

Update on California's Heavy-Duty Truck Program: Past, Present, and Future



October 24, 2014
Diamond Bar, California

Today's Presentation

- Introduction
- Current Program
- Recent Program Evaluation
- Achieving Additional Criteria Reductions
- New Phase 2 Standards
- Driving Towards Zero Emissions

Heavy-Duty Trucks in California

- Many weight classes and applications
- Millions on the road in California
- Predominately diesel powered
- Class 8 trucks are largest emissions contributor
- Class 2b/3 have highest sales volume



Class 8



Class 5



Class 3

Heavy-Duty Trucks Remain a Significant Source of Emissions*

- 33% of Statewide NOx
- 26% of Statewide diesel PM
- 8% of Statewide GHG emissions
 - 21% of Transportation GHG



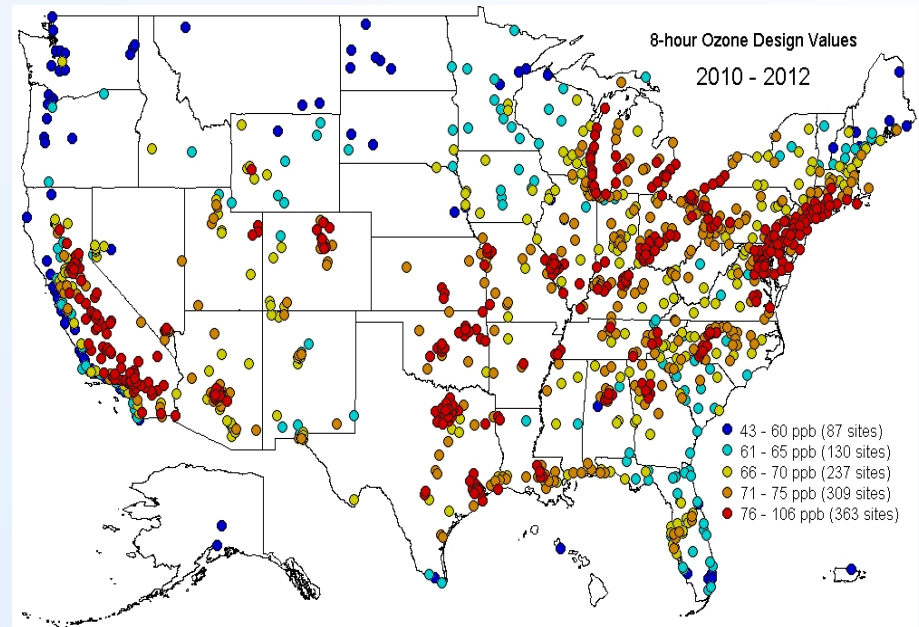
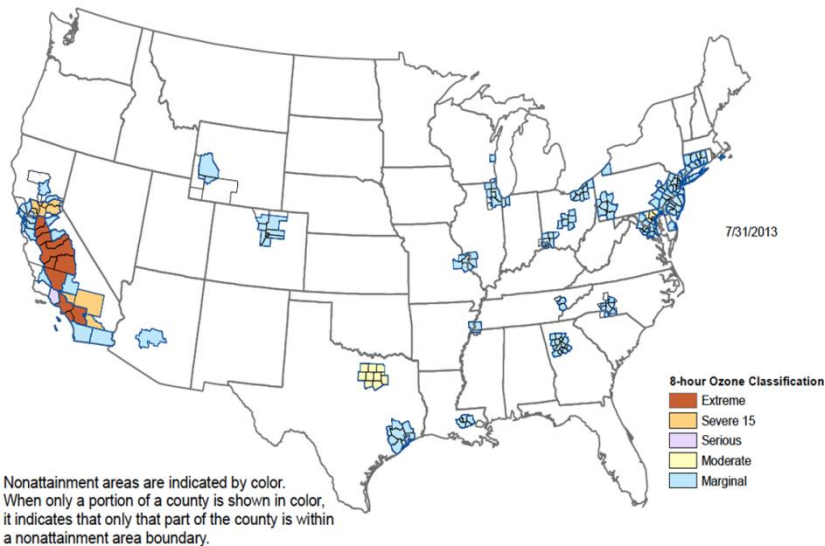
*Tank to wheel emissions

