Transit and Reducing Greenhouse Gases: A Look at the Numbers

Presentation for Rail~Volution 2008

Tina Hodges
Program Analyst
Office of Budget and Policy
Federal Transit Administration

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Why Look at the Numbers

• Determine what overall reduction level is needed.
• Determine what role transit can play.
• Communicate transit’s benefits.
• Access new sources of funding.
• Inventory and decrease emissions from transit agency operations.
• Report to Climate Registry and other agencies.
What Level of Reduction is Needed?

IPCC approach:
• Look at impacts at different temperature levels
• Let policy-makers determine what level to target based on impacts

What is IPCC:
• Intergovernmental Panel on Climate Change
• Represents consensus of world's leading climate scientists; U.S. scientists and U.S. government officials well represented
• Issued fourth assessment report in 2007
Examples of impacts associated with global average temperature change

*Impacts will vary by extent of adaptation, rate of temperature change, and socio-economic pathway*

<table>
<thead>
<tr>
<th>Global mean annual temperature change relative to 1980-1999 (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>WATER</td>
</tr>
<tr>
<td>Increased water availability in moist tropics and high latitudes</td>
</tr>
<tr>
<td>Decreasing water availability and increasing drought in mid-latitudes and semi-arid low latitudes</td>
</tr>
<tr>
<td>Hundreds of millions of people exposed to increased water stress</td>
</tr>
</tbody>
</table>

| ECOSYSTEMS       |
| Up to 30% of species at risk of extinction |
| Increased coral bleaching Most corals bleached |
| Widespread coral mortality |
| Terrestrial biosphere tends toward a net carbon source as: |
| ~15% |
| ~40% of ecosystems affected |
| Ecosystem changes due to weakening of the meridional overturning circulation |

| FOOD             |
| Complex, localised negative impacts on small holders, subsistence farmers and fishers |
| Tendencies for cereal productivity to decrease in low latitudes |
| Productivity of all cereals decreases in low latitudes |
| Tendencies for some cereal productivity to increase at mid- to high latitudes |
| Cereal productivity to decrease in some regions |

| COASTS           |
| Increased damage from floods and storms |
| About 30% of global coastal wetlands lost |
| Millions more people could experience coastal flooding each year |

| HEALTH           |
| Increasing burden from malnutrition, diarrhoeal, cardio-respiratory, and infectious diseases |
| Increased morbidity and mortality from heat waves, floods, and droughts |
| Changed distribution of some disease vectors |
| Substantial burden on health services |

*Significant is defined here as more than 40%. Based on average rate of sea level rise of 4.2 mm/year from 2000 to 2080.*
Large Cuts in GHG Emissions Needed

- IPCC: To limit warming to 2–2.4 C (3.6–4.3 F):
  - stabilize greenhouse gas emissions by 2015, and
  - decrease emissions to 50 to 85% below 2005 levels by 2050.

- Target for developed countries likely on high end, ~ 80%
U.S. Greenhouse Gas Emissions Inventory

U.S. Total: 7261 MMT CO₂eq

Electric Power Industry 33%

Transportation 28%
(2014 MMT CO₂eq)

Industry 19%

Agriculture 8%

Commercial 6%

Residential 5%

U.S. Territories 1%

Sources of Transportation GHGs

Freight Trucks 385.8

Light-Duty Trucks 566.7

Passenger Cars 632.9

Commercial Aircraft 158.1

Other Non-Road 176.2

Refrigerants and Lubricants 77.2

Share of Transportation GHGs

3.8%

8.7%

7.9%

19.1%

0.8%

59.5%

Transportation Solutions

Vehicle efficiency
- Fuel economy standards
- Research & development – hybrids, plug-in hybrids, fuel cells, light weight materials, etc.
- Feebates

Carbon content of fuel
- Renewable fuels standard
- Emissions performance standard
- Research on alternative fuels

Vehicle Miles Traveled (VMT)
- Road pricing, parking fees, pay as you drive insurance
- System efficiencies (reduce circuity, idling, congestion)
- Carpooling, telecommuting
- Land use and transportation planning
- Invest in public transportation and other low GHG modes

Effect all 3:
- Cap and trade
- Carbon tax
- Fuel tax
VMT increases cancel out improvements in efficiency and carbon content

Light-Duty Vehicle CO\textsubscript{2} Emissions

- business as usual
- new CAFE standard
- new CAFE standard plus renewable fuel standard (RFS)

Transit’s Role in Reducing GHG Emissions

By moving more people in fewer vehicles, transit can reduce VMT and greenhouse gas emissions.

Photo Credit: City of Ottawa

40 commuters traveling by car

40 commuters traveling by bus.
Investments in Transit can Cut Emissions

Transit has lower emissions per passenger mile.

Efficiencies would be even higher at higher transit ridership levels.

