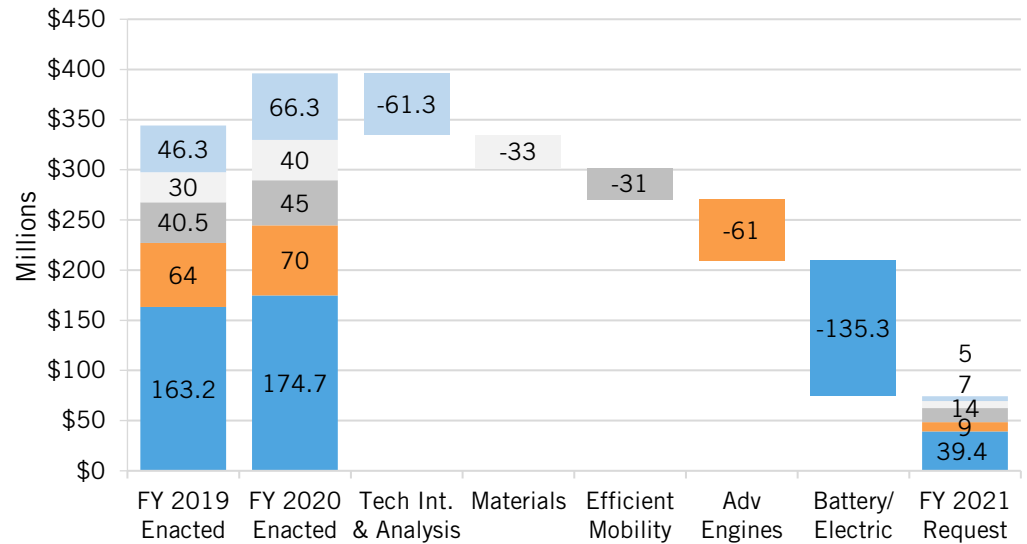
*This briefing is part of a series on the U.S. energy budget. See: [itif.org/energy-budget](http://itif.org/energy-budget).*



Vehicles (light orange)  
Other Transportation (orange)  
Energy R&D (light grey)

The transportation sector accounted for 69 percent of petroleum use and 33 percent of all carbon pollution in 2018, surpassing the power sector as the top source of U.S. greenhouse gas emissions in 2016.<sup>1</sup> The average U.S. household spends 16 percent of its total family expenditures on transportation, making it the most expensive spending category after housing.<sup>2</sup> With 11.4 percent of U.S. petroleum consumption coming from net imports, U.S. consumers on average send more than \$4.5 billion per month overseas for crude oil.<sup>3</sup> By investing in research and development (R&D) to use conventional fuels more efficiently and develop domestically produced alternative-vehicle technologies, the Vehicle Technologies Office (VTO) works to keep prices low for consumers, improve national energy security, and enhance environmental performance.<sup>4</sup>

**Figure 1: The FY 2021 budget request would cut vehicle technologies R&D by 81 percent<sup>5</sup>**



## What's at Risk

VTO has established technology cost and performance targets to help meet national imperatives in energy security, environmental stewardship, and economic growth. Reaching these goals will require new technologies and cost reductions in batteries, efficient engines, fast charging, lightweight materials, and other enabling technologies, as well as systems-level innovations in automated and connected vehicles, and integration into electricity systems.

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For electric vehicles (EVs), the office has established targets of reducing the cost of batteries to 100 dollars per kilowatt-hour (\$100/kWh), increasing their range to 300 miles, and decreasing charging time to 15 minutes or less by 2028, with an ultimate cost goal of \$60/kWh. But new battery chemistries will be needed to reach these cost targets and for EVs to achieve their full potential. China is currently leading the world in EV deployment, while the European Union is moving quickly to catch up and secure its own EV supply chain.<sup>6</sup> Reductions in battery and electrification R&D funding threaten to delay progress that would help move the United States toward a similar track.

The SuperTruck II research activity set a target of doubling the freight-hauling efficiency of heavy-duty Class 8 long-haul trucks by 2020, over the 2009 efficiency level.<sup>7</sup> Long-haul trucking is a key “hard-to-decarbonize” transportation subsector that is not amenable to electrification using the same lithium-ion batteries used in light-duty EVs. Improving efficiency is one of the few good near-term options for lowering energy costs and reducing carbon emissions from this sector.<sup>8</sup> The Department of Energy (DOE) has also established goals to improve mobility efficiency through connected, shared, and autonomous vehicles, and to identify novel high-strength structures that can reduce vehicle weight and improve fuel economy. Reduced funding for these programs threatens to stall DOE’s efforts to improve vehicle efficiency and save energy costs for consumers.

