Continued evolution of HDV
Greenhouse Gas and
Efficiency Policies

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Outline

- ICCT research
  - DOE Supertruck program
  - Class 8 technology potential and payback
  - Trailers
  - Pickups and Vans (2bs and 3s)
- Phase 2 rule proposal
  - Comparison with Phase 1
  - Engine stringency
  - Accelerate timing
- Observations and conclusions
ICCT research

DOE Supertruck
Class 8 “Big Rigs”
Trailers
Class 2b/3s
Goal: Demonstrate 50% increase in freight efficiency (e.g., ton-mi/gal)
- For a given payload, this would approximately result in 10 mpg tractor-trailers (from 6-7 mpg baseline)

Progress to date:

Fuel consumption and associated payback periods from selected efficiency technology packages


“Error” bars reflect range of estimates for varying technology cost, fuel price (US EIA AEO 2014 forecast, Low $3.10 to High $5.40 per gallon), and discount rates (3%-10%).
Trailer technology cost reductions in recent years (2013-2014 study)

- Nearly half of all new box trailers are sold with side skirts
- Costs of trailer aerodynamic technologies—particularly side skirts—have decreased substantially in the past 3-5 years

Sharpe and Roeth (2014). Costs and adoption rates of fuel-saving trailer technologies
Pickups and Vans (2bs and 3)

- 2014 baseline
- 2025-2027 target

- +35-38% by 2025 (adopted)
- +29-34% by 2027 (proposed)
- +20-27% by 2027 (proposed)

<table>
<thead>
<tr>
<th>Regulatory fuel economy (mpg)</th>
<th>Consumer fuel economy (mpg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiat</td>
<td></td>
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<tr>
<td>Ford</td>
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<tr>
<td>GM</td>
<td></td>
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<tr>
<td>Average</td>
<td></td>
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<tr>
<td>Heavy-duty gasoline pickups</td>
<td></td>
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<tr>
<td>Heavy-duty diesel pickups</td>
<td></td>
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<tr>
<td>Light-duty gasoline large pickups</td>
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Clean Transportation
Phase 2 proposal

Comparison to Phase 1
Engine Stringency
Accelerate timing
# US HDV Phase 1 vs Phase 2: Overview

<table>
<thead>
<tr>
<th></th>
<th>Phase 1</th>
<th>Phase 2 (proposed)</th>
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<tbody>
<tr>
<td>Engine</td>
<td>Completely separate standard for engine</td>
<td>Separate standard maintained in Phase 2. Reweighted test cycles better reflect real world operation.</td>
</tr>
<tr>
<td>Trailers</td>
<td>Not regulated</td>
<td>Regulated in Phase 2</td>
</tr>
<tr>
<td>Transmission</td>
<td>Not accounted for under standard protocol</td>
<td>Accounted for through improvements to GEM model inputs or (optional) powertrain test</td>
</tr>
<tr>
<td>Vehicle simulation</td>
<td>Limited inputs and many defaults</td>
<td>Increased number of inputs including real engine fueling map and transmission information</td>
</tr>
<tr>
<td>Vocational vehicles</td>
<td>Three segments, only promoting tire and engine improvements</td>
<td>Increased number of segments (18) based on fuel type, usage profile, and GVW -- to promote additional technologies where applicable</td>
</tr>
<tr>
<td>Stringency</td>
<td>Weighted ~2%/year 2010-2017</td>
<td>Weighted ~2.8%/year 2017-2027</td>
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<tr>
<td>Real world testing</td>
<td>Not included</td>
<td>Chassis dyno testing on a subset of vehicles to validate standards impact</td>
</tr>
<tr>
<td>Natural gas</td>
<td>Negligible controls</td>
<td>Limit CH₄ emissions from engine crankcase and LNG tank</td>
</tr>
<tr>
<td>Payback</td>
<td>Average payback 12-18 months</td>
<td>Average payback is ~ 2-5 years (Lower for tractors, pickups; higher for vocational vehicles)</td>
</tr>
</tbody>
</table>

Phase 2 Sample Compliance Pathway
New tractor + trailer fuel consumption reduction of 34% from 2018 to 2027

Key issue: Tractor engine stringency

- Tractor engine stringency is modest compared to NGOs, Cummins, SwRI, ICCT, WVU, US DOE SuperTruck demonstration data

Lutsey (2015). The ever-improving efficiency of the diesel engine
US HDV Phase 2: Preliminary assessment of what is in play, potentially

- If standards shifted 3 years earlier, and with increased stringency,
- GHG and oil benefits would be roughly 30% greater than the proposed Phase 2

Where are we going?

Global landscape
Observations and
Conclusions
US and California are playing an important role in the evolution of global HDV CO₂ /efficiency policies

"New" policies are proposed or under development

Observations and conclusions

- Regulatory action to address CO$_2$ emissions and fuel use from heavy-duty vehicles is accelerating around the world.
  - Japan, US, China and Canada currently have programs while India, Mexico, Korea and Europe are actively developing programs.
- Low volumes of heavy-duty vehicles and engines create economic incentives for global alignment of standards.
  - Global harmonization of regulatory programs is challenging due to diverse vehicle types and drive cycles, but shared use of simulation models holds promise.
- US Phase 2 rule proposal offers significant improvements over Phase 1, but challenges remain.
  - Added grade to simulation modeling, compliance testing, broader application to trailers and vocational, integrated engine and transmission are all positive improvements.
  - Increased engine stringency and accelerated implementation should be considered by the Agencies.
- Revised ambient air quality standards are likely to add pressure for further reductions of NOx emissions from heavy-duty vehicles.
Resources

- US EPA and NHTSA pages
  - http://www.epa.gov/oms/climate/regs-heavy-duty.htm

- ICCT US HDV resource page:

- ICCT US HDV Phase 2 policy update: