Symposium on California's Phase II Greenhouse Gas Emission Standards for On-Road Heavy-Duty Vehicles

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Heavy-Duty Vehicle and Engine Industry

- Not fully vertically integrated
  - Engine and vehicle from separate companies
  - Tires, transmissions and axles also separate
  - Trailers built and purchased separately
- Diverse products
  - Class 2b through Class 8 commercial vehicles
  - Extensive vehicle customization and low production volumes
  - Multi-stage manufacturing of vocational trucks
  - Each tractor will be coupled with many different trailers
- Sophisticated customers
  - Almost unlimited variety of trucking operations
  - Each uniquely specifies vehicles for maximum efficiency
  - Vehicle purchase is a capital investment that must return a profit
  - No requirement to buy new equipment

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- Leading manufacturers of commercial trucks and engines
  - On-Highway members: Caterpillar, Cummins, Daimler, FCA, Ford, FPT, GM, Hino, Isuzu, Navistar, PACCAR, Scania, Volvo
- Progressive industry with a history of successful collaboration with government and stakeholders
- Achieved tremendous exhaust emissions reductions
  - Reduced criteria pollutants to near-zero levels
  - Demonstrated that exhaust from modern diesel engines does not increase the risk of lung cancer
  - Successfully implemented fast-track Phase I greenhouse gas/fuel efficiency rules

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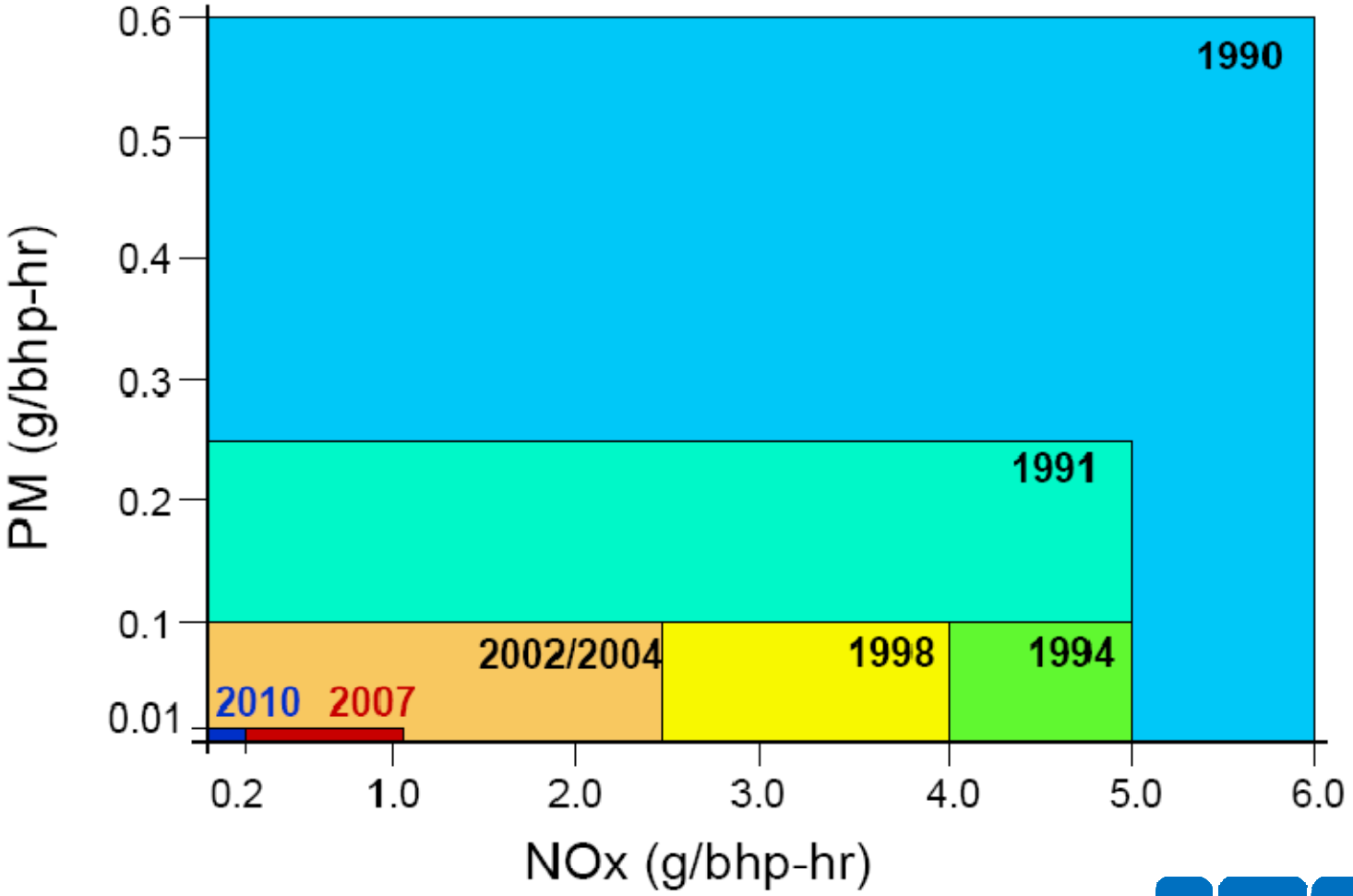
History of Success in Reducing Criteria Pollutant Emissions



