PROMOTING THE GROWTH OF HYDROGEN FUEL CELL VEHICLES BY DEVELOPING THE INFRASTRUCTURE

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AGENDA

Background
Defining the issue
Production
Distribution
Utilization
Alternatives
Recommendations
THE ISSUE
Background

• Growth of Fuel Cell Electric Vehicles (FCEVs) will take place as one part of alternative fuel development

• FCEVs helps reduce CO$_2$ emissions and dependence on foreign energy sources
Defining the Issue

• Increased development because of Zero Emission Vehicle (ZEV) Mandate
• Reduce high cost by building the infrastructure to support FCEV growth

FY 2012 Budget Fuel Cells Technologies Office Sub Program Amount
Hydrogen Fuel R&D $33,785,000
Fuel Cell Systems R&D $43,556,000
Technology Validation $8,987,000
Safety, Codes & Standards $6,893,000
Education $0
Systems Analysis $2,925,000
Market Transformation $3,000,000
Manufacturing R&D $1,941,000
Total $101,087,000
THE INFRASTRUCTURE
# Hydrogen Production

## Table 8.0. Examples of Domestic Hydrogen Production Options and Resource Needs

<table>
<thead>
<tr>
<th>Resource</th>
<th>Resource Availability</th>
<th>Resource Consumption (without hydrogen production for FCEVs)</th>
<th>Resources Needed to Produce Hydrogen for 20 million FCEVs</th>
<th>Increase in Projected Consumption Required for 20 million FCEVs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current (2038)</td>
<td>Projected (2040)</td>
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<tr>
<td><strong>Gasification and Reforming</strong></td>
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<tr>
<td><strong>Biomass</strong></td>
<td>384 million(\times 10^{12}) (dry) metric tons/year(^\text{a})</td>
<td>214 million (dry) metric tons/year(^\text{a})</td>
<td>566 million (dry) metric tons/year(^\text{a})</td>
<td>50 million (dry) metric tons/year(^\text{a})</td>
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<tr>
<td><strong>Coal (with carbon sequestration)</strong></td>
<td>239 billion metric tons (estimated recoverable reserves)(^\text{b})</td>
<td>1,070 million metric tons/year(^\text{a}) (all grades)(^\text{c})</td>
<td>1,153 million metric tons/year(^\text{a}) (all grades)(^\text{c})</td>
<td>54 million metric tons/year(^\text{a})</td>
</tr>
<tr>
<td><strong>Natural Gas</strong></td>
<td>273 trillion cubic feet (proven reserves)(^\text{d})</td>
<td>22 trillion cubic feet(^\text{d})</td>
<td>26 trillion cubic feet(^\text{d})</td>
<td>634 billion cubic feet(^\text{d})</td>
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<tr>
<td><strong>Water Electrolysis</strong></td>
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<tr>
<td><strong>Wind</strong></td>
<td>3,500 GWe (nameplate capacity, not power output)(^\text{e})</td>
<td>22.6 GWe (installed nameplate capacity, not power output)(^\text{f})</td>
<td>50 GWe (installed nameplate capacity, not power output)(^\text{f})</td>
<td>46 GWe</td>
</tr>
<tr>
<td><strong>Solar Energy</strong></td>
<td>5,400 GWe (capacity, entire U.S.)(^\text{g})</td>
<td>1,293 GWe (net summer capacity)(^\text{f})</td>
<td>100 – 250 GWe (net summer capacity)(^\text{f})</td>
<td>92 GWe</td>
</tr>
<tr>
<td><strong>Nuclear Energy (high-temperature electrolysis)</strong></td>
<td>87 million metric tons of uranium at $56/kg; 385 million metric tons of uranium at $110/kg(^\text{h})</td>
<td>100.6 GWe(^\text{f}) (power output, using ~22,000 metric tons of uranium/ year)</td>
<td>111.1 GWe(^\text{f}) (power output using ~24,000 metric tons of uranium/ year)</td>
<td>15 GWe (power output, using ~3,200 metric tons of uranium/ year)</td>
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<tr>
<td><strong>Thermo-Chemical</strong></td>
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<tr>
<td><strong>Nuclear Energy</strong></td>
<td>87 million metric tons of uranium at $86/kg; 385 million metric tons of uranium at $110/kg(^\text{h})</td>
<td>314 GWh(^\text{f}) (thermal output, using ~22,000 metric tons of uranium/ year)</td>
<td>347 GWh(^\text{f}) (thermal output, using ~24,000 metric tons of uranium/ year)</td>
<td>27 GWh (thermal output, using ~1,900 metric tons of uranium/ year)</td>
</tr>
</tbody>
</table>
Hydrogen Distribution

• Centralized
  – Pipelines
  – Tube Trailers
• Distributed
  – Onsite
  – Production
  – Pipelines or
  – Tubes Trailers
• Concerns
  – Cost
  – Technology

Photos from DOE (Above) and EIA (Below)
Hydrogen Utilization

• Currently 9 stations in California open to the public
• Concerns
  – Cost
  – Size
  – Technology

Photos from California Fuel Cell Partnership
THE ALTERNATIVES
Taxes and Subsidies

• Taxes
  – Expansion of “Gas Guzzler” tax
  – Price floor on gasoline and diesel fuel

• Subsidies
  – Tax Credits
    • Hydrogen Fuel Infrastructure
    • Hydrogen Fuel Mixture Excise
    • Hydrogen Fuel Excise Tax
  – Loan Guarantees
Increased Environmental Restrictions

• Corporate Average Fuel Economy (CAFE)
  – Recently increased by NHTSA
  – Do not do this again
    • Rebound Effects
    • Not specific to Alternate Fuel Vehicles
• CO$_2$ emission restrictions
  – Recently increased by EPA
  – Helps to promote Alternate Fuel Vehicles
    • Do not do this again
• Regulation
  – Expedite the establishment of safety codes and standards
Coordination

• Prepare the public
  – Distribute information about hydrogen safety
  – Inform people about the benefits of Alternate Fuel Vehicles
  – Offer incentives to OEMs to demonstrate Alternate Fuel Vehicles to the public

• Actively participate in H2USA
  – Help coordinate the development of the infrastructure with OEMs

Mercedes F-Cell  Honda Clarity  GM Equinox
Recommendations

• Shift more of Fuel Cell Technology Program budget toward developing better transport and storage for hydrogen and education for the public
• Increase subsidies with a price floor on gasoline and diesel fuel
• Quickly establish safety codes and standards
• Promote demonstrations by OEMs of Alternative Fuel Vehicles