Natural Gas Vehicles
A Roadmap for Cleaner Air, Cheaper Fuel and Investment in Pennsylvania’s Future

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Overview

- There are clear environmental and economic benefits to increased use of natural gas as a transportation fuel
  - MSC commissioned analysis on mobile sources of emissions and the corresponding air quality improvements in a SEPA neighborhood
  - Small scale deployment has a large scale impact on emissions reduction
  - 2011 roadmap for Pennsylvania NGV infrastructure
• Potential Benefits on the local scale of movement to natural gas as a transportation fuel
• Analysis examined the effects of emissions from vehicle traffic in a “representative” Southeastern PA neighborhood
• The analysis looked at two emission cases:
  • “Base Case” to represent the current situation: vehicles burning diesel fuel
  • “CNG Case” same types of vehicles, but burning natural gas
  • Generally assumed “all other things being equal”
• Consider Scale-up
  • This is one neighborhood – imagine the benefits realized if implemented in a handful of neighborhoods across Southeastern PA and the region
Neighborhood Study

- Representative Philadelphia neighborhood
  - Neighborhood is 1.7 sq miles in area
  - Includes 22.5 miles of “local roads” and 1.5 miles of “highway”

- “Base Case” has the following vehicles
  - Delivery Trucks: 10 deliveries/day, 6 day/week, 52 week/year
  - Garbage Trucks: 2 routes/week, 52 week/year
  - Semi-Trailers: 840 vehicles/day, 7 day/week, 52 week/year
  - School Buses: 4 buses at 2 trips/day, 5 day/week, 37 week/year
  - All vehicles run on diesel fuel

- “CNG Case”: Same as Base Case, but all vehicles on natural gas
Representative SEPA Neighborhood
<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emissions (lbs/year)</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Case</td>
<td>CNG Case</td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td>NOx</td>
<td>11,842</td>
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<tr>
<td>Carbon Monoxide</td>
<td>CO</td>
<td>6,906</td>
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<tr>
<td>Sulfur Dioxide</td>
<td>SO2</td>
<td>49</td>
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<tr>
<td>Particulates</td>
<td>PM10</td>
<td>211</td>
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<tr>
<td>Hydrocarbons</td>
<td>HC</td>
<td>6,372</td>
</tr>
</tbody>
</table>
Neighborhood Air Emissions
Base Case (Diesel) vs. CNG Case

- **NOx**: 42% Reduction
- **CO**: 88% Reduction
- **SO2**: 91% Reduction
- **PM10**: 91% Reduction
- **HC**: 91% Reduction
Converting 50% of semi trucks in the 5-county area of SEPA from diesel to natural gas has about the same effect on NOx reductions as retiring a medium-sized coal-fired power plant

50% of semi’s in SEPA moving to natural gas

≈ 275 million miles per year additional fueled by natural gas

≈ 1,500 tons less per year of NOx

≈ 1 well-controlled, medium-sized coal-fired power plant (345 MW)
Scale up Across the Region: Neighborhood Air Emissions …
… in 5-County Context …
… in the local vicinity, but …
... impacts happen at this level
Pennsylvania’s NGV Roadmap
Summary of Roadmap

• Proximity to Marcellus provides the Commonwealth with a unique opportunity to expand its clean energy transportation infrastructure.

• Key findings:
  • Over five years, implementation of the MSC NGV Roadmap would result in $123 million of new investment in the commonwealth;
  • A reduction in annual fuel costs for Pennsylvania fleet operators of roughly $9.2 million;
  • Direct impact on nearly 1,300 Pennsylvania jobs; and
  • Annual emissions reductions
    • Nitrogen oxides (Nox) by 720 tons
    • Particulate matter (PM) by 14.5 tons
    • Greenhouse gases by 21,000 metric tons
Fuel Cost Comparison (Diesel)

Source: DOE EIA, April 2012
Fuel Cost Comparison (Gasoline)

Source: DOE EIA, April 2012
Pennsylvania CNG Stations

By the numbers

Total: 34
Public: 12
Private: 22
Planned: 5
LNG Planned: 3

Source: DOE NREL
Observations

- NGV’s provide a clear, clean and cost-savings alternative for fleet operators and the public

- The air quality benefits of NGVs are real, with every conversion making a difference

- Volatility in gasoline and diesel markets can be offset with affordable and long-term natural gas prices

- Regulatory certainty and consumer confidence is key to sustained growth and deployment of NGVs
Thank You