Reducing Energy Use through Transport Planning in the United States: Proven and Promising Practices

presented to
IEA Experts’ Group on R&D Priority Setting and Evaluation

presented by
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Transportation leadership you can trust.
Overview

- U.S. Context and Trends
- Effectiveness of Energy/GHG Reduction Strategies
- How do We Get There?
- Research Needs
U.S. energy and climate change mitigation experience

- National-scale assessment studies
  - Moving Cooler, USDOT Report to Congress, National Renewable Energy Lab - Transportation Energy Futures

- State and Metropolitan Planning Organization (MPO) GHG & energy inventories, mitigation plans, & tools
  - Massachusetts, Maryland, Oregon, Southern California, Northern New Jersey
Transportation declines slightly to about one-quarter of U.S. energy consumption.

Energy consumption by sector, quadrillion BTU

Source: Energy Information Administration, Annual Energy Outlook 2013 (Reference Case)
Transport energy use expected to hold steady, but modal contributions change.

Energy consumption, quadrillion BTU

Source: Energy Information Administration, Annual Energy Outlook 2013 (Reference Case)
Rapid growth in freight truck activity expected

Growth in Activity by Mode (index to 2010)

- Commercial trucks & buses
- Light-duty passenger vehicles
- Air
- Shipping & rail freight

Source: Energy Information Administration, Annual Energy Outlook 2013 (Reference Case)
The United States has low urban densities and high distance traveled. The graph shows the relationship between population density (persons/hectare) and distance traveled (km/person/day) across different regions. The data source is from a CS analysis of the Millennium Cities Database for Sustainable Transport (2001).
The United States has more than twice the distance traveled per capita compared to European countries.

**Total Private Vehicle-KM/Capita**

- **Source:** CS analysis of UITP Millennium Cities Database for Sustainable Transport (2001)
VMT has stopped growing … will the trend last?

Total VMT (millions)

VMT per Capita

Source: Sundquist, E., State Smart Transportation Initiative, 2013
Urban development trends are changing—at least in some areas

Large metropolitan regions with the greatest increase in share of infill home construction

Effectiveness of Energy/GHG Reduction Strategies
Moving Cooler –
GHG reduction potential of ~50 strategies

Travel Reduction
- Pricing
- Land use and smart growth
- Nonmotorized transportation
- Public transportation improvement
- Regional ride-sharing, car-sharing and commuting
- Regulatory strategies

System Efficiency
- Operational and intelligent transportation systems (ITS)
- Bottleneck relief and capacity expansion
- Multimodal freight
Moving Cooler - sample results

Total Surface Transportation Sector GHG Emissions (mmt)

- **Study Baseline**
- **Aggressive**
- **Economy-Wide Pricing**

1990 & 2005 GHG Emissions – Combination of DOE AEO data and EPA GHG Inventory data
Study Baseline – Annual 1.4% VMT growth combined with 1.9% growth in fuel economy
Aggressive – GHG emissions from bundle deployed at aggressive level without economy wide pricing measures

Source: Moving Cooler, Prepared for Urban Land Institute by Cambridge Systematics, 2009
Northern New Jersey - 68% GHG reduction feasible by 2050

Source: Greenhouse Gas Mitigation Plan developed by Cambridge Systematics for North Jersey Transportation Planning Authority, 2012
Combined impact of demand management/efficient driving strategies could be 7-15%.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Percentage of On-Road Energy/GHG Reduction</th>
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<tbody>
<tr>
<td>Pricing</td>
<td></td>
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<tr>
<td>PAYD Insurance (Mandatory)</td>
<td>2.5%</td>
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<tr>
<td>VMT Fee – $0.02-$0.05/Mile</td>
<td>1.0%-2.5%</td>
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<tr>
<td>Congestion Pricing</td>
<td>0.5%-1.1%</td>
</tr>
<tr>
<td>Transit Improvements</td>
<td>0.4%-1.1% (2030); 0.6%-2.0% (2050)</td>
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<tr>
<td>Nonmotorized Improvements</td>
<td>0.3%-0.8%</td>
</tr>
<tr>
<td>Parking Management</td>
<td>0.3%</td>
</tr>
<tr>
<td>Work Site Trip Reduction/Employee Commute Options</td>
<td>0.2%-1.1%</td>
</tr>
<tr>
<td>Telework and Alternative Work Schedules</td>
<td>0.9%-1.1%</td>
</tr>
<tr>
<td>Ridesharing and Vanpooling</td>
<td>0.1%-2.0%</td>
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<tr>
<td>Carsharing</td>
<td>0.1%-0.2%</td>
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<tr>
<td>Educational and Marketing Campaigns</td>
<td>0.3%-0.5%+</td>
</tr>
<tr>
<td>Eco-Driving and Maintenance</td>
<td>1.1%-5.0%</td>
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<tr>
<td>Idle Reduction</td>
<td>0.1%-0.4%</td>
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<tr>
<td>Speed Limit Reduction/Enforcement</td>
<td>1.7%-2.7%</td>
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<tr>
<td><strong>Combined Effects</strong></td>
<td><strong>7.0%-15.3%</strong></td>
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Land use changes are key to long-term benefits

