Reducing Light-Duty Vehicle GHG Emissions: Technologies and Policies

Presentation by
Coralie Cooper
Transportation Program Manager
NESCAUM

Transportation Solutions to Climate Change
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NESCAUM – Who We Are

• Northeast States For Coordinated Air Use Management formed in 1967 by the region’s Governors
• Nonprofit association of air pollution control agencies in the 6 New England States, New York & New Jersey
• Provide technical assistance and policy guidance to member states on air pollution issues of regional concern
Presentation Overview

- Inventory overview
- Near-term technologies to reduce light-duty vehicle GHGs
- Advanced technologies to reduce GHGs
- Policy options to reduce GHGs
- Conclusions
Highway Vehicle GHG Inventory
Light-Duty Contribution to Highway Vehicle Greenhouse Gas Emissions

Highway Vehicle GHGs
USA
- HD vehicles 18%
- MD vehicles 3%
- Cars and light trucks 79%

Highway Vehicle GHGs
Eastern Canada
- HD vehicles 26%
- MD vehicles 6%
- Cars and light trucks 68%

Source: EIA
Source: Natural Resources Canada
Near Term Technologies to Reduce GHGs
Near Term Technologies

- Many technologies already in “full volume” production (500,000 units/year or more)
- Examples include: variable valve lift and timing, 6-speed automatic transmissions, electric power steering, improved air conditioning, turbocharging and downsizing, 42 volt ISG or “mild hybrids” and others
- Some technologies widely used in Europe but not yet in the U.S. – diesels, gasoline direct injection, and automated manual transmissions
- Widespread introduction could occur between 2009 and 2016
Near Term Technologies

Cylinder Deactivation

2005 Chrysler 300C Hemi

Automated Manual Transmission Audi TT

Audi TT 3.2 V6

Source: CARB
Near Term Technologies (continued)

Acura RSX

Variable valve timing & lift

Honda Accord

Toyota Matrix

Source: CARB
Lifetime vehicle costs with reduced GHG emissions

CO\textsubscript{2} Reduction from 2002

Supply Curve @ $2.00 per Gallon
Supply Curve @ $1.58 per Gallon
Advanced Technology Vehicles
Advanced Technology Vehicles

- Either not yet in “full volume” production or still in development
- Full volume sales of Prius-type hybrids
- Diesel hybrids
- HCCI – homogeneous charge compression ignition engines
- Electrohydraulic camless valve actuation
- Fuel cell vehicles
- Plug-in hybrid-electric vehicles
- Electric vehicles (neighborhood and full function electrics)
- Flex fuel vehicles, flex fuel plug-in hybrids
Plug-in Hybrids

- One OEM plug-in hybrid in production – DC “sprinter”
- New York Times plug-in hybrid delivery van in New York City
- NYSERDA plans to equip 600 NYS fleet hybrids with plug-in capability - first vehicles scheduled for delivery this month
- Issues include: certification, verifying mpg, winter operation, warranty, cost

Daimler Chrysler
25 mile all-electric range
Fuel Cell and Electric Vehicles

• Fuel cell or electric vehicles required as part of the Zero Emission Vehicle requirement of LEV II
• 250 fuel cells expected to be placed in service between now and 2008 (nationwide)
• Approximately 10,000 ZEVs will be required in the Northeast (2012-2014)
• From 2014-2017, ~25,000 required
• Several fuel cell vehicles currently placed in the Northeast
• Few electric vehicles in service – but still being produced
Policies to Reduce Light-Duty GHGs
Policies to Reduce GHGs

• California Low Emission Vehicle Program (LEV II) including:
  • Zero Emission Vehicle (ZEV) requirement
  • Light-duty greenhouse gas standards
• Executive orders to reduce fuel consumption in state fleets
• Incentives for hybrids
• Feebates
• Incentives for advanced technology vehicles – carsharing and station cars
California LEV II Program

- 10 states outside of CA have adopted the program in lieu of the federal light-duty standards
- The ZEV requirements are currently phasing in
- The LEV GHG standards go into effect in 2009
- LEV GHG standards require a 22% reduction in new vehicle GHG emissions in 2012, and a 30% reduction in 2016
- NESCAUM estimates an 18% reduction in fleet GHGs in 2020 and a 24% reduction in 2030
- ZEV mandate provides a modest (2.5%) reduction
## GHG Reductions Resulting from LEV II

<table>
<thead>
<tr>
<th>State</th>
<th>Baseline GHGs (millions of tons)</th>
<th>With GHG regulation (millions of tons)</th>
<th>GHGs reduced in 2030 (millions of tons)</th>
<th>Percent reduction from baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut</td>
<td>18.2</td>
<td>13.8</td>
<td>4.4</td>
<td>24%</td>
</tr>
<tr>
<td>Maine</td>
<td>8.8</td>
<td>6.7</td>
<td>2.1</td>
<td>24%</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>28.8</td>
<td>21.9</td>
<td>6.9</td>
<td>24%</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>5.5</td>
<td>4.1</td>
<td>1.4</td>
<td>26%</td>
</tr>
<tr>
<td>Vermont</td>
<td>5.0</td>
<td>3.8</td>
<td>1.2</td>
<td>24%</td>
</tr>
<tr>
<td>Total</td>
<td>66.3</td>
<td>50.3</td>
<td>16.0</td>
<td>24%</td>
</tr>
</tbody>
</table>
LEV II GHG Reductions (MA)
### LEV GHG Standards: Cost to consumers

