

Transportation accounts for two-thirds of U.S. petroleum use, and on-road vehicles are responsible for 80% of this amount. Our dependence on petroleum creates significant national security and environmental challenges, limits our potential for economic growth, and hits our individual wallets – making it a high-value opportunity for change. The Vehicle Technologies Office develops and deploys advanced highway transportation technologies that reduce petroleum consumption and greenhouse gas emissions, while meeting or exceeding vehicle performance expectations.

What We Do

The Vehicle Technologies Office uses an integrated portfolio approach and relies on strategic partnerships to accelerate the movement of technologies from lab to showroom and onto the road:

- ✓ **Research and Development** seeks to reduce the cost and improve the performance of a mix of near- and long-term technologies, including advanced batteries, power electronics and electric motors, 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 and Deployment** 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 no additional cost to the government.

Program Goals/Metrics

- Cut battery costs to \$125/kWh by 2022 from \$325/kWh in 2013.
- Eliminate almost 30% of vehicle weight through lightweighting by 2022, compared to a 2002 baseline.
- Reduce the cost of electric drive systems to \$8/kW by 2022 from \$16/kW in 2013.
- Improve engine efficiency to demonstrate 25% fuel economy improvement for passenger vehicles by 2015.

FY 2015 Priorities

- **EV Everywhere Grand Challenge:** Seeks to enable the United States to produce plug-in electric vehicles (PEV) that are as affordable and convenient as gasoline vehicles by 2022. The companion Workplace Charging Challenge encourages private-sector leadership in the build-out of convenient PEV charging for consumers.
- **Advanced Combustion R&D** supports the SuperTruck initiative to increase the fuel efficiency of Class 8 heavy-duty trucks by at least 50%, as well as supporting low-temperature combustion regimes that can dramatically increase passenger vehicle fuel economy.
- **Natural Gas and Drop-in Biofuel** expands R&D to eliminate technical barriers to the increased use of alternative and renewable fuels. Focus includes natural gas storage and high-efficiency natural gas engines, as well as analysis of optimal biorefinery products for use in fueling infrastructure and vehicles (working with EERE Bioenergy Technologies).

(Dollars in Thousands)	FY 2013 Current	FY 2014 Enacted	FY 2015 Request
Batteries and Electric Drive Technologies	111,663	108,935	135,531
Vehicle and Systems Simulation & Testing	44,763	43,474	39,500
Advanced Combustion Engine R&D	55,004	49,970	49,000
Materials Technology	40,336	38,137	54,069
Fuels and Lubricant Technologies	16,960	15,990	27,400
Outreach, Deployment and Analysis	34,439	31,231	50,400
NREL Site-Wide Facility Support	0	2,000	3,100
Total, Vehicle Technologies	303,165	289,737	359,000

- **Material Lightweighting** supports greater depth and quantity of ultra lightweight vehicle substructure demonstrations. Emphasis includes improved properties, manufacturability, computational materials science, and enabling technologies for carbon fiber composites, advanced high-strength steels, aluminum alloys, and magnesium alloys.
- **EERE Crosscutting** continues support for the vehicle-related components of key EERE cross-cutting initiatives, including Grid Integration, Clean Energy Manufacturing, and Incubator.

Key Accomplishments

- **Developed Better-Performing, Lower-Cost Advanced Battery Technologies:** Vehicle Technologies continues to build on its history of successful battery R&D.
 - Most hybrid electric vehicles sold in the United States use EERE-developed battery technology.¹ The Office's efforts to improve nickel-metal hydride (NiMH) batteries resulted in efficiency improvements of up to 50% compared to similar non-hybrid vehicles, and R&D to discover and optimize new lithium-ion battery technologies led to battery size and weight reductions of 25%–35% compared to NiMH technology. These lithium-ion battery technologies are entering the market.
 - Office-supported R&D helped reduce the high-volume production cost of high-energy, high-power batteries to \$325/kWh in 2013² from \$1,000/kWh in 2008, and are on track toward program goals of \$300/kWh by 2014 and \$125/kWh by 2022. Achieving these cost-reduction goals would enable a wide range of PEVs to be directly cost competitive with conventional vehicles over the next 5–10 years.
- **Increased Fuel Economy for Heavy-duty Trucks:** Vehicle Technologies' SuperTruck Initiative demonstrated a 22% engine efficiency improvement in the laboratory and

a 61% improvement in freight efficiency. All four SuperTruck teams are expected to meet the 50% freight efficiency improvement goal with on-road demonstrations.

- **Accelerated Development of Lightweight Materials for Better Fuel Economy:** Vehicle Technologies R&D supported the design/construction of a composite vehicle floor panel that saves 13 kg versus the original steel design, and it has enabled the development of a magnesium alloy and processing technique to produce high-strength parts that can absorb crash energy while reducing weight by more than 30%. The newly-developed alloys contain no rare-earth elements, which are typically required for high performance magnesium.
- **Celebrated 25 Years of Advanced Vehicle Technology Competitions:** More than 16,000 students from 118 universities have received real-world, hands-on experience with advanced transportation technologies. Graduates are working across the automotive industry and leading the development of advanced vehicles and technologies at auto manufacturers, suppliers, national laboratories, and academia.
- **Decreased Oil Dependence for Local Transportation:** Since 1993, the Clean Cities Initiative has grown to a national network of nearly 100 local coalitions that have collectively displaced more than 5 billion gallons of gasoline. These coalitions have helped deploy thousands of alternative fuel vehicles and the fueling stations needed to serve them, aided in the elimination of millions of hours of vehicle idling, and helped accelerate the entry of PEVs into the marketplace.
- **Increased Use of Advanced Transportation Technology through Public-Private Partnerships:**
 - The **National Clean Fleets Partnership** collaborates with large vehicle fleets to reduce fuel use and save money. The partnership focuses on the nation's largest corporate fleets to achieve the highest impact and has grown from less than 10 partners at its launch, to 23 partners in February 2014.
 - The **Workplace Charging Challenge** calls upon America's employers in all sectors of the economy to provide PEV charging access at worksites across the country. Launched in January 2013, with 13 partners and eight ambassador stakeholder groups, the Challenge has more than 50 partners.

¹ "Linkages of DOE's Energy Storage R&D to Batteries and Ultracapacitors for Hybrid, Plug-in Hybrid and Electric Vehicles." U.S. DOE, February 2008

² Based on high volume manufacturing projection of prototypes that meet or exceed performance requirements using a peer-reviewed cost model, and on proprietary data from battery companies participating in the U.S. Advanced Battery Consortium