Transportation Energy Futures
Project Overview and Findings
Transportation Energy Futures

Modes

Service Demand

Fuels
Outline

• Approach and motivation for the study
• Key findings from primary topic areas
• Study conclusions regarding transportation energy consumption and emissions reduction potential.
Transportation Energy Futures: A Landmark Collaboration

• TEF is a project implemented by EERE, ANL, NREL, and draws upon broad expertise from EPA, DOT, academia, and private sector advisors to address underexplored opportunities in transportation.

• TEF is cross-sector; it includes elements for light-duty, non-light duty, fuels, and transportation demand.

• TEF consists of nine published technical reports as well as summary material.
Scoping and Review

- Built on a foundation of previous and ongoing DOE, DOT, and EPA analysis
- Selected a 19-member steering committee of experts from industry, academia, government, and non-profits
- Refined the topic list into a set of highest-priority issues to cover in partnership between the steering committee and project team
- Engaged experts for extensive peer review throughout the project.
Scoping and Review

Areas of Study

Possible Topics

Specific Subjects Studies to Produce 9 Reports

Topic
Topic
Topic
Topic
Topic
Topic
Topic
Topic
Topic

Summary Materials (Output)

Ongoing Analysis (DOE, EPA, DOT, etc.)
Key Findings/Modes

LDVs
- Car
- SUV
- Passenger Van

Non-LDV
- Buses
- Rail
- Marine
- Airplane
- Trucks
- Pipeline
- Military
Current transportation energy use is closely split between LDV and Non-LDV

2011: 27.4 quadrillion Btu of transportation energy use

LDV 55%

Non-LDV 45%

Trucks and Buses 21%
Aviation 7%
Marine 4%
Pipeline 3%
Rail 2%
Off-Road 8%
Vehicle efficiency improvements are essential to balance increases in travel and freight demand

Effects of vehicle efficiency improvements and use increases on net energy consumption by 2050

<table>
<thead>
<tr>
<th></th>
<th>LDVs</th>
<th>Trucks</th>
<th>Aviation</th>
<th>Inland Marine</th>
<th>Ocean Marine</th>
<th>Rail</th>
<th>Pipeline</th>
<th>Off-road</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle energy efficiency improvements</strong></td>
<td>61%</td>
<td>50%</td>
<td>65%</td>
<td>30%</td>
<td>75%</td>
<td>35%</td>
<td>20%</td>
<td>18%</td>
</tr>
<tr>
<td><strong>Vehicle use increases</strong></td>
<td>75%(^a)</td>
<td>87%(^a)</td>
<td>217%(^b)</td>
<td>32%(^a)</td>
<td>450%(^c)</td>
<td>47%(^a)</td>
<td>16%(^a)</td>
<td>20%(^d)</td>
</tr>
<tr>
<td><strong>Net changes in total energy consumption</strong></td>
<td>-32%</td>
<td>-17%</td>
<td>+11%</td>
<td>-8%</td>
<td>+38%</td>
<td>-4%</td>
<td>+1%</td>
<td>-6%</td>
</tr>
</tbody>
</table>

\(^a\) EIA projections extrapolated.  
\(^b\) FAA projections extrapolated.  
\(^c\) Growth in dollar value of trade (EIA).  
\(^d\) Projected at half the population growth.
Advanced vehicles have the potential to dominate the LDV market by 2050

See studies for additional scenario vehicle mixes.
Non-cost barriers to adoption of advanced vehicles must be overcome to reach such scenarios

<table>
<thead>
<tr>
<th>Non-Cost Barrier</th>
<th>Relevant Factors</th>
<th>Possible Policy Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited driving range and fueling/charging stations</td>
<td>Vehicle range, Driver mobility needs, Local conditions, Driver’s value of time</td>
<td>Subsidization of charging/fueling stations, Information</td>
</tr>
<tr>
<td>Unfamiliarity, Lack of awareness</td>
<td>Prevalence of new technology, Preferences of early adopters</td>
<td>Labeling, Information, Outreach programs</td>
</tr>
<tr>
<td>Bias or perceived negative differences, Uncertainty of benefits</td>
<td>Social and behavioral factors</td>
<td>Information, Outreach programs</td>
</tr>
<tr>
<td>Lack of adequate standards</td>
<td>Maturity of new technologies, Potential for incompatibilities or safety issues</td>
<td>Testing and standards development</td>
</tr>
<tr>
<td>Limited availability in models/makes</td>
<td>Consumer preferences, Modularization of design and manufacturing</td>
<td>R&amp;D on modularization</td>
</tr>
</tbody>
</table>
Key Findings: Fuels

- Petroleum
- Biofuels
- Electricity
- Hydrogen
Petroleum is the dominant fuel for the current transportation system

2011: 27.4 Quadrillion Btu of transportation energy use
Biofuels can displace significant volumes of petroleum in future fuel markets.
Total fuel retail capital costs remain small relative to total annual fuel costs in advanced fuel scenarios.
Key Findings: Service Demand

Moving People

Moving Freight
Coordinated demand reduction strategies can lead to significant savings while maintaining service quality.

<table>
<thead>
<tr>
<th>Demand Reduction Strategy</th>
<th>Impact Type</th>
<th>Potential Magnitude of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built Environment Characteristics</td>
<td>LDV VMT reduction</td>
<td>12-18% (15% used for summary)</td>
</tr>
<tr>
<td>Trip Reduction</td>
<td>LDV VMT reduction</td>
<td>1-10% (5% used for summary)</td>
</tr>
<tr>
<td>Efficient Driving</td>
<td>MPG improvement</td>
<td>1-5% (5% used for summary)</td>
</tr>
<tr>
<td>Non-LDV Mode Switching</td>
<td>Ton-miles switched</td>
<td>&lt;10% (10% used for summary)</td>
</tr>
</tbody>
</table>

2011: 27.4 quadrillion Btu of transportation energy use
TEF Conclusions: Deep reductions in transportation energy use are technically possible by 2050...

Projected 2050 Petroleum Use and Potential Reductions
...As are deep reductions in transportation greenhouse gas emissions

(Source: Summary of prior values in presentation)
For More Information

- TEF Website with papers: [http://www1.eere.energy.gov/analysis/transportationenergyfutures/](http://www1.eere.energy.gov/analysis/transportationenergyfutures/)

- TEF represented in an online scenario analysis tool: [https://bites.nrel.gov/inputs.php?id=1146](https://bites.nrel.gov/inputs.php?id=1146)

- Many of the vehicle and fuel cost assumptions are also in the “Transparent Cost Database,” available at: [openei.org/tcdb/](http://openei.org/tcdb/)

- For questions, contact [eere.analysis@EE.Doe.Gov](mailto:eere.analysis@EE.Doe.Gov).