<table>
<thead>
<tr>
<th></th>
<th>Near Term (2012)</th>
<th>Mid Term (2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Payment Increase</td>
<td>$7</td>
<td>$20</td>
</tr>
<tr>
<td>Monthly Operating Cost Savings</td>
<td>$18</td>
<td>$23</td>
</tr>
<tr>
<td>Monthly Net Savings</td>
<td>$11</td>
<td>$3</td>
</tr>
</tbody>
</table>
Executive Orders to Reduce Fuel Consumption in State Fleets

- New York State – EO #111 – requires introduction of greater numbers of alternative fuel and advanced technology vehicles in the state fleet. 600 hybrids are in the fleet.
- Massachusetts – EO #388 – requires 10% of fleet purchases be ZEVs, and sets targets for fuel economy.
- Rhode Island – sets fuel economy target for state fleets, limits purchase of SUVs, requires purchase low rolling resistance tires and improved lube oil.
- Other states and jurisdictions also have requirements.
## Hybrid Cars and SUVs

<table>
<thead>
<tr>
<th>Car type</th>
<th>make</th>
<th>model</th>
<th>city/hwy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Car</td>
<td>Honda</td>
<td>Civic</td>
<td>49/51</td>
</tr>
<tr>
<td>Medium Car</td>
<td>Honda</td>
<td>Accord</td>
<td>28/35</td>
</tr>
<tr>
<td>Medium Car</td>
<td>Lexus</td>
<td>GS 450h</td>
<td>25/28</td>
</tr>
<tr>
<td>Medium Car</td>
<td>Toyota</td>
<td>Camry</td>
<td>40/38</td>
</tr>
<tr>
<td>Medium Car</td>
<td>Toyota</td>
<td>Prius</td>
<td>60/51</td>
</tr>
<tr>
<td>SUV</td>
<td>Ford</td>
<td>Escape 2wd</td>
<td>36/31</td>
</tr>
<tr>
<td>SUV</td>
<td>Ford</td>
<td>Escape 4wd</td>
<td>32/29</td>
</tr>
<tr>
<td>SUV</td>
<td>Lexus</td>
<td>RX 400h 2wd</td>
<td>32/27</td>
</tr>
<tr>
<td>SUV</td>
<td>Lexus</td>
<td>RX 400h 4wd</td>
<td>31/27</td>
</tr>
<tr>
<td>SUV</td>
<td>Mercury</td>
<td>Mariner 4wd</td>
<td>32/29</td>
</tr>
<tr>
<td>SUV</td>
<td>Saturn</td>
<td>Vue</td>
<td>27/32</td>
</tr>
<tr>
<td>SUV</td>
<td>Toyota</td>
<td>Highlander 2wd</td>
<td>32/27</td>
</tr>
<tr>
<td>SUV</td>
<td>Toyota</td>
<td>Highlander 4wd</td>
<td>31/27</td>
</tr>
</tbody>
</table>
Feebate Program

- Feebate programs impose a fee on the purchase of vehicles that emit high levels of GHGs and provide a rebate to purchasers of low emitting vehicles
- Feebates promote the introduction of technologies that reduce light-duty vehicle GHGs
- Feebates have yet to be implemented in any state
- Modeling suggests that emissions can be reduced over 20% from current levels - using a model developed by Transport Canada to evaluate a feebate program
CA LEV GHG Standards with Feebate

![Graph showing CA LEV GHG Standards with Feebate over time]

- Reference
- CA LEV GHG
- Feebate
Advanced Technology Vehicles – Carsharing and Station Cars

- 30 percent of the U.S. carsharing fleet is made up of hybrids, alternative fuel vehicles, and electric vehicles (Shaheen, et al. 2003)
- CO₂ reductions from carsharing programs (studies suggest VMT reductions are realized with carsharing) can be increased with the use of advanced technology vehicles
- EVermont has a car sharing program planned for 2007 (3 electrics and one plug-in hybrid)
- Some state fleets can be switched to car sharing programs: Philadelphia has eliminated its fleet by car sharing and employees are using more fuel efficient vehicles
Conclusions

- Adopt LEV II (GHG + ZEV) in states and provinces that have not yet adopted the standards
- Consider adoption of feebate programs to encourage introduction of more efficient vehicles
- Provide incentives for hybrid electrics such as reduced tolls, HOV lane access, and preferential parking
- Shift government agency trips to car sharing programs, where possible
- Provide incentives for introduction of advanced technology station cars
- Require introduction of hybrid-electric vehicles and efficient tires in state and provincial fleets
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Contact Information

Coralie Cooper
Transportation Program Manager
NESAUM
617-259-2022
ccooper@nescaum.org
www.nescaum.org