

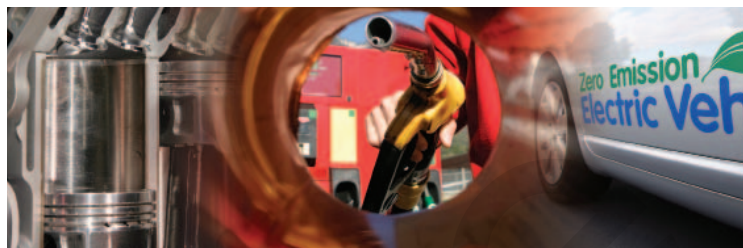
Improving Vehicle Efficiency, Reducing Dependence on Foreign Oil

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, lightweight, high-strength materials can significantly reduce vehicle weight without compromising safety.



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

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 \$4 billion annually.

Partnering for Success

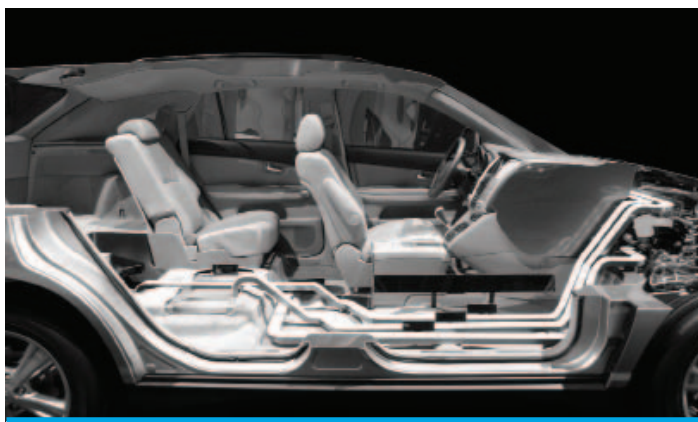
The program's success depends on its relationship with universities, vehicle and engine manufacturers, material suppliers, nonprofit technology organizations, energy suppliers, and national laboratories. DOE's partnerships with industry identify and select appropriate R&D objectives to achieve its and 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.



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

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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, lightweight, 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 nonpetroleum 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 team is developing advanced lubricants to lower the friction losses in new and legacy vehicles and evaluating alternative fuels that could displace conventional petroleum-derived fuels.

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.

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 2: Plugging into 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.

Energy Efficiency

The Recovery Act offers financial incentives for EERE awards Energy Efficiency and Conservation Block Grants to local governments, states, U.S. territories and Indian tribes to support activities that reduce energy use and fossil fuel emissions, create jobs, and improve energy efficiency in all sectors. The funding supports energy audits and energy efficiency retrofits in residential and commercial buildings, the development and implementation of advanced building codes and inspections, and the creation of financial incentive programs for energy efficiency improvements.

Better Biodiesel Through Chemistry

In addition to FPL's strong commitment to biodiesel, much of the company's biodiesel success is attributed to its stringent fuel testing and handling program. Diesel vehicles operate well on high-quality B20, but off-specification or degraded B20 can cause problems such as fuel filter clogging.

To prevent these issues, FPL starts by screening biodiesel producers, working only with those who are BQ-9000 certified¹ and prequalified via a detailed checklist. It then tests fuel quality throughout the distribution and storage processes: before the producer delivers the B100 to FPL, before the B100 is blended with petroleum diesel (to produce B20) and stored in FPL's tank, and continually during storage. The B100 must meet all parameters of the ASTM D-6751 biodiesel standard as well as FPL's own more stringent requirements for acidity, glycerin content, and oxidation stability. This includes use of biocide and antioxidant additives to extend the biodiesel's shelf life. Florida's warm, humid climate is conducive to organism growth in biodiesel, so FPL requires that producers add stabilizing additives at the point of origin. As a result, FPL has been able to store its treated B20 for up to 2 years.

"Watching the broader market experience with biodiesel, it's obvious to us that the benefits of ensuring quality from the producer to the final fuel deployment have more than justified the investment in building the expertise needed to manage fuel quality,"

The Road Ahead

FPL plans to use Alternative Compliance petroleum-reduction strategies to "green" its fleet and meet its EPCRA obligations in 2010 and beyond. One benefit of this approach is that Alternative Compliance allows for 100% of fleet requirements to be met through purchase and use of biodiesel. FPL is also reducing petroleum use through acquisition of heavy-duty HEV bucket trucks and material handlers as well as light-duty HEV sedans and sport-utility vehicles. The fleet currently has more than 300 HEVs, mostly Toyota Priuses and Ford Escapes. FPL has even converted some of its HEVs into plug-in HEVs and is testing their performance.

"FPL's biodiesel program, in conjunction with other measures like HEVs and improved vehicle efficiency, has created an opportunity to operate a large fleet on renewable fuels and to lower emissions dramatically—at an affordable cost," says Survant.