California's Issues are National Issues

- Today's federal O₃ nonattainment areas for current standard: 75 ppb

- If U.S. EPA lowers standard to: 60 to 70 ppb*
- Expected in December

8-Hour Ozone Nonattainment Areas (2008 Standard)



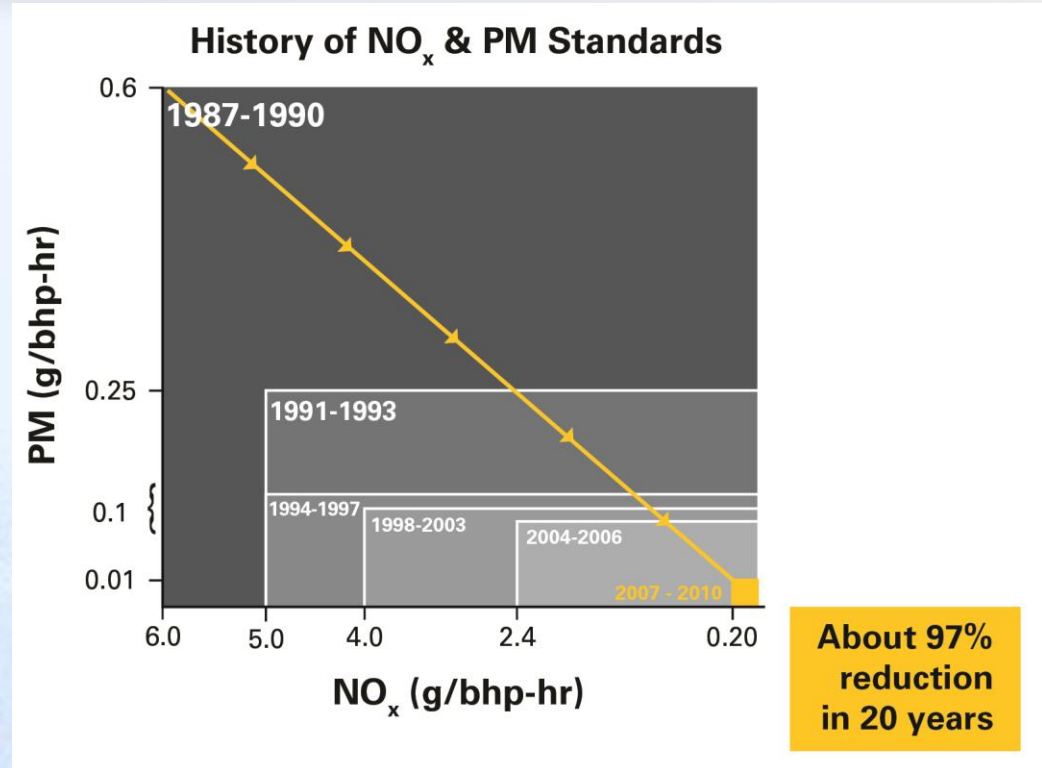
From U.S. EPA Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards, EPA-452/R-14-006, August 2014.

Today's Presentation

- Introduction
- Current Program
- Recent Program Evaluation
- Achieving Additional Criteria Reductions
- New Phase 2 Standards
- Driving Towards Zero Emissions

Current Heavy-Duty Vehicle/Engine Program

- New engine standards
 - NO_x/PM
 - GHG
- In-Use Requirements
 - Diesel fleet rules
 - Tractor/trailer GHG program*



History of NO_x and PM Standards

*Tractor-Trailer GHG Regulation also includes some requirements for new tractors and trailers

Current NOx and PM New Engine Requirements

- Certification requirements
 - Engine standards harmonized with U.S. EPA
 - Not-to-Exceed limits (NTE)
 - Durability testing requirements
 - Warranty requirements
 - On-Board Diagnostics (OBD)
- ARB optional NOx standards



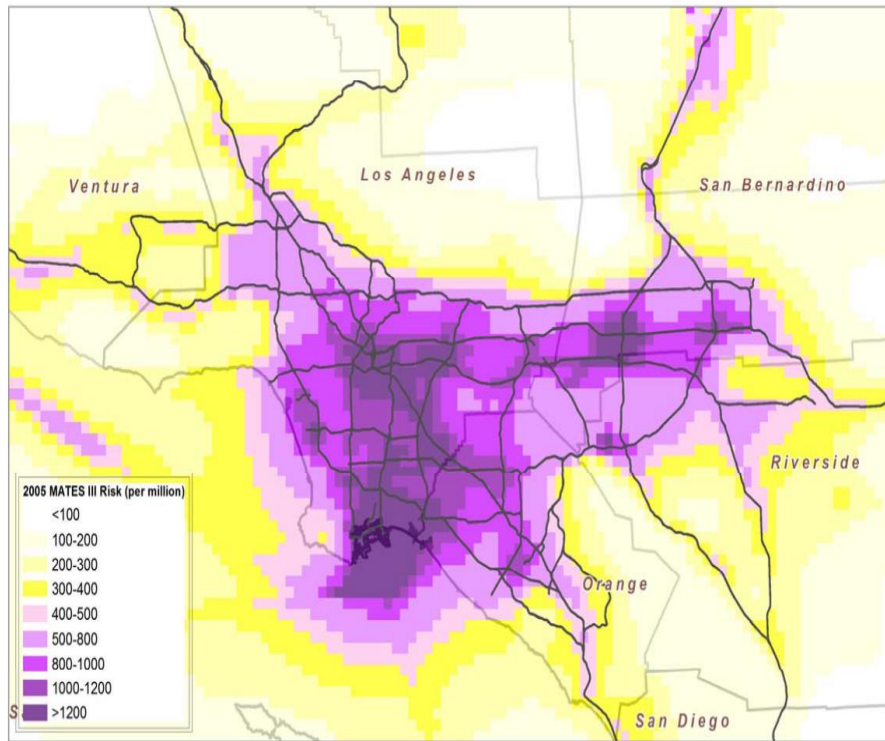
Reducing Emissions from the Legacy Fleet

- Fleet rules
 - Turnover and retrofit requirements
- Idling restrictions
- Inspection and maintenance requirements
- Incentive programs
 - Carl Moyer
 - \$69M in annual State funding
 - \$12M in annual air district funding
 - Proposition 1B
 - \$150M in 2013

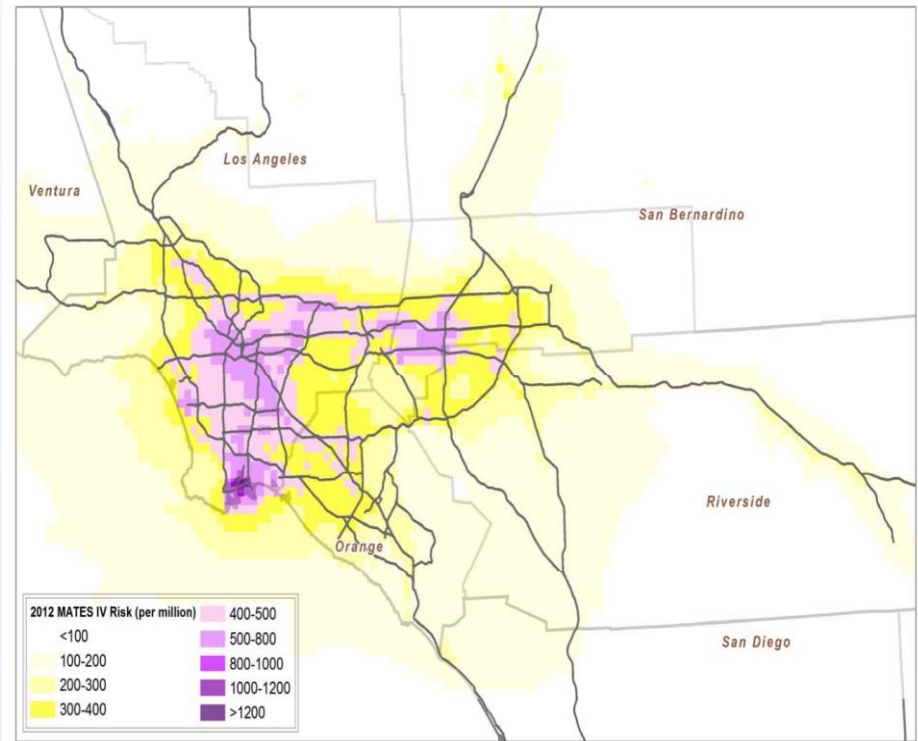


MATES IV* Data Show We are Successfully Reducing Diesel Risk

2005 Risk



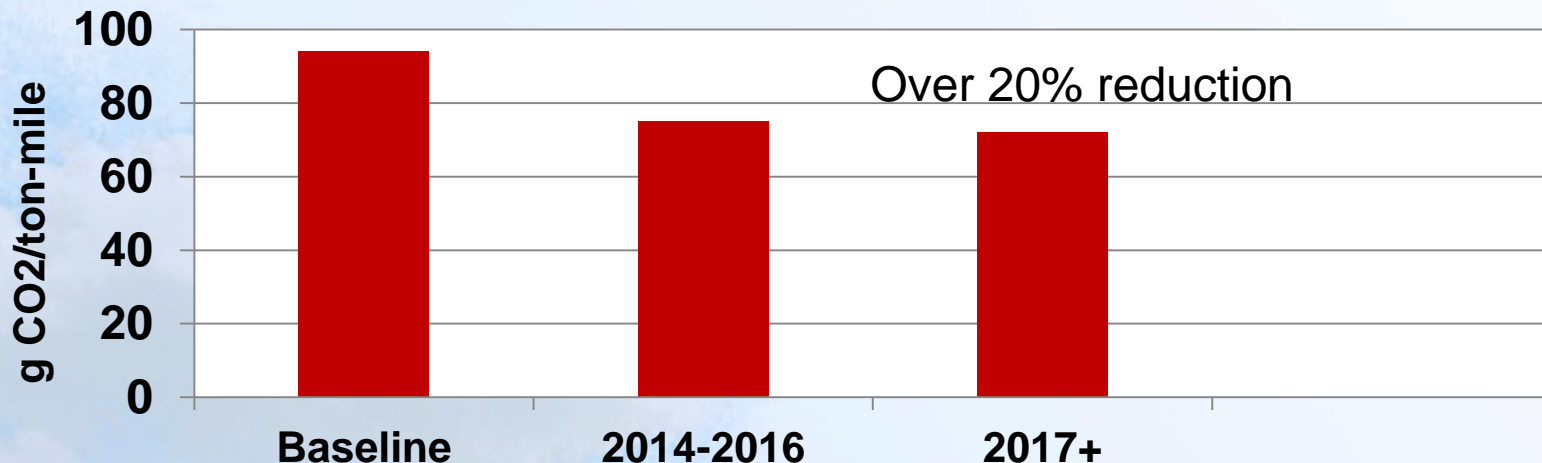
2012: Risk Greatly Reduced



*Risk values do not reflect pending update to OEHHA Health Risk Assessment Guidance

Current GHG Requirements

- ARB Tractor-Trailer GHG Regulation
 - AB32 early action item
- U.S. EPA Phase 1 Standards



* g CO2//ton-mile Phase 1 standards for Class 8 high-roof sleeper cabs

Today's Presentation

- Introduction
- Current Program
- Recent Program Evaluation
- Achieving Additional Criteria Reductions
- New Phase 2 Standards
- Driving Towards Zero Emissions

Staff Evaluated Existing Heavy-Duty Program

- Inspection of over 1,000 trucks
- Stakeholder discussions/surveys
- Review of warranty, emissions and maintenance data
- Three main areas of focus:
 1. Diesel particulate filters
 2. Engine durability
 3. In-Use NOx emissions



Data Show Filters Work

- Properly functioning filter virtually eliminates PM emissions
- Monitoring studies validate reductions
- Warranty claims low for retrofits and most factory installed filters
- End-users must monitor and maintain filters and engines

Engine Durability is a Concern

- Engine component malfunctions affect filters
- Engine warranty claims relatively high
 - On average, more than one claim per engine for some model years
 - Warranty only covers small fraction of useful life
- Need to hold manufacturers more accountable
- Need better tools to ensure durability

In-Use NOx Control Needs Improvement

- Selective-catalytic reduction (SCR) achieves substantial NOx control
 - Effective under vehicle cruise condition
 - Requires minimum operating temperature
 - Excess emissions observed under low-temperature and low engine loads
- Better control needed for broader range of engine operation modes



Today's Presentation

- Introduction
- Current Program
- Recent Program Evaluation
- Achieving Additional Criteria Reductions
- New Phase 2 Standards
- Driving Towards Zero Emissions

Opportunities to Improve Current Emissions Performance

- Improved in-use compliance testing
- Expanded preventive maintenance
 - Work with stakeholders to identify most beneficial maintenance procedures
- Potential new inspection/maintenance requirements

Looking Forward to Lower Criteria Pollutant Emissions Standards

- Staff working to lay technical foundation
- Continue coordination with U.S. EPA
- Three goals:
 1. Lower NOx standard
 2. Stronger durability and warranty requirements
 3. Broader in-use NOx and PM control

Today's Presentation

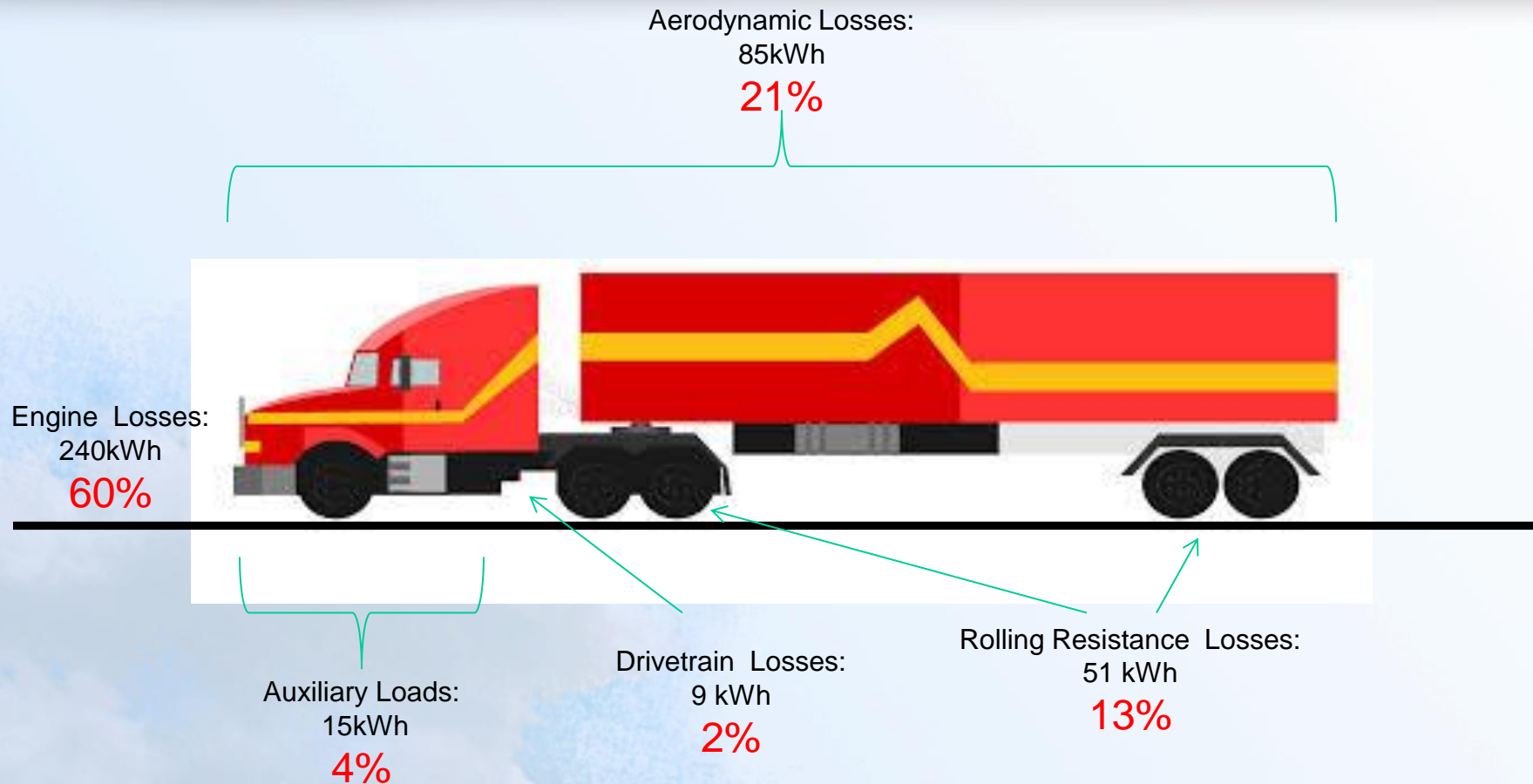
- Introduction
- Current Program
- Recent Program Evaluation
- Achieving Additional Criteria Reductions
- New Phase 2 Standards
- Driving Towards Zero Emissions

