



# Proposed Research Plan

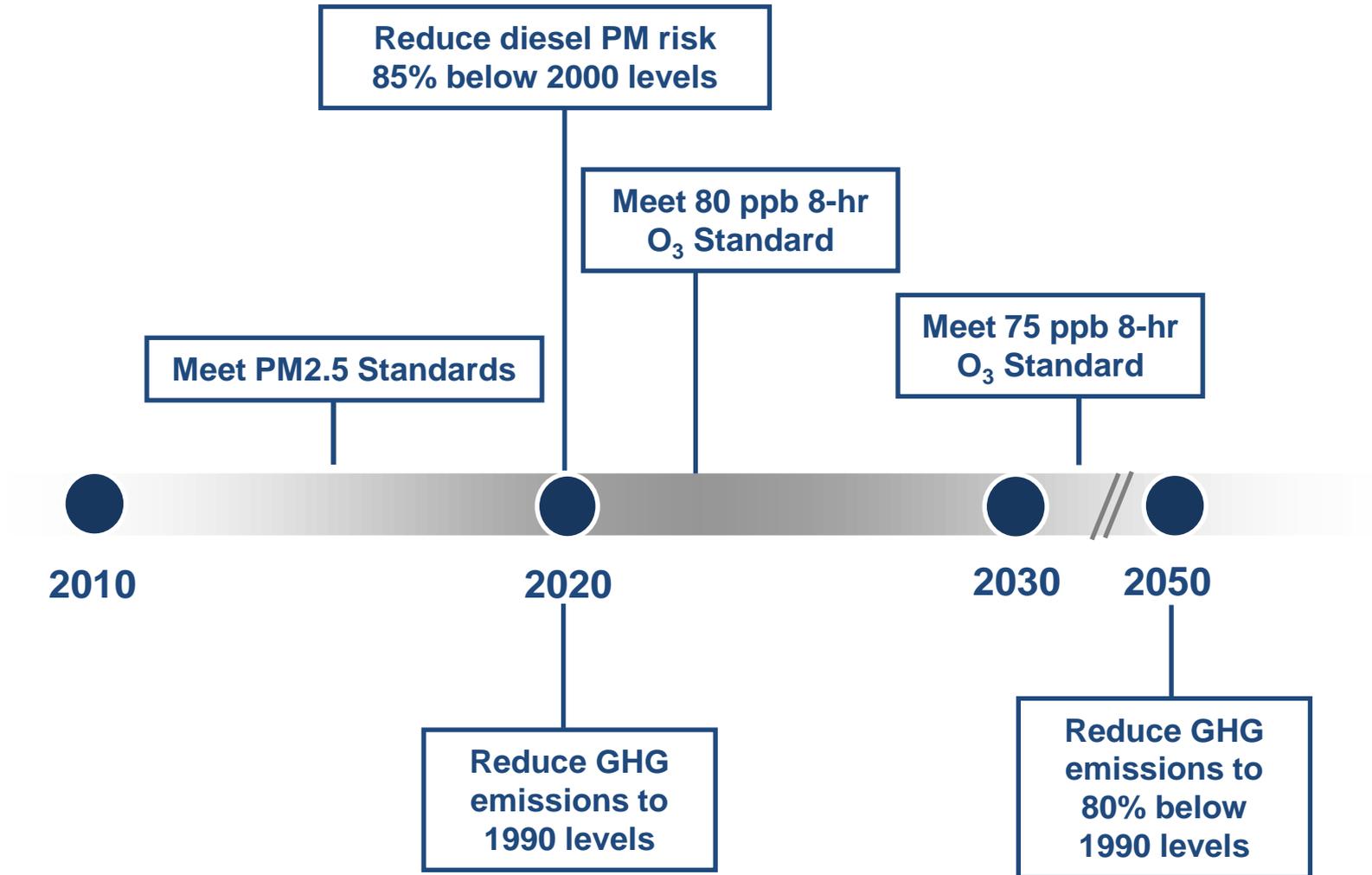
Fiscal Year  
2014-2015



# Today's Action

- Approve Fiscal Year 2014-2015 Research Plan
- 14 research concepts
- Total \$5.3 million