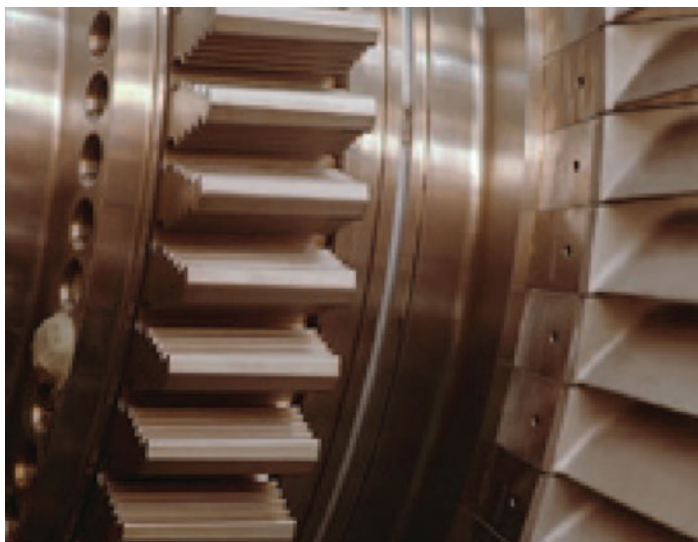
FPL provides electricity to more than 4.5 million customers in Florida and relies on its 2-million-gallon B20 storage tank to ensure a stable supply of biodiesel. *Photo credit*

For more information about FPL's advanced transportation efforts, contact Patti Earley, fleet fueling operations supervisor, at Patti.Earley@fpl.com or 561-904-3222. For more about biodiesel, visit the Alternative Fuels and Advanced Vehicles Data Center (www.afdc.energy.gov/afdc/fuels/biodiesel.html) and National Biodiesel Board (www.biodiesel.org) Web sites. For more information about the Alternative Compliance option to comply with EPCRA requirements, visit the EPCRA Program Web site (www.eere.energy.gov/vehiclesandfuels/epact).

Florida Power & Light Company (FPL)—one of the nation's largest electric utilities—relies heavily on biodiesel to comply with the Energy Policy Act of 1992 (EPCRA). In the process, it has become a biofuel leader, reducing petroleum use and pollutant emissions throughout Florida.

"We use biodiesel because it works with our existing vehicles and infrastructure and because it's a truly renewable fuel made from U.S. feedstocks like soy and sunflower oil," says George Survant, FPL's director of fleet services. "Biodiesel is in sync with FPL's corporate commitment to renewable energy."

This strong commitment to renewable energy, a successful biodiesel fueling infrastructure strategy, and a robust fuel quality—assurance program set an example for other fleets who are seeking to comply with EPCRA while providing environmental and energy security.



Caption here. Photo from Florida Power Company, NREL/PIX 17237

Applying for Recovery Act Funding

The easiest method for tracking EERE funding opportunity announcements specific to the Recovery Act is through the DOE Recovery Act Web site—www.energy.gov/recovery. First-time applicants should register before submitting applications. Applicants should register early as the process can take up to two weeks. Be sure to read and follow the instructions carefully to avoid delays and the possibility of missing funding opportunities.

New processes have demonstrated high levels of conversion efficiency and yields, with improved process economics.

Research, Development, and Demonstration Grants

DOE uses a competitive solicitation process to select research, development, and demonstration projects, as well as industrial energy efficiency projects. Grants, contracts, cooperative agreements, and other transactions to companies, universities, and other entities are selected through a competitive process.

Energy Efficiency and Conservation Block Grants

EERE awards Energy Efficiency and Conservation Block Grants to local governments, states, U.S. territories and Indian tribes to support activities that reduce energy use and fossil fuel emissions, create jobs, and improve energy efficiency in all sectors. The funding supports energy audits and energy efficiency retrofits in residential and commercial buildings, the development and implementation of advanced building codes and inspections, and the creation of financial incentive programs for energy efficiency improvements. Other activities that could receive funding include transportation programs designed to conserve energy, projects to reduce and capture methane emissions from landfills, renewable energy installations on government buildings, energy-efficient traffic signals and street lights, combined heat and power systems, and district heating and cooling systems.

Program Goals

- By 2012, develop technologies to make ethanol from cellulosic feedstock more cost-competitive.
- By 2017, create an environment conducive to sustainable biofuels production, including cost effective technology, supportive infrastructure, and market acceptance.
- By 2022, facilitate U.S. biorefinery production of 21 billion gallons of cellulosic and advanced biofuels.

State Energy Program

Under the State Energy Program (SEP), EERE provides funding to states and territories to design and implement energy efficiency and renewable energy programs that address energy priorities. SEP strength efficiencies include general education, transportation efficiency, building energy efficiency, industrial energy efficiency, and utility clean energy efforts.

If you have questions about the Recovery Act and the funding allotted to EERE, please contact the EERE Information Center at www.eere.energy.gov/informationcenter/ or 1-877-337-3463.