

Transportation accounts for two-thirds of U.S. petroleum use, and on-road vehicles are responsible for nearly 85% of this amount. U.S. dependence on petroleum affects the national economy and potential for future growth—making it a high-value opportunity for change. The Vehicle Technologies Office (VTO) develops and overcomes barriers to the widespread use of advanced highway transportation technologies that reduce petroleum consumption and greenhouse gas emissions, while meeting or exceeding vehicle performance expectations.

What We Do

VTO uses an integrated portfolio approach and relies on strategic partnerships to accelerate the movement of technologies from the laboratory onto the road. This includes:

- ✓ **Research and Development (R&D)** seeks to reduce the cost and improve the performance of a mix of near- and long-term technologies, including advanced batteries, electric drive technologies, lightweight and propulsion materials, advanced combustion engines, advanced fuels and lubricants, and other enabling technologies.
- ✓ **Modeling, Evaluation, and Demonstration** provides objective, publicly-available data to identify pathways for technology improvements, and lessons learned for cost-effective future deployment.
- ✓ **Outreach** provides technical assistance, tools, and resources to help consumers and fleets understand their options for saving money on fuel.
- ✓ **Partnerships** leverage technical expertise, accelerate progress, and catalyze action to enable the widespread use of advanced technology vehicles—at very little cost to the government.

Program Goals/Metrics

- Cut battery costs to \$125/kWh by 2022 from \$264/kWh in 2015.
- Eliminate almost 30% of vehicle weight through lightweighting by 2022, compared to a 2012 baseline.
- Reduce the cost of electric drive systems to \$8/kW by 2022 from \$12/kW in 2015.
- Improve engine efficiency to demonstrate 35% fuel economy improvement for passenger vehicles by 2020.

FY 2017 Priorities

- **EV Everywhere Grand Challenge:** EV Everywhere is a Clean Energy Grand Challenge to position the U.S. to become the first nation in the world by 2022 to produce plug-in electric vehicles that are affordable for the average American family as gasoline powered vehicles were in 2012. R&D targets focus efforts on reducing PEV battery and electric drive system cost by up to 50%. This initiative cuts across VTO subprograms (Battery Technology R&D, Electric Drive Technologies R&D, Vehicle Systems, and Materials Technology).
- **SuperTruck II:** With an emphasis on cost-competitiveness, SuperTruck II program develops and demonstrates technologies to increase the freight hauling efficiency of heavy-duty Class 8 trucks by greater than 100% in 2020, with respect to comparable 2009 vehicles. This cuts across VTO subprograms (Advanced Combustion Engine R&D, Vehicle Systems, and Materials Technology). This is a fully funded, \$80 million program.

(Dollars in Thousands)	FY 2015 Enacted	FY 2016 Enacted	FY 2017 Requested
Batteries and Electric Drive Technologies	\$103,701	\$141,100	\$0
Battery Technology R&D	\$0	\$0	\$130,000
Electric Drive Technologies R&D	\$0	\$0	\$39,000
Vehicle Systems	\$40,393	\$30,600	\$90,000
Advanced Combustion Engine R&D	\$49,000	\$37,141	\$74,800
Materials Technology	\$35,602	\$26,959	\$82,700
Fuel and Lubricant Technologies	\$20,000	\$22,500	\$20,500
Outreach, Deployment, and Analysis	\$28,304	\$48,400	\$31,500
NREL Site-Wide Facility Support	\$3,000	\$3,300	\$0
Total, Vehicle Technologies	\$280,000	\$310,000	\$468,500

- **Advanced Materials Crosscut:** This is a joint effort between industry and the national laboratories to develop a set of validated computational tools to rapidly design and predict properties and processing for optimized low-cost carbon fiber precursors. This program will be supported through the Lightweight Materials Consortium established under the Energy Materials Network at the national laboratories and planned competitive awards with industry.
- **Co-Optimization of Fuels and Engines:** Establishes a link early in the R&D cycle of both fuels and engines for a systems-based approach and to create optimized solutions for fuels and engines. Involves collaboration with Bioenergy Technologies and cuts across Vehicle Technologies (Advanced Combustion Engine R&D and Fuel and Lubricant Technologies).
- **Grid Modernization:** Supports aspects of vehicle-to-grid integration associated with PEVs, focusing on technologies needed to fully integrate PEVs into the distribution system in a safe, reliable, and cost-effective manner.
- **Transportation as a System:** Explores opportunities to realize untapped energy efficiency and will evaluate how transportation assets, travelers, and the transportation system interact and influence each other, with the longer-term goal of optimizing the transportation system.
- **that reduces production time and costs while yielding strong and lightweight parts.** Using aluminum, it can deliver a car door inner panel that is 62% lighter and 25% cheaper than one produced with today's manufacturing methods, while maintaining the speed, scale, quality, and consistency required by the auto industry.
- **PEV Infrastructure Demonstration:** The world's largest PEV infrastructure demonstration recently came to a close, having collected data on more than 15 million miles worth of driving and 6 million charging events. The data collected is essential for policymakers, city planners, and other key stakeholders to better understand PEV driver behavior and can inform their planning for future charging infrastructure placements.
- **SuperTruck Success:** One of four SuperTruck teams reached a record 12 miles per gallon (mpg) freight efficiency for its Class 8 tractor-trailer, resulting in a 115% increase in freight efficiency (which includes both fuel used and weight hauled) over typical Class 8 trucks, which average 5.8 mpg. In addition, it substantially surpassed the SuperTruck goal of boosting freight efficiency by 50% over baseline tractor trailers.
- **Clean Cities:** Helped to reduce petroleum use by over 1 billion gallons in 2014, which resulted in 6.6 million tons of greenhouse gas reduction, the equivalent of removing 1.5 million cars from the road.

Key Accomplishments

- **Battery Costs Continue to Fall:** In 2015, VTO R&D reduced the modeled, high-volume production cost of PEV batteries to \$264/kWh, a more than 45% reduction from the EV Everywhere baseline established in 2012.
- **Electric Drive Systems:** VTO R&D reduced the modeled, high-volume cost of an electric drive system from \$15/kW in 2014 to \$12/kW in 2015, a 20% reduction.
- **Advanced Combustion Engines:** In 2015, demonstrated a 25% improvement in passenger vehicle fuel economy compared to a 2009 baseline.
- **New Process Will Enable Expanded Use of Lightweight Materials:** A partnership with General Motors, TWB Company LLC, Alcoa, and Pacific Northwest National Laboratory developed a friction stir welding process



SuperTruck initiative partner improves Class 8 truck efficiency by 115%.