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<tbody>
<tr>
<td>2050 % new/re-development</td>
<td>41-55%</td>
<td>64%</td>
<td>67%</td>
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<tr>
<td>% of new devel. that is “compact”</td>
<td>25-75%</td>
<td>43-90%</td>
<td>60-90%</td>
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<tr>
<td>VMT in compact development</td>
<td>5-25% lower</td>
<td>23% lower</td>
<td>30% lower</td>
</tr>
<tr>
<td>Urban light-duty VMT reduction</td>
<td>1-11%</td>
<td>2-13%</td>
<td>12-18%</td>
</tr>
<tr>
<td>Transportation GHG/energy reduction</td>
<td>0.6 – 6.5%</td>
<td>2.0 – 3.4%</td>
<td>7 – 10%</td>
</tr>
</tbody>
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Another look at land use impacts

- Shift population from lower-density, single-use areas to higher-density, mixed-use areas (up to 15% in 2030, 30% in 2050)
- Pedestrian environment improvements

Source: Built Environment Analysis Tool developed by CS for National Renewable Energy Laboratory, 2012
Conclusions regarding transportation energy and GHG reduction potential in the U.S.

- Recently-adopted fuel economy standards will reduce surface transport energy by over one-third by 2035, compared to a previously flat baseline.

- More aggressive vehicle and fuel technology strategies could reduce energy use by over half.

- Land use and travel demand/efficiencies provide smaller, but still important benefits.
  - Land use could achieve up to 10% reduction in VMT by 2050, 6% reduction in energy/GHG.
  - Other travel reduction/demand management could achieve 7-15% reduction collectively (surface transportation).
How do We Get There?
The U.S. planning context

National (Federal)
- Vehicle and fuel standards and fuel pricing
- Transport planning - procedural requirements, funding, and technical assistance

State
- Transport investment priorities (non-metropolitan)
- Roadway design standards
- Freeway/arterial systems management
- Freeway/arterial systems management

Regional (MPO)
- Transport investment priorities (metropolitan)
- Transit investment
- Freeway/arterial systems management
- Voluntary cooperation on land use, etc.

Local (City, County, Town)
- Land use planning
- Local transport investment priorities & design standards
- Bicycle and pedestrian infrastructure
Some energy reduction measures look familiar…

“Transportation Control Measures” in the 1990 Clean Air Act Amendments

1. Improved public transit
2. HOV lanes
3. Employer-based transportation management
4. Trip-reduction ordinances
5. Traffic flow improvements
6. Park-and-ride
7. Auto-restricted zones
8. High-occupancy vehicle programs
9. Spatial or temporal restriction on motorized vehicle use of roads
10. Bicycle parking and lanes
11. Idle control programs
12. Extreme cold-start emissions control
13. Flexible work schedules
14. Programs to facilitate non-automobile travel
15. Non-motorized paths
16. Vehicle scrappage
... some are fairly new

**Demand Management**
- VMT fees and congestion pricing
- Pay-as-you-drive insurance
- “Smart” parking management
- Dynamic ridesharing
- Car-sharing and bike-sharing programs
- Real-time, multimodal travel information
- Location-based marketing

**System Efficiency**
- Eco-driving with real-time feedback
- Dynamic eco-routing
- Eco-adaptive traffic signals & corridor management
- Low-emissions zones
All metro areas required to set GHG reduction targets for passenger vehicles for 2020 and 2035 (vs. 2005)
  » Met through transport planning and land use strategies
  » Target reductions of 5-8% in 2020, 10-15% in 2035 (larger areas)
  » Achieve 2.8% of state’s GHG reduction goal for 2020 (5 MMT)

Required to adopt “Sustainable Communities Strategy” as part of Regional Transportation Plan
  » Approval by state air agency = environmental review exemptions for certain types of development
  » Alternative Planning Strategy (APS) – does not meet target
Planning innovations - regional visioning and scenario planning

- Multi-sectoral - transportation, land use, housing, economic development, environment
- Extensive public and stakeholder involvement process
- GIS-based data and technical tools to support indicator development
Planning innovations (example) – Sacramento Blueprint

- Increased residential density, mixed-use areas, expanded transit
- 25% reduction in VMT, 15% reduction in CO₂ from base case by 2050

Source: Sacramento Area Council of Governments
Federal criteria for transit-supportive land use, plans & policies - required in assessment of new transit project funding since late 1990s.
Challenges to reducing transport energy use

- Historically auto-oriented development patterns
- Fragmented/multi-level decision-making environment
- Strong private property rights ethic
- No appetite for Federal requirements or for pricing of externalities
- Gas is still cheap
Opportunities

- Shifting demographic trends and lifestyle preferences
- Changing economics
- Interest and innovations in voluntary, regional-scale planning
- “Leader” states stepping in where Federal government cannot
- New technology to support travel efficiencies
Research Needs

- Continued demonstration, deployment, and evaluation of new technologies to promote travel reduction/efficient driving
  - Pricing (congestion, VMT, PAYD)
  - Dynamic ridesharing
  - Eco-driving & eco-system operations
  - Real-time information
- Strategy interactions – land use, transit, pricing, TDM
- Long-term impacts of telework, teleshop, etc. (including location decisions)
- Urban form – measures and impacts (economic, accessibility, etc.)