PHASE 2 HEAVY DUTY VEHICLE GHG STANDARDS AND LIGHT DUTY VEHICLE GHG TRENDS/COMPLIANCE

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Heavy Duty Phase 2

• This spring, EPA and DOT/NHTSA will propose a rule that would establish a phase 2 of the heavy duty GHG and fuel efficiency program
• Builds on Phase 1 structure
Heavy Duty Truck Categories

Line-Haul Tractors

65% of HD Fuel Consumption and GHG Inventory (together)

Line-Haul Trailers (currently unregulated Federally)

Vocational Vehicles

Large Pickups & Vans
14% of HD Fuel Consumption and GHG Inventory
Heavy-duty vehicles responsible for about one fifth of the energy use and GHG emissions from transportation sources

In terms of energy use, heavy-duty vehicles are also the fastest growing transportation sector in the U.S. and globally
MD/HD Phase 1 – Implementation Highlights

- Phase 1 standards began in 2014, fully phased-in by 2018
  - Manufacturers expected to comply primarily with “off-the-shelf” technologies
  - Cost-effective technologies lead to fuel-savings greater than technology cost
- Phase 1 program for heavy-duty pickups and vans is similar to light-duty program
  - Vehicle certification based on testing complete vehicle
- Phase 1 program for other heavy-duty vehicles include:
  - Engine certification based on EPA’s existing criteria pollutant test procedures
  - Computer simulation certification of vehicle performance (without engine, transmission and axle) – instead of actual vehicle testing
- Computer simulation is used to certify heavy-duty vehicle performance
  - HDV size makes complete vehicle testing more difficult and expensive
  - Custom-build aspect of heavy-duty market means thousands of different vehicle configurations – too many to actually test
  - Vehicle simulation brings together the results from a smaller number of vehicle component tests (tires, aerodynamics, etc.)
- Market: 2014 tractor sales up 33%, trailers up 42%, vocational up 10.5% vs 2013 (ACT Research Aug 26, 2014)

- 530 million barrels less oil
- 270 MMT lower GHGs
- $50 billion in fuel savings
- $49 billion in net benefits
Climate Action Plan: “During the President’s second term, the Administration will once again partner with industry leaders and other key stakeholders to develop post-2018 fuel economy standards for heavy-duty vehicles .....”

White House Announcement: “This second round of fuel efficiency standards will build on the first-ever standards for medium- and heavy-duty vehicles (model years 2014 through 2018), and will reach well into the next decade.”
Heavy-duty Phase 2: Objectives Discussed in Phase 1 Rule

- Joint NHTSA/EPA rulemaking process with notice and opportunity for public review and comment.

- Heavy-duty Phase 2 may include:
  - Looking beyond off-the-shelf technology
  - Potential inclusion of trailers
  - Additional and new technologies beyond Phase 1
  - Refined test procedures and updates to the GEM vehicle simulation compliance model—a full vehicle approach that includes engines
  - Full SBREFA panel process to develop solutions for small businesses
  - Updated technology, economic and environmental assessments
Phase 2 – NHTSA/EPA Research

➢ Technology evaluations
  - In-house and contractor modeling and testing of fuel-efficiency technologies for medium- and heavy-duty vehicles in the years prior to and in the Phase 2 timeframe
  - Evaluating the effectiveness and the costs

➢ Test procedure development, refinement and validation studies
  - Evaluating improvements to Phase 1 drive cycles, and additional idle cycle
  - Validating new aerodynamic and powertrain test procedure approaches
  - Validating a wide range of improvements to Greenhouse Gas Emissions compliance model (GEM) to fully recognize new technologies
NHTSA/EPA Research: Engine Technologies

- Advanced Bottoming Cycle
- Air Handling Improvement
- Coolant Pump
- Cylinder Deactivation
- Down-sizing & Boosted vs. NA
- Electric Turbo-compounding
- Engine Down-sizing
- Engine Down-speeding (reduced cruise RPM, combined with transmission technology)
- Engine Friction Reduction
- Engine Oil Pump Improvement
- GDI + Cooled EGR
- Improved Selective Catalytic Reduction (SCR) Conversion, combined with reducing or removing EGR
- Lean Burn GDI w/ SCR
- Lower Friction Engine Oil
- Mechanical Turbo-compounding
- Natural Gas
- Reduced After-treatment Backpressure
- Stoichiometric Gasoline Direct Injection (GDI)
- Stop / Start
- Turbo Efficiency Improvement
- Variable Valve Timing

Technology application varies by vehicle class, vocation, and engine fuel type
## Research on Vehicle & Trailer Technologies

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National Academies of Science

2010
- Issued, “Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles”
- EPA and NHTSA considered this study in support of Phase 1; similar for Phase 2

2014
- As required by 2007 Energy Independence and Security Act, NHTSA sponsored a second NAS study for heavy-duty
- Published an interim report in April 2014 to help inform Phase 2 considerations; focused on recommendations that were nearly 100% in-line with EPA and NHTSA staff-level thinking
- Final report expected in 2016 to inform considerations beyond Phase 2
What’s Happening in California?

- **2008:** ARB adopted mandatory fleet-level requirements for tractors and trailers
  - Based on EPA SmartWay performance

- **2012:** ARB Released 2050 Vision for Clean Air document
  - Calls for significant additional NOx and CO2 reductions from heavy-duty sector

- **2013:** Adopted EPA GHG Phase 1 Standards
  - Board hearing in December 2013
  - Similar to ARB’s adoption of HD criteria emissions standards
  - Also adopting new voluntary Low NOx standards for heavy-duty
  - Signaled intent to move beyond Federal Phase 1
  - Sunsetted CA fleet-level program for tractors, but not for trailers

- **2014:** ARB is significantly engaged on Phase 2
Light Duty Vehicle GHG Program Compliance

- Highlights from Manufacturer Performance Report for MY 2013, published March 2015

  1. For the second consecutive year, the auto industry outperformed the GHG standard by a substantial margin
  2. Most manufacturers outperformed their individual 2013 standard
  3. All large manufacturers are in compliance with the 2012 and 2013 GHG standards
  4. Manufacturers continue to use a wide variety of compliance flexibilities that were designed into the program
LDV Fuel Economy Trends (2014 report)

- Fuel Economy is at a record high: 24.1 mpg for MY 2013
- CO2 is at a record low: 369 g/mile for MY 2013
- Fuel Economy has improved 8 of the last 9 years (25% improvement)
Manufacturers Are Using Multiple Technology Pathways

- **GDI**
- **Turbo**
- **CVT**
- **7 or More Gears**
- **Cylinder Deactivation**
- **Non-Hybrid Stop/Start**
- **Hybrid**
- **Diesel**
Consumers have more choices

- MY 2009
- MY 2014

Number of Models

- Includes city/hwy combined label MPG estimates for gasoline, diesel and hybrid vehicles, and MPGe estimates for EVs and PHEVs

Bar chart showing:
- Pickups and Minivans/Vans ≥ 20 MPG
- SUVs ≥ 25 MPG
- Cars ≥ 30 MPG
- Cars ≥ 40 MPG
QUESTIONS