### Vehicle Technologies R&D Subprograms

R&D in the Vehicle Technologies program is distributed across six subprograms:<sup>9</sup>

- **Battery and Electrification Technologies** explores new battery chemistry and cell technology to reduce the cost of EV batteries; supports work on EV integration with the electric grid; conducts R&D to improve electric drivetrains; and explores fast charging technologies.
- **Energy Efficient Mobility Systems** applies complex modeling and simulation to explore the energy impact of emerging disruptive technologies such as connected and autonomous vehicles, information-based mobility-as-a-service platforms, and advanced powertrain technologies in order to identify opportunities to improve efficiency.
- **Advanced Engine & Fuel Technologies R&D** works both to develop advanced combustion engines and to co-optimize fuels and engines to improve fuel economy.
- **Materials Technology** supports vehicle lightweighting and improved propulsion (powertrain) efficiency through materials R&D.
- **Technology Integration** supports cooperative agreements with Clean Cities coalitions, maintains the Alternative Fuels Data Center and the annual Fuel Economy Guide, conducts transportation data and systems research, and supports the collegiate advanced vehicle technology competitions and other workforce development programs.

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- **Data, Modeling, and Analysis** provides technology, economic, and interdisciplinary analyses to inform and prioritize the Vehicle Technologies research portfolio.

### Key Elements of the FY 2021 Budget Proposal

- **A 77-percent reduction of the Battery and Electrification Technologies subprogram**, including an \$85 million cut for battery R&D; no new funding for battery development work through the Advanced Battery Consortium; a \$35.6 million cut to electric-drive R&D; no funding to develop advanced motor and inverter drive systems that do not rely on heavy rare earth minerals; a \$14.7 million cut to electrification R&D; and no funding for smart charging systems, high-power charging systems, or wireless charging systems.
- **No new funding for SuperTruck II activities**, a cross-cutting activity that aims to double the freight-hauling efficiency of heavy-duty Class 8 long-haul trucks by 2020.<sup>10</sup> DOE is launching new research activities to build on the success of SuperTruck II, but is providing significantly reduced funding.
- **An 87-percent reduction of Advanced Engine & Fuel Technologies R&D**, including no funding for lightweight high-efficiency engine research projects; no funding to improve efficiency and reduce harmful emissions from off-road vehicles, including agricultural vehicles; the elimination of research on spark-ignited engines; and reduced funding for emission reduction of diesel engines.
- **A 69-percent reduction in Energy Efficient Mobility Systems**, including reduced funding for the Systems and Modeling for Accelerated Research in Transportation (SMART) National Laboratory Consortium; and a \$13 million cut to research in connectivity and automation technologies.
- **An 83-percent reduction in Materials Technology R&D**, including the elimination of research on lightweight metal alloys and on-vehicle applications, projects utilizing the LightMAT Consortium to accelerate the discovery of advanced materials, and research on lightweight high-efficiency engines.
- **An 89-percent reduction in Technology Integration**, including no new funding for the Clean Cities program, and minimal support for the advanced vehicle technology competition for university students.
- **A 75-percent reduction in Data, Modeling, and Analysis**, including reduced funding for techno-economic analyses to inform research portfolio planning.

## ENDNOTES

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2. Davis and Boundy, *Transportation Energy Data Book Edition 38*, Table 11.1 Average Annual Expenditures of Households by Income.
3. Transportation Energy Data Book 38th Edition, Table 1.11, “U.S. Petroleum Production, Imports, and Exports 1950–2018,” Table 1.13, “Consumption of Petroleum by End-Use Sector, 1950–2018,” Table 11.5, “Prices for a Barrel of Crude Oil and a Gallon of Gasoline, 1978–2018.”
4. Department of Energy, “FY 2021 Congressional Budget Justification,” Volume 3 Part 1, (Washington, D.C.: DOE/CF-0163, February 2020), 31, <https://www.energy.gov/sites/prod/files/2020/02/f72/doe-fy2021-budget-volume-3-part-1.pdf>.
5. DOE, “FY 2021 Congressional Budget Justification” Volume 3 Part 1, 19.
6. International Energy Agency (IEA), “Global EV Outlook 2019” (OECD/IEA, 2019), 80, <https://www.iea.org/reports/global-ev-outlook-2019>.
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8. Colin Cunliff, “An Innovation Agenda for Deep Decarbonization: Bridging Gaps in the Federal Energy RD&D Portfolio” (Information Technology and Innovation Foundation, 2018), <http://www2.itif.org/2018-innovation-agenda-decarbonization.pdf>.
9. DOE, “FY 2021 Congressional Budget Justification” Volume 3 Part 1, 17-44.
10. American Council for an Energy-Efficient Economy (ACEEE), “DOE’s SuperTruck Program: Slashing Fuel Waste from Tractor-Trailers” (ACEEE, May 24, 2017), <https://aceee.org/fact-sheet/super-truck>.

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