Heavy Rail Transit Systems CO₂ Emissions

Data Sources:
- Private auto: single occupancy, 20.3 mpg average fuel economy, U.S. Environmental Protection Agency.
<table>
<thead>
<tr>
<th>State</th>
<th>Heavy Rail System</th>
<th>Lbs CO2/ passenger mile</th>
<th>KWH/seat mile (Efficiency of Vehicle)</th>
<th>Average % of seats full (Ridership)</th>
<th>Pounds CO2/ MWH for eGRID subregion (Carbon Content)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY</td>
<td>New York City Subway</td>
<td>0.171</td>
<td>0.108</td>
<td>58%</td>
<td>922</td>
</tr>
<tr>
<td>DC, MD, VA</td>
<td>Washington Metro</td>
<td>0.336</td>
<td>0.098</td>
<td>32%</td>
<td>1,096</td>
</tr>
<tr>
<td>CA</td>
<td>San Francisco BART</td>
<td>0.089</td>
<td>0.071</td>
<td>32%</td>
<td>399</td>
</tr>
<tr>
<td>IL</td>
<td>Chicago &quot;L&quot;</td>
<td>0.604</td>
<td>0.132</td>
<td>34%</td>
<td>1,556</td>
</tr>
<tr>
<td>GA</td>
<td>Atlanta MARTA</td>
<td>0.265</td>
<td>0.067</td>
<td>37%</td>
<td>1,490</td>
</tr>
<tr>
<td>MA</td>
<td>Boston &quot;T&quot;</td>
<td>0.336</td>
<td>0.163</td>
<td>44%</td>
<td>909</td>
</tr>
</tbody>
</table>

### Estimated CO₂ Emissions per Passenger Mile at Different Occupancies

<table>
<thead>
<tr>
<th>Mode</th>
<th>Pounds CO₂ per Passenger Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Average Vehicle Occupancies</td>
<td></td>
</tr>
<tr>
<td>Private auto (SOV)</td>
<td>0.96</td>
</tr>
<tr>
<td>Private auto trip to work</td>
<td>0.85</td>
</tr>
<tr>
<td>Private auto general trip</td>
<td>0.59</td>
</tr>
<tr>
<td>Bus transit</td>
<td>0.65</td>
</tr>
<tr>
<td>Heavy rail transit</td>
<td>0.24</td>
</tr>
<tr>
<td>Light rail transit</td>
<td>0.41</td>
</tr>
<tr>
<td>Commuter rail</td>
<td>0.35</td>
</tr>
<tr>
<td>Van pool</td>
<td>0.22</td>
</tr>
<tr>
<td>Full Seats</td>
<td></td>
</tr>
<tr>
<td>Private auto carpool</td>
<td>0.16</td>
</tr>
<tr>
<td>Bus transit</td>
<td>0.11</td>
</tr>
<tr>
<td>Heavy rail transit</td>
<td>0.15</td>
</tr>
<tr>
<td>Light rail transit</td>
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Greenhouse Gas Emissions from Full Life Cycle, including Operation, Construction, and Maintenance

Vehicle Operation (fuel consumption)

Non-operation (road/rail/station construction, vehicle manufacture, maintenance, lighting, etc)

Source: Mikhail Chester, August 2008. Note: 9 passenger case is calculated from 5 and 40 passenger cases presented in study.
Transit’s Land Use Effects

- Greater impact on reducing GHGs than mode shift. About twice as large, ICF study.
- By facilitating compact land use, reduces driving trip distances and supports walking/biking.
- Combining transit and supportive land use policies offers synergies that increase each strategy’s impact.
- Quantitative results will be available from new study, *Moving Cooler*, in the spring.
- APTA Methodology for measuring transit carbon footprint includes land use effects.
Minimizing its Own Impact

- Transit agencies can use efficient vehicles, alternative fuels, and green building materials decrease impact of construction and operations.
Minimizing its Own Impact

Well-to-wheels greenhouse gas emissions per mile for transit buses

Key to Acronyms
CNG = compressed natural gas
ULSD = ultra low sulfur diesel
B20 = 20% Biodiesel, 80% ULSD
Diesel Hybrid

FTA Climate Change Activities

- Transit GHG Management Compendium
- FTA Transit and Sustainability Website
- Support for DOT Climate Change Center
  - Report to Congress on how to reduce GHGs from transportation
  - Information Clearinghouse (FHWA lead)
  - Integration of Climate Change Considerations into Planning (FHWA lead)
- Transit greenhouse gas impacts programmatic review for NEPA documents
- Improving assessment of transit environmental benefits in New Starts process
- National Fuel Cell Bus Program & other technology research
- Proposals for addressing climate change in reauthorization (under development)
- Engaging Transit to Address Sustainability in Transportation Planning - with AMPO and APTA; Technical Assistance in Transit-Focused Sustainability - with APTA
- APTA Standards Development Program, Climate Change Group - developing standard for measuring transit agency carbon footprint (FTA funded)
- Moving Cooler (FTA is co-sponsor)
Resources


- DOT Climate Change Center http://www.climate.dot.gov

- *Understanding and Responding to Climate Change: Highlights of National Academies Reports, 2008.* http://dels.nas.edu/basc/climate-change/

- U.S. Climate Change Science Program www.climatescience.gov

- U.S. EPA Climate Change Website: http://www.epa.gov/climatechange/index.html
Thank You!

Tina Hodges  
Program Analyst  
Office of Budget and Policy  
Federal Transit Administration  
Washington, DC  
202-366-4287  
Tina.Hodges@dot.gov