Improving Vehicle Efficiency, Reducing Dependence on Foreign Oil

Today, the United States spends about $400 billion each year on imported oil. To realize a secure energy future, America must break its dependence on imported oil and its volatile costs. The transportation sector accounts for about 70% of U.S. oil demand and holds tremendous opportunity to increase America's energy security by reducing oil consumption. That's why the U.S. Department of Energy (DOE) conducts research and development (R&D) on vehicle technologies which can stem America's dependence on oil, strengthen the economy, and protect the environment.

R&D drives innovation while lowering technology costs, which then enables the private sector to accelerate clean technology deployment. Along with R&D, DOE's Vehicles Technologies Program deploys clean, efficient vehicle technologies and renewable fuels, which reduce U.S. demand for petroleum products. The program works with industry, universities, and state and local governments on projects that make a difference in the everyday lives of Americans.

Goals and Activities

- Hybrid-electric and plug-in hybrid-electric vehicles can significantly improve fuel economy, displacing petroleum. Researchers are making batteries more affordable and recyclable, while enhancing battery range, performance, and life. This research supports President Obama's goal of putting 1 million electric vehicles on the road by 2015. The program is also working with businesses to develop domestic battery and electric-drive component plants to improve America's economic competitiveness globally.
- The program facilitates deployment of alternative fuels (ethanol, biodiesel, hydrogen, electricity, propane, and natural gas) and fuel infrastructures by partnering with state and local governments, universities, and industry.
- Reducing vehicle weight directly improves vehicle efficiency and fuel economy, and can potentially reduce vehicle operating costs. Cost-effective, high-strength materials can significantly reduce vehicle weight without compromising safety.
- Improved combustion technologies and optimized fuel systems can improve near-and mid-term fuel economy by 25% for passenger vehicles and 20% for commercial vehicles by 2015, compared to 2009 vehicles.

Reducing the use of oil-based fuels and lubricants in vehicles has more potential to improve the nation's energy security than any other action; even a 1% improvement in vehicle fuel efficiency would save consumers more than $2 billion annually.

The Vehicle Technologies Program is developing more energy efficient and environmentally friendly highway transportation technologies that will enable the United States to use less petroleum. *Photos from left to right: from iStock/863848; from iStock/2383648; from iStock/13088911*

Partnering for Success

The program's success depends on its relationship with universities, vehicle and engine manufacturers, material suppliers, nonprofit technology organizations, energy suppliers, and national laboratories. DOE's partnerships with industry identify and select appropriate R&D objectives to achieve its and its partners' strategic goals. Projects are conducted through various mechanisms, including cooperative agreements, university grants, subcontracts, and research funded at DOE's national laboratories.

Achieving Results

Hybrid Electric Systems R&D (e.g. energy storage, electric-drive components, and systems analysis and testing) continues to be a hugely successful part of DOE's vehicle research program.

Energy storage technologies, mainly batteries, are critical to more fuel-efficient light-and heavy-duty vehicle development. Developing durable and affordable advanced batteries is essential for wide-spread integration. Currently, the program is enabling industry to build domestic battery manufacturing and electric-drive component plants, which will improve America's economic competitiveness.

Power electronics and electrical machines technologies, such as advanced motors, are integral to the hybrid plug-in and hybrid-electric vehicle acceptance in the market place. These technologies must be compatible with high-volume manufacturing; must ensure high reliability, efficiency, and ruggedness; and must simultaneously reduce cost and weight.

Technology validation confirms that the program's innovations will work in real-world settings under varying operating scenarios.

Through laboratory testing, researchers compare vehicles and components to validate models, support the setting of technical benchmarking targets, and provide data to guide technology development.