# Planning Considerations



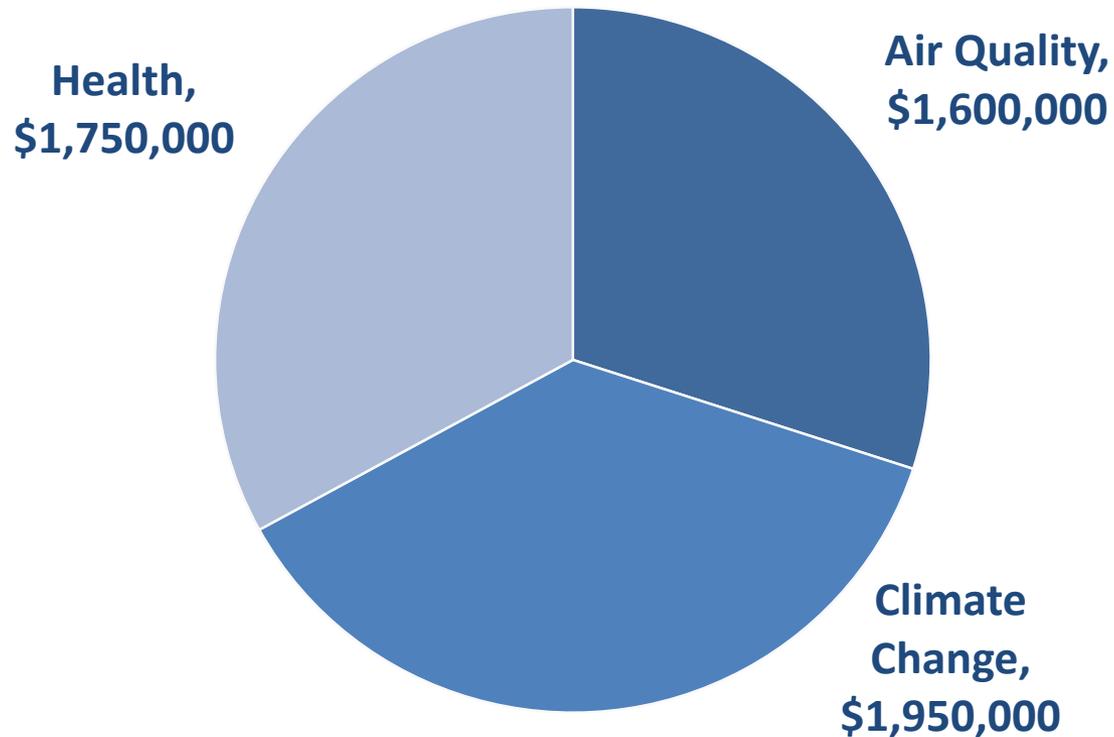
# Developing the Research Plan

- Identified priorities based on ARB program needs
- Developed concepts and scopes of work in-house
- Open call to the public for research ideas

# Leveraging Other Research

- Collaboration with federal and state agencies
- More than \$14 million of related research
- Relevant research by others
  - PM2.5 measurements in the San Joaquin Valley (NASA)
  - GHG emission measurements in Los Angeles (NIST)
  - N<sub>2</sub>O emissions from agricultural soils (CEC & CDFA)
  - Ultrafine cohort study (U.S. EPA)
  - Sustainable transportation research (U.S. DOT)

# 2014-2015 Key Program Areas





# Health



# Health Research Program



## Past Programs Supported by ARB Research

- SB 25: Children's Environmental Health Protection Act
- Lower-emission School Bus Program
- SB 124: School bus idling and idling at schools
- SB 352: Siting new schools away from traffic
- AB 2276: Limiting ozone emissions from indoor air cleaners

