California On-Road MD/HD WTW GHG Emissions and Fuel Demand

2050 Goal = 80% below 1990 GHGs = 7.2 MMT CO2e
Comparison of Carbon Intensity for the Various Technologies

- Diesel: 91.4 g CO2e/MJ
- Renewable Diesel*: 65.4 g CO2e/MJ
- Biodiesel (B100): 71.5 g CO2e/MJ
- Biodiesel (B20): 87.4 g CO2e/MJ
- CNG (NA): 65.3 g CO2e/MJ
- Biomethane: 7.3 g CO2e/MJ

* Preliminary estimate
Is it possible to achieve the on road medium and heavy duty 2050 GHG goals with a combination of technology options?

**Assumptions:**
- Vehicle efficiency (miles/MJ) doubled over entire segment from class 3 through 8 trucks
- Biodiesel blended at 20% (B20) in all conventional diesel
- Aggressive introduction of renewable diesel
- Aggressive use of biomethane

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<thead>
<tr>
<th>HDV Scenarios</th>
<th>Baseline</th>
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<tbody>
<tr>
<td>Vehicle Efficiency Improvement from Baseline</td>
<td>0%</td>
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<tr>
<td>Blended Diesel Penetration</td>
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<tr>
<td>Renewable Diesel Penetration</td>
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<tr>
<td>Biomethane Penetration</td>
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<td>50%</td>
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Projection of MD and HD GHG Emissions in 2050

2050 WTW Goal = 80% of 1990 GHGs = 7.2 MMT CO2e
Aggressive adoption of higher vehicle efficiencies coupled with renewable fuel pathways can achieve substantial GHG reductions in on road sector by 2050 but these reductions still fall short of goal.

What types of policies will encourage GHG reductions? Carbon and fuel pricing maybe insufficient to achieve aggressive reduction goals.

- Intermodal
- Fuels
- Technology
- Operations
- Logistics
- Demand