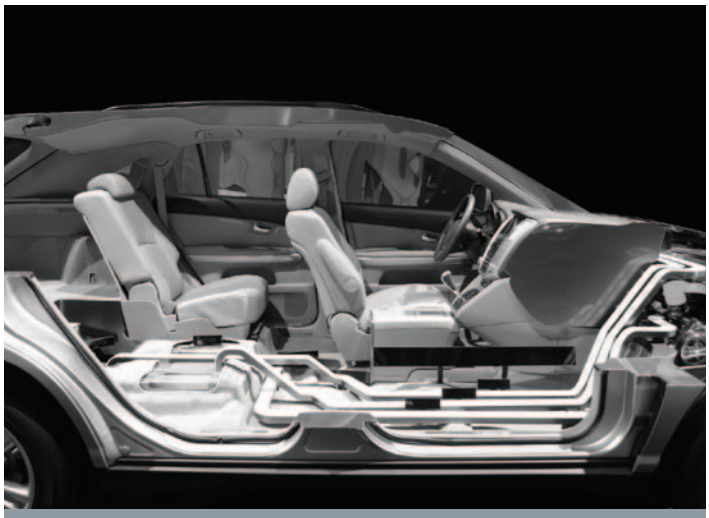
Advanced Combustion Engine R&D boosts internal combustion engines efficiency and is a very promising, cost-effective approach to increasing vehicle fuel economy in the near-term. In fact, the United States can cut its transportation fuel use 20–40% through advanced engine commercialization. The program is working to identify technologies, configurations, and engine control strategies—such as low-temperature combustion, variable compression ratio, and exhaust gas recirculation—which achieve the best combination of high fuel economy and low emissions for advanced internal combustion engines, advanced diesel engines, hybrid-electric vehicles, and other alternative-fueled vehicles.

Materials Technology includes lightweight, high-performance materials that will improve fuel economy and enable vehicles to remain comparable in size, comfort, and safety to today's vehicles. The goal is to develop and validate cost-effective, high-strength materials that significantly reduce vehicle weight without compromising cost, performance, safety, or recyclability. Improved propulsion materials are critical to meeting programmatic performance and cost targets. Efforts focus on developing lightweight, highly efficient propulsion systems for advanced passenger cars and commercial vehicles operating on a combination of conventional and nonpetroluem fuels and electricity.

Fuels Technology R&D will lead to fuel options that are cost-competitive, enable higher fuel economy, deliver lower emissions, and reduce imported oil use. For example, the program evaluated impacts of intermediate ethanol gasoline blends (e.g., E15 and E20) on performance, emissions, and durability in the existing vehicle fleet, and on small, nonroad engines.

Technology Integration and Deployment is a multi-faceted challenge, incorporating workforce development and training, consumer education, and early adopter support. This area also supports relevant legislative and rulemaking activities.

Clean Cities is the main deployment arm of the program. It is a public-private partnership designed to reduce the transportation sector's petroleum consumption by advancing alternative and renewable fuels, idle-reduction technologies, and fuel economy measures. This initiative supports nearly 100 local coalitions that partner with local, state, and federal agencies; public health and transportation departments; commercial fleets; transit agencies; auto manufacturers; car dealers; fuel and equipment suppliers; public utilities; and nonprofit associations. Since 1993, Clean Cities and its stakeholders have reduced petroleum consumption by nearly 3 billion gallons.



Advancements are being made in developing lightweight materials for passenger and commercial vehicles that can operate with current conventional fuels and electricity.
Photo from iStock/4332987

The program's education activities include Graduate Automotive Technology Education (GATE) Centers of Excellence at U.S. universities, and advanced student engineering competitions to provide a new generation of engineers and scientists with advanced automotive technologies knowledge and skills. The latest student competition, EcoCAR: Plugging in to the Future, challenges university students to reduce a vehicle's environmental impact by minimizing its fuel consumption and reducing its emissions while retaining its performance, safety, and consumer appeal. Many students who graduate from the student vehicle competitions and the GATE Program go on to take jobs in the auto industry, government, and academia, where they bring an appreciation and understanding of advanced automotive technologies.

Learn More

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