# Health Research Topics

- Health Effects of Ultrafine Particles (2 projects)
- Toxicity Testing (1 Project)
- Indoor Air Exposure (1 Project)

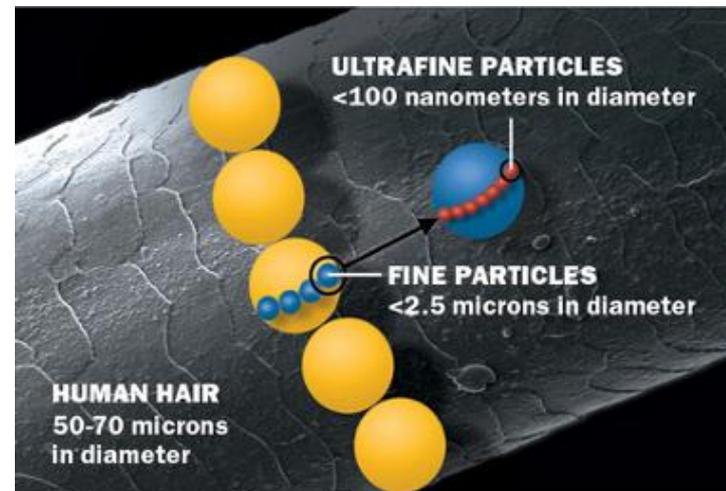
# Ultrafine Particle Research Overview

- **Ultrafine Particles**

- Limited research on toxicity compared to PM<sub>2.5</sub>
- Cardiovascular effects seen in human and animals studies
- Can accumulate in the brain and other organs

- **Epidemiological Studies**

- Past epidemiological studies used a single monitor to estimate city-wide concentrations
- No long-term health studies



# Long-Term Ultrafine Particle Exposure and Premature Death

- Estimate the risk of premature death associated with exposure to ultrafine particulate matter (UFPM) in California
- Assess statewide UFPM concentration
- Calculate an estimated risk using a cohort from existing epidemiological study
- Proposed funding: \$800,000



# Ultrafine Particles and Neurodegenerative Disease

- Assess if long-term exposure to ultrafine particles is associated with the development of neurodegenerative processes and related cognitive deficits
- Investigate the role of ultrafine particle exposure in the progression of neurodegenerative disease
- Exposures will be conducted in a rodent model of neurodegenerative disease
- Proposed funding: \$500,000

# Protocol for Particulate Matter Toxicity Testing

- Develop a sample preparation protocol for future PM<sub>2.5</sub> toxicity studies
- Define the best method for sample preparation and for comparison of toxicities of vehicle emissions in a consistent manner
- Compare results with those from existing PM<sub>2.5</sub> sample preparation protocols
- Proposed funding: \$100,000



# Formaldehyde Emissions from Home Particle Filters

- Assess benefits of formaldehyde-free particle filters
- Inform potential changes to California's building code specifications for central heating and air conditioning filters
- Proposed funding: \$350,000





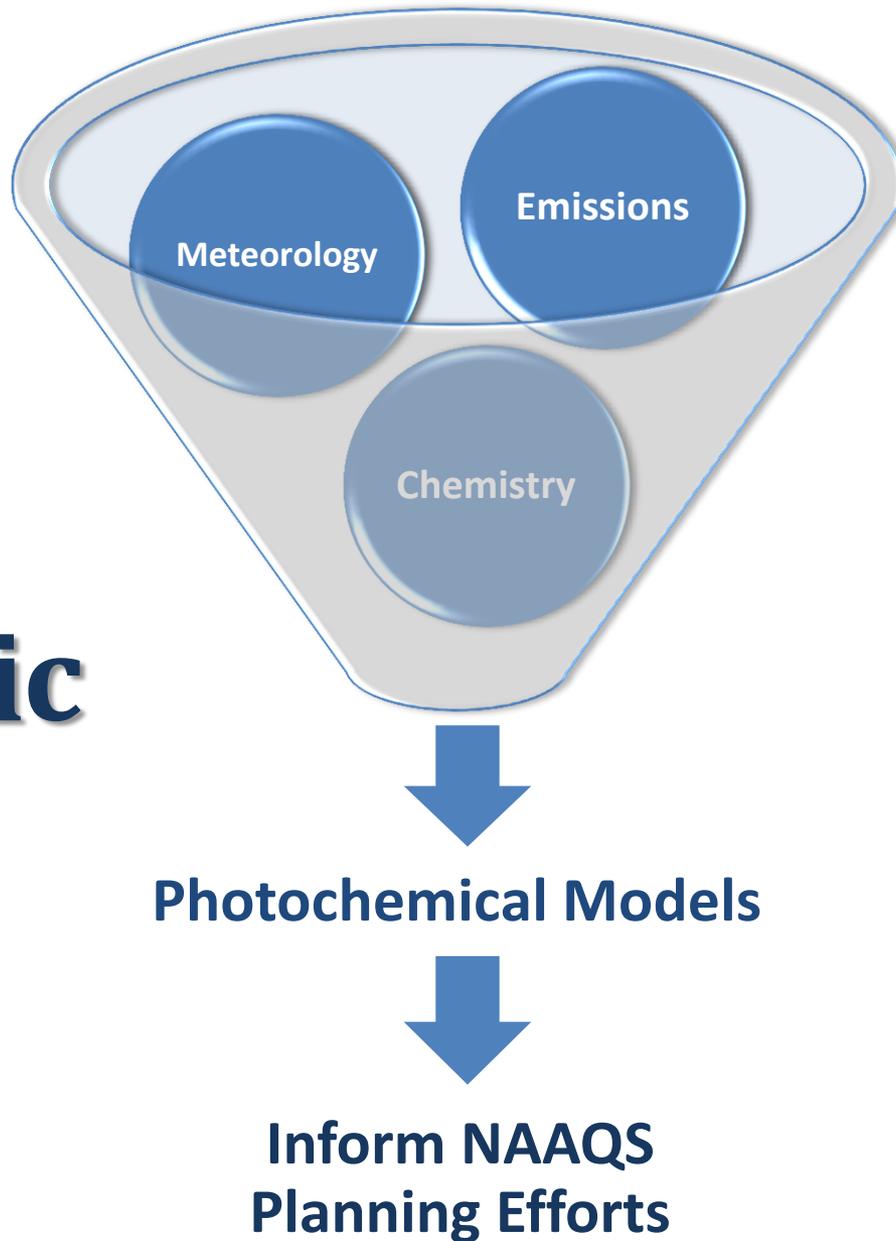
# Air Quality



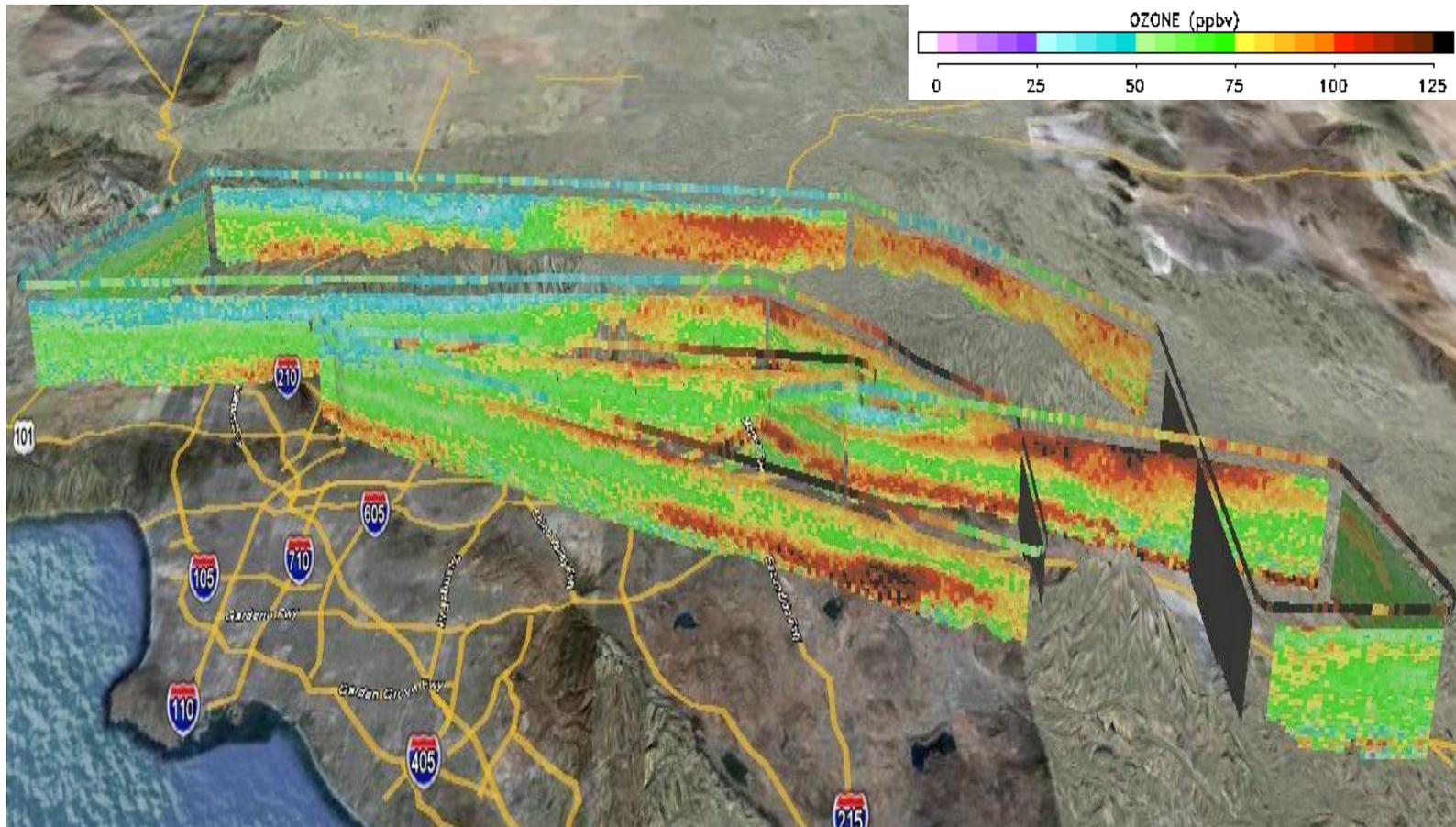
# Air Quality Research Topics

- Atmospheric Science (2 projects)
- Vehicle Emissions (2 projects)

# Atmospheric Science Research



# Ozone Research Efforts



# Aloft Conditions & Air Quality Modeling

- Understand the contribution of “aloft” pollution on high ozone days in the San Joaquin Valley
- Detailed air quality and meteorological measurements will be used to improve ozone modeling for SIPs
- Proposed funding: \$300,000