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Advanced Collaborative Emissions Study

- Industry collaborated with Health Effects Institute, EPA, ARB and other stakeholders to study exhaust emissions of New Technology Diesel Engines (NTDE)
  - Exhaust emissions characterization
  - Health effects assessment
- ACES conclusions:
  - Criteria pollutants are well below EPA and ARB standards
  - Other harmful components have been reduced more than 99%
  - Exposure to exhaust from NTDE did not increase the risk of lung cancer in animals

Principles for Greenhouse Gas Reduction/ Fuel Efficiency Improvement Programs

- Ensure single nationwide GHG/FE program
- Provide adequate leadtime and stability
- Recognize commercial needs of marketplace
- Avoid unintended consequences
- Balance stringency, cost and effect date
- Consider NO_X vs. GHG tradeoff
- Provide incentives for new technology adoption
- Consider impacts of trailer designs on tractor aerodynamics
- Minimize certification and compliance burdens
- Assure accurate and cost-effective assessment methods
- Acknowledge benefits of global measurement methods
- Consider other road freight efficiency improvement opportunities

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Greenhouse Gas Reductions/ Fuel Efficiency Improvements

- Unlike criteria pollutants, market forces work to maximize fuel efficiency and minimize CO_2 emissions
  - Fuel is 1st or 2nd highest operating expense for trucking fleets
- Heavy-duty GHG/FE programs must take into account the work performed by the vehicle
  - MPG metric may improve per vehicle fuel economy, but would cause overall worse freight movement efficiency
- GHG vs. NO_X tradeoff
  - There exists a tradeoff between further reductions in GHG emissions and lower NO_X standards

GHG/FE Phase I Rule

- Success of GHG/FE Phase I rule was a result of:
  - EPA, NHTSA and ARB working together to develop rules that form a single nationwide program
  - Consideration of the work performed by the vehicle
  - Following the principle of “do no harm”
    - Fleets continue to specify vehicles for unique operations
    - No fleets required to adopt technology that would be inefficient in a particular application
  - Truck and engine manufacturers rose to the challenge of reducing GHG emissions and improving FE
    - CO_2, N_2O, CH_4, and A/C refrigerant leakage standards
    - Corresponding FE standards

GHG/FE Phase II Rule

- With increased GHG/FE stringency, avoiding unintended consequences is critical
  - Fleets may be forced to adopt fuel efficiency technology that increases the costs of moving freight
  - For certain operations, mandated technologies may have the unintended consequence of increasing fuel consumption
- The tradeoff between more stringent GHG standards and more stringent NO_X standards must be recognized
  - Low GHG emissions are achieved with a combination of high combustion efficiency and high SCR conversion efficiency
  - Ultra-low NO_X may require lower engine-out NO_X with higher EGR rates, causing lower combustion efficiencies

Other GHG/FE Opportunities

- GHG/FE Phases I and II are focused on trucks and engines
- Other opportunities in road freight sector exist:
  - Road speed limits
  - Pavement compounds
  - Truck length and weight
  - Driver behavior/hours of service
  - Capacity utilization
  - Congestion mitigation
  - Idling reductions/truck stop electrification
  - Tractor-trailer gap reduction
  - Tractor-trailer height alignment
- Must focus on emissions per ton-mile of goods moved

Summary

- Modern diesel engines emit near-zero levels of exhaust emissions, thereby minimizing adverse health effects
- In addition to limiting criteria pollutant emissions, truck and engine manufacturers have risen to the challenge of reducing GHG emissions and improving FE
- GHG/FE Phase II must avoid unintended consequences
- Improving FE and reducing GHG emissions make it more difficult to lower NO_X standards
- Other opportunities exist for improving freight efficiency

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