Revised Transition Scenarios for California

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NextSTEPS (Sustainable Transportation Energy Pathways)
Transition Scenarios Model

• Develop scenarios for transportation to analyze future vehicle market shares, fuel usage, emissions and costs
  • Analyze 2010-2050, CA based
  • Presently LDVs and trucks
  • Model includes
    – Fleet stock turnover
    – Vehicle and fuel costs
    – Vehicle fuel economies
    – GHG emissions
    – Technology types (gasoline, diesel, hybrids, NG, BEV, fuel cell)
    – Fuels types (diesel, gasoline, biofuels, NG, electricity, hydrogen)
  • Focus on the cost and emissions impacts of a transition to decarbonized transportation system
Vehicle Market Penetrations Scenarios (LDVs)

• Scenarios
  – Specify percentage of new vehicle sales for each technology for each vehicle type every year through 2050
  – Created as “What if?” inputs to model to analyze potential effects of new vehicle technologies entering market

• LDV business as usual (BAU)
  – CAFÉ standards through 2025
  – ZEV standards through 2020, modest increases through 2050

• LDV ZEV
  – Phase out conventional vehicles by 2040
  – Modest HEV by 2050 (4-6%)
  – PHEV, ZEV, Fuel cell make up remainder
  – Ethanol blend in gasoline 41% in 2050
Vehicle Market Penetrations Scenarios (Trucks)

- **BAU**
  - Meet phase I and phase II standards for fuel economy
  - No advanced technologies (BEV, fuel cell)
  - Modest diesel biofuels (6%)

- **High Efficiency**
  - Increased fuel efficiency for long haul trucks
  - Higher penetration of HEVs
  - No advanced technologies (BEV, fuel cell)

- **ZEV**
  - Aggressive fleet penetration for fuel cell and BEVs (~50% market share by 2050)

- **ZEV + Biofuels**
  - Fleet penetration roughly half of ZEV scenario for fuel cell and BEVs
  - Diesel biofuels contribution grows to 50% by 2050
Fuel CI (gCO2e/gge) for ZEV scenarios in 2050:
Electricity ~ 130-500, H2 ~ 1650-1800, Diesel blend ~ 12,700
Fuel CI (gCO2e/gge) for ZEV scenarios in 2050:
Electricity ~ 130-500, H2 ~ 1650-1800
Diesel biofuels blend ~ 12700, Ethanol blend ~ 8600
## GHG Emissions Reductions by Scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>LDVs</th>
<th>Trucks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAU</td>
<td>34</td>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>High Efficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZEV</td>
<td>80</td>
<td>50</td>
<td>71</td>
</tr>
<tr>
<td>ZEV + Biofuels</td>
<td></td>
<td></td>
<td>47</td>
</tr>
</tbody>
</table>
Fuel Cost 2050: Diesel blend = $4.25/gge, H2 = $6.30 - $7.75/gge
Scenario Cost Comparison (Trucks + LDVs)

Fuel Cost 2050: Diesel blend = $4.25/gge, Gasoline blend = $2.85/gge
H2 = $6.25 - $7.75/gge
Fuel Cost 2050: Diesel blend = $3.03/gge, Gasoline blend = $2.85/gge
H2 = $6.25 - $7.75/gge
Rough Estimate of Cost per GHG tonne reduced

- Calculate additional Cost of ZEV scenario
  - Capital cost in year of purchase
  - Fuel costs from (2010 – 2050)

<table>
<thead>
<tr>
<th>Diesel blend price ($/gge)</th>
<th>GHG Reductions (billion tonnes CO2e)</th>
<th>Additional Cost for ZEV scenario (billion $)</th>
<th>Mitigation Cost ($/tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.25</td>
<td>2</td>
<td>1.7</td>
<td>0.83</td>
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<tr>
<td>3.03</td>
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<td>16.2</td>
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Thank You