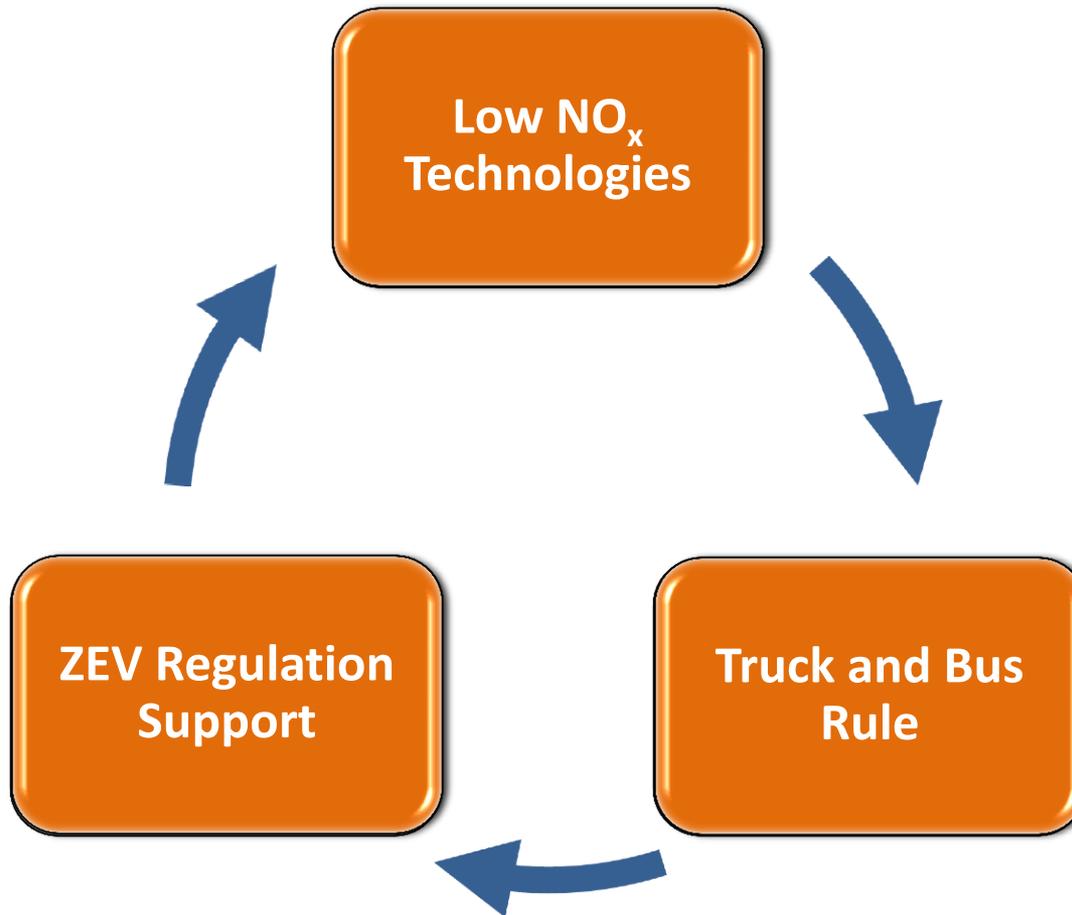


# Analysis of PM<sub>2.5</sub> Data from DISCOVER-AQ

- Investigate the physical and chemical processes that led to high PM<sub>2.5</sub> concentrations in the Fresno area during the DISCOVER-AQ field study in the winter of 2013
- Analyze DISCOVER-AQ data to provide updated information for future PM<sub>2.5</sub> SIP modeling
- Proposed funding: \$200,000



