FOCUS AREA
LDVs
Light-Duty Vehicles

- **Deployment pathways issues being considered include the use of advanced LDV technology, transition challenges, and strategies to facilitate an efficient transition to advanced technologies, including current programs (e.g., Clean Cities, Federal Fleets).**

- **Non-cost barriers, such as range anxiety, refueling availability, technology reliability, and lack of consumer familiarity, are being classified according to their cause, estimated magnitude of effect, and ease of mitigation.**

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WHY

Understand Pathways to Reduce Petroleum Consumption and Greenhouse Gas Emissions While Improving Transportation Services

The transportation sector is an engine of economic strength. Automakers, drivers, fleet operators, legislators, and regulators of the future will face challenges in enabling growth while reducing impacts on climate change and lowering dependence on petroleum. Transportation currently accounts for 71% of total U.S. petroleum consumption and 33% of its total carbon emissions. If the nation seeks to address the associated economic, environmental, and security effects, transportation stakeholders will need to follow a pathway toward reduced greenhouse gas (GHG) emissions and petroleum dependence.

Although considerable analysis has been conducted on these issues in recent years, significant research opportunities remain. The U.S. Department of Energy (DOE) has explored how low-carbon 2050 scenarios can be achieved through technologies supported by its Office of Energy Efficiency and Renewable Energy (EERE). One scenario would reduce greenhouse gas emissions by 83% below 2005 levels, shrink the share of internal combustion engine vehicles to less than 10%, and produce 60 billion gallons of biofuels per year.

These scenarios are not predictions or goals, but can help identify opportunities to add to the DOE's research portfolio. They highlight actions needed in addition to research in order to create a market and policy climate receptive to advanced transportation technologies and systems. Addressing these areas can help inform decisions about transportation energy research investments, as well as the role of advanced transportation energy technologies and systems in the development of possible new physical, strategic, and policy pathways.

FOCUS AREA
NLDVs
Non-Light-Duty Vehicles

- **Opportunities to improve the efficiency of heavy highway vehicles, including medium and heavy trucks, and off-road and non-road modes, including aircraft, ships, railroads, mobile equipment, and pipelines, are being examined in greater detail than that found in existing analyses.**

- **Mode-switching opportunities, such as moving freight from trucks to rail and ships or passengers from air to rail travel, are being evaluated, and quantitative estimation methods are being developed and reviewed.**

A Study to Identify Short-and Long-Term Solutions

DOE has conducted a study to pinpoint underexplored GHG-abatement and oil-savings opportunities related to transportation. This Transportation Energy Futures (TEF) study connects strong leadership with top-notch analytical expertise to consolidate current transportation energy knowledge, advance analytic capacity-building, and explore additional opportunities for sound strategic action. Analysis of specific issues and associated key questions is intended to strengthen the existing knowledge base and help cultivate partnerships among federal agencies, state and local governments, and industry.

The study's primary goal is to help address high-priority questions, informing domestic decisions about transportation energy strategies, priorities, and investments. Results are being documented in written reports, analytic tools, and data that will be disseminated and discussed with stakeholders. The project involves gathering a compendium of existing studies and findings, and conducting original research and analysis in previously less-examined areas identified as having the greatest potential impact on GHG emissions and oil use.

Research and analysis are being conducted with an eye toward short-term actions that support long-term solutions. The study encompasses more than just the impact of technology and examines each key question in the context of the marketplace, consumer behavior, industry capabilities, and the energy and transportation infrastructure.

Transportation Energy Use by Mode, Through 2035
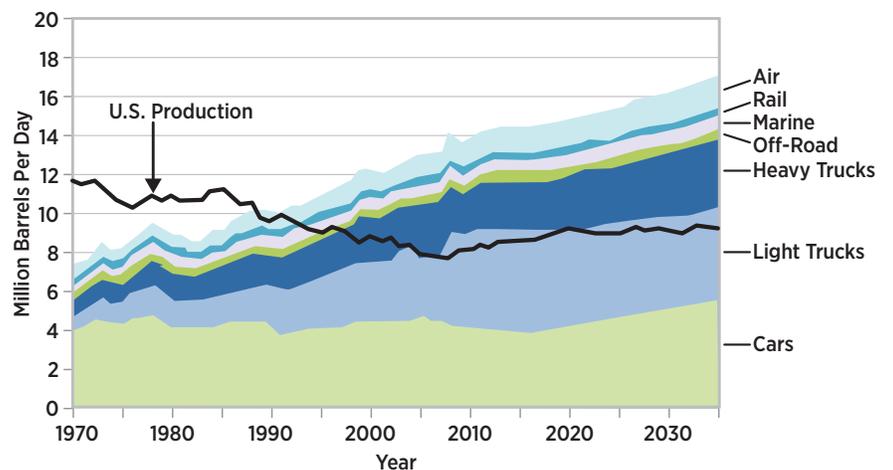
Sources: Historical information from *Transportation Energy Databook 28*
Forecasts from the *Energy Information Administration Annual Energy Outlook 2010*