DOE SuperTruck Program Shows Potential for Class 8 Tractor Trailers

- \$115 million in DOE funding awarded
 - \$155 million in private-industry investments
- Four participating teams
- Demonstrate major improvements in engine, drivetrain, and vehicle efficiencies
- Substantial benefits possible using incremental improvements to conventional technologies



Many Opportunities for Efficiency Improvements



Based on Data from U.S. DOE (21st Century Truck Partnership). 2006

Phase 2 HD GHG Standard Development

- Jointly being developed by U.S. EPA, National Highway Traffic Safety Administration, and ARB
- Notice of Proposed Rulemaking expected in early 2015
 - Federal rule adoption in March 2016
 - ARB rule adoption in mid-2016
- Further fuel economy improvements and GHG reductions for 2018+ model years
 - NAS and UCS/ACEEE agree additional 13-25% CO₂ reduction beyond Phase 1 possible*

Many Options for Phase 2 Compliance

- Combustion and after-treatment optimization
- Engine downsizing
- Hybridization
- Reduced friction and optimized gear ratios in transmissions
- Auxiliary load reduction
- Aerodynamics
- Low-rolling resistance tires



Lower NOx and GHG are Achievable

- Systems integration is important
 - Engine and vehicle efficiency measures simultaneously reduce NOx and GHG
 - Optimize operations/control for in-use performance and emissions
- Advanced technologies are key
 - Hybridization

Today's Presentation

- Introduction
- Current Program
- Recent Program Evaluation
- Achieving Additional Criteria Reductions
- New Phase 2 Standards
- Driving Towards Zero Emissions

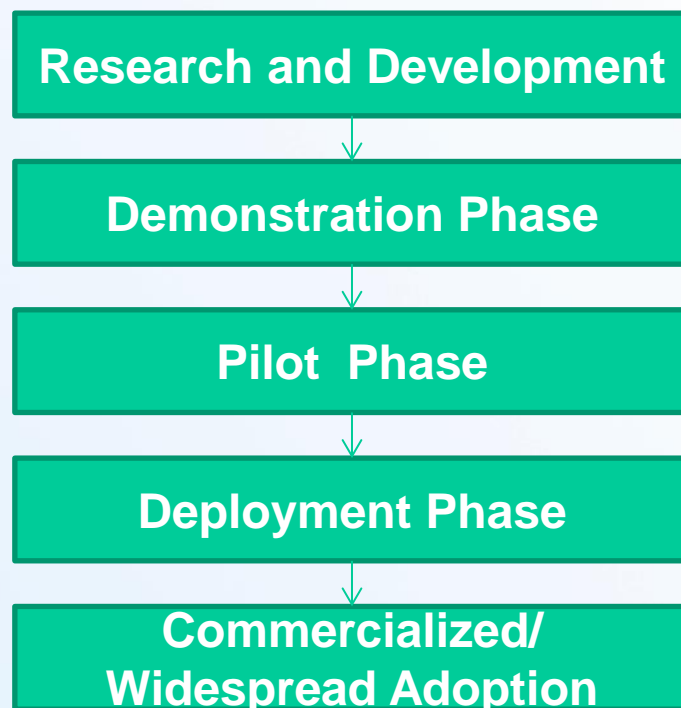
Beyond Phase 2: Zero and Near-Zero Technologies

- Technology assessment evaluating commercialization pathways
- Need to address
 - Technology development and deployment
 - Well to wheel emissions
 - Infrastructure



Incentives Help Develop Markets for Zero-Emission Trucks

- On-going major public investments
 - \$200M annually
 - Cap and Trade
 - Other incentive funds
- Diverse portfolio
 - Demonstrations
 - Pilot deployments
 - Infrastructure
 - Renewable fuels



Move Forward with Comprehensive Strategy

- Existing programs have been effective, but further improvements possible
- Encourage technologies that advance pathways to zero emissions
- Milestones:
 - Phase 2 Standards
 - Technology Assessments
 - SIP Development