



## Advancing New Vehicle Technologies and Fuels

Today, America imports more than half of the oil we consume, 69 percent of which is used for transportation. Unless action is taken, Americans will continue to be dependent on this non-renewable resource and its ever fluctuating price and availability. Research and development undertaken by the U.S. Department of Energy's (DOE's) Vehicle Technologies program (VT) is helping to change this trend.

The VT program is actively developing and accelerating the deployment of clean and efficient vehicle technologies, as well as renewable fuels, which together could dramatically reduce the U.S. demand for petroleum products. The VT program works with industry, universities, and state and local governments to strengthen the economy, create jobs, and make a difference in the everyday lives of Americans.

### Current Goals and Activities

- Development of hybrid-electric and plug-in hybrid-electric vehicles can provide significant improvement in fuel economy and petroleum displacement. Researchers are looking to make batteries more affordable and recyclable, as well as enhance battery range, performance, and life. This research

supports President Obama's goal of 1 million plug-in hybrid vehicles (PHEVs) by 2015. The Program is also actively working with industry and state and local governments to develop domestic battery and electric-drive component plants to secure our energy future.

- Deployment of alternative fuels can rapidly reduce oil imports. The VT program leads in facilitating deployment of alternative fuels (ethanol blends, biodiesel, hydrogen, electricity, propane, and compressed 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. The introduction of 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 efficiency. Goals are to improve efficiency for passenger vehicles to 45 percent by 2010, and for commercial vehicles to 55 percent by 2013.

Reducing highway oil use has more potential to improve the Nation's energy security than any other action; even a one percent improvement in

vehicle fuel efficiency would save consumers over \$2 billion annually.

### Partnering for Success

The VT program's success depends on its relationship with universities, vehicle and engine manufacturers, material suppliers, nonprofit technology organizations, energy suppliers and national laboratories. The FreedomCAR and Fuel Partnership and 21st Century Truck Partnership are designed to identify and select appropriate research and development objectives to achieve the Program and its partners' strategic goals. Projects are conducted through a variety of mechanisms including cooperative agreements, university grants, subcontracts, and in-house research funded at DOE's national laboratories.

### Program Components Work Together: Achieving Results

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

Energy storage technologies, mainly batteries, are critical enabling technologies for the development of more fuel-efficient light- and heavy-duty vehicles. The development of durable and affordable advanced batteries is essential for wide-spread integration of hybrid-electric and plug-in hybrid-electric vehicles. Currently,



# Vehicle Technologies Program

the Program is enabling industry and state and local governments to build domestic battery manufacturing and electric-drive component plants, one of the strategic goals set forth in President Obama's Recovery Act.

Power electronics and electrical machines' technologies are integral to the advancement of hybrid and plug-in hybrid electric vehicles acceptance into the market place. These technologies must be compatible with high-volume manufacturing; must ensure high reliability, efficiency, and ruggedness; and must simultaneously reduce cost, weight, and volume.

Technology validation confirms that the technologies the VT program helps create will work in the actual vehicle system under varying operating scenarios. It is important to compare the Program's research results with similar work performed worldwide. 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** — Boosting the efficiency of internal combustion engines is one of the most promising and cost-effective approaches to increasing vehicle fuel economy over the next 30 years. In fact, the United States can cut its transportation fuel use 20 to 40% through commercialization of advanced engines. The Advanced Combustion Engine R&D subprogram is working to identify technologies, configurations, and engine control strategies—such as low-temperature combustion, variable compression ratio, and exhaust gas recirculation—that 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** — Advanced propulsion materials enable the

development of durable and cost-effective high-efficiency materials for vehicles. This is accomplished by identifying and addressing materials needs based on technological hurdles expected to confront envisioned advanced vehicle systems. These efforts are closely coordinated with the other VT subprograms to effectively identify future materials needs and provide efficient technology transfer from materials development to component applications. The use of lightweight, high-performance materials will contribute to the development of vehicles that provide better fuel economy, yet are comparable in size, comfort, and safety to today's vehicles. The goal is to develop and validate cost-effective high strength materials technologies that significantly reduce vehicle weight without compromising cost, performance, safety, or recyclability.

**Fuels Technology** — The fuels and lubricants effort supports R&D that will provide consumers with fuel options that are cost-competitive, enable higher fuel economy, deliver lower emissions, and reduce the use of imported oil. For example, the team is evaluating the impacts of intermediate ethanol/gasoline blends (e.g., E15 and E20) on performance, emissions, and durability of the existing vehicle fleet and on small, non-road engines.

**Technology Integration and Deployment** — Integrating newly validated technologies is a multi-faceted challenge incorporating education and training, consumer education, and early adopter support, as well as supporting relevant legislative and rulemaking activities.

Clean Cities is the main deployment arm of the VT program. It is a government-industry partnership designed to reduce petroleum consumption in the transportation sector by advancing the use of alternative fuels and vehicles, idle reduction technologies, hybrid electric vehicles, fuel blends, and fuel

economy measures. This subprogram facilitates deployment and encourages the adoption of alternative fuels through partnerships with local, state, and federal agencies; public health and transportation departments; commercial fleets; transit agencies; and other government offices; as well as 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 2 billion gallons.

The VT program's education activities include 10 Graduate Automotive Technology Education Centers of Excellence at nine U.S. universities, and advanced student engineering competitions. The latest student competition, EcoCAR: The Next Challenge, challenges university students to reduce the environmental impact of vehicles by minimizing the vehicle's fuel consumption and reducing its emissions while retaining the vehicle's performance, safety and consumer appeal. Many students who graduate from the student vehicle competitions, and from the GATE Program, go on to take jobs in the auto industry, government, and academia, where they bring unprecedented appreciation and understanding of advanced automotive technologies.

## For More Information

Contact the EERE Information Center  
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