FOCUS AREA
FUELS

- **Infrastructure expansions required for deployment of low-GHG-intensity fuels (especially electricity, biofuel, and hydrogen) are being compared through a consistent evaluation framework.**

- **Biomass resource demand and supply are being analyzed to explore allocations for transportation, electricity generation, and other applications, as well as for different uses within the transportation sector.**

## Pinpointed Research on Four Topic Areas

The team is collecting and compiling existing literature and conducted original research analysis in areas that have not been thoroughly examined for their potential impact on GHGs and oil dependency. The four primary areas under exploration are light-duty vehicles (LDVs), non-light-duty vehicles (NLDVs), fuels, and transportation demand.

Across the study's analytic topics, team members are:

- Reviewing the state of knowledge and available tools.
- Generating new tools for novel transportation analysis.
- Analyzing the cost of possible low-carbon scenarios.
- Analyzing potential actions by DOE and other federal agencies.
- Pairing analytic outputs with research, deployment, and policy recommendations.
- Summarizing findings in issue papers.

Final TEF deliverables will include a flexible suite of issue papers to support formulation of comprehensive transportation strategy, along with a series of analytical tools for ongoing examination of individual issue areas.

Potential Transportation CO_2 Emissions Reduction 2050 Scenario
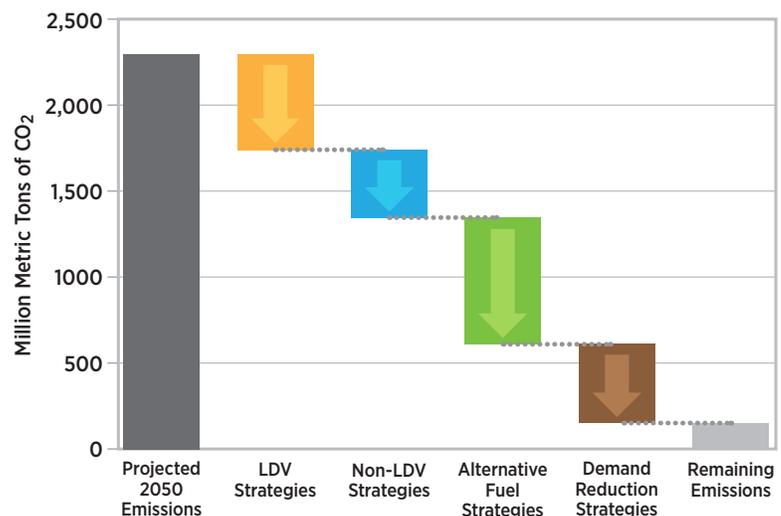
Colored bars represent possible CO_2 reductions resulting from strategies applied to each studied sector. Initial projections only.

Photo from Corbis/CB008806

Figure by Raymond David/NREL

FOCUS AREA
TRANSPORTATION DEMAND

Changes in transportation demand are being assessed to understand underlying transportation service needs, relationships to transportation technologies and systems, and quantification methods. These transportation demand changes include:

- **Community development and urban planning opportunities to save energy and abate GHGs.**
- **Trip reduction through mass transit, teleworking, teleshopping, and carpooling.**
- **Efficient driving, including driver behavior and driver feedback.**
- **Freight demand, including trends in freight needs and considerations in exploring possible future use levels.**

Photo from iStock/2294764

INITIAL FINDINGS

Significant Impact Via Multiple Strategies

Initial TEF findings spotlight the potential for deep reductions in petroleum use and GHG emissions—possible only if a number of strategies are implemented in concert and significant barriers are overcome.

Technology improvements in advanced light-duty vehicles promise to transform markets if significant barriers fall, including the already well-researched high cost of advanced vehicles and other barriers that TEF investigated: consumer unfamiliarity, limited availability, and short driving range. In addition, manufacturers' investment risks must be addressed to accelerate market growth.

Non-light-duty-vehicle petroleum use and GHG emissions are projected to increase as economic growth spurs higher service demand. Reaching the technical potential for energy-efficiency improvements would stabilize energy use in this subsector.

TEF estimates that retail infrastructure costs for all types of fuels, including electricity and hydrogen, are expected to be small relative to total fuel costs. Even in deep emission reduction scenarios, fuel production capacity expansion is similar in magnitude to current infrastructure projections. Biofuels can compete successfully with petroleum to reach significant levels in mature markets with projected costs, based on market equilibrium modeling.

Demand intensity reduction options that appear to hold the most promise include policy-driven changes to the built environment; strategies to decrease personal travel and improve its energy efficiency; and moderating freight demand overall, while switching truck freight to more-energy-efficient rail and waterway modes.

The TEF project confirms the potential of multiple strategies, and reveals that combined implementation may be the most effective path to lower transportation energy use and GHG emissions.

Final reports will be posted to eere.energy.gov/analysis/transportationenergyfutures.

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