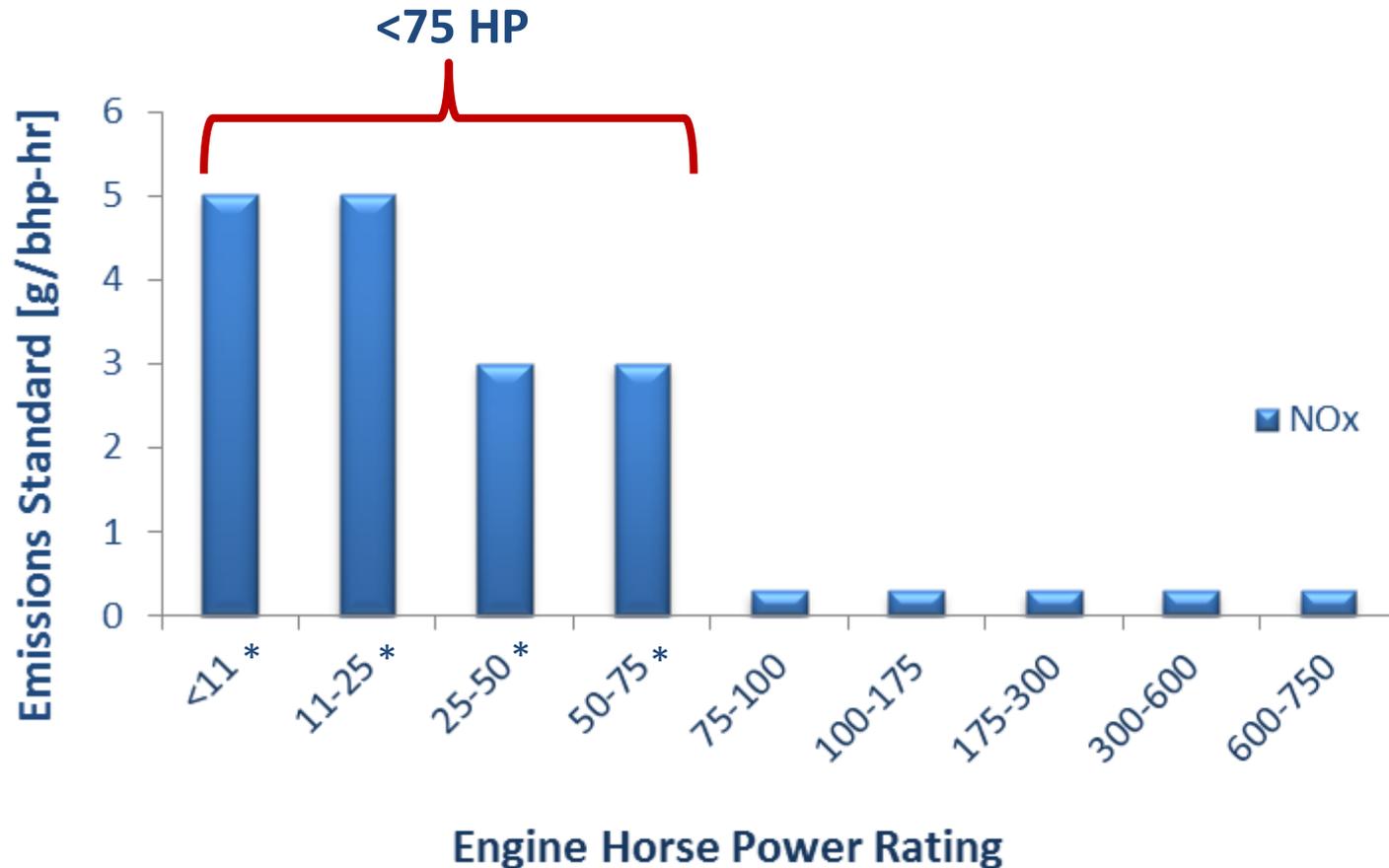
# Current Vehicle Emissions Research



# Aftertreatment for Small Off-Road Engines



# Tier IV Final Off-Road Engine Standards



\*Calculated based on combined THC + NO<sub>x</sub> standards

# Aftertreatment for Small Off-Road Engines

- Quantify costs versus the performance of various emission control technologies for small off-road diesel engines
- Determine whether future regulatory measures to reduce emissions would be feasible and cost effective
- Proposed funding: \$800,000

# Distributional Impacts of Off-Road Tier IV Standards



## Federal Programs

- Averaging Banking, and Trading
- Trading and Transition Program for Equipment Manufacturers

# Distributional Impacts of Off-Road Tier IV Standards

- Examine the impact of federal programs on the criteria pollutant emissions from 2011 and later model year off-road diesel engines in California
- Determine if regions in California have received more than a proportionate share of higher emitting engines
- Evaluate if further federal or state action is needed to achieve expected emission reductions
- Proposed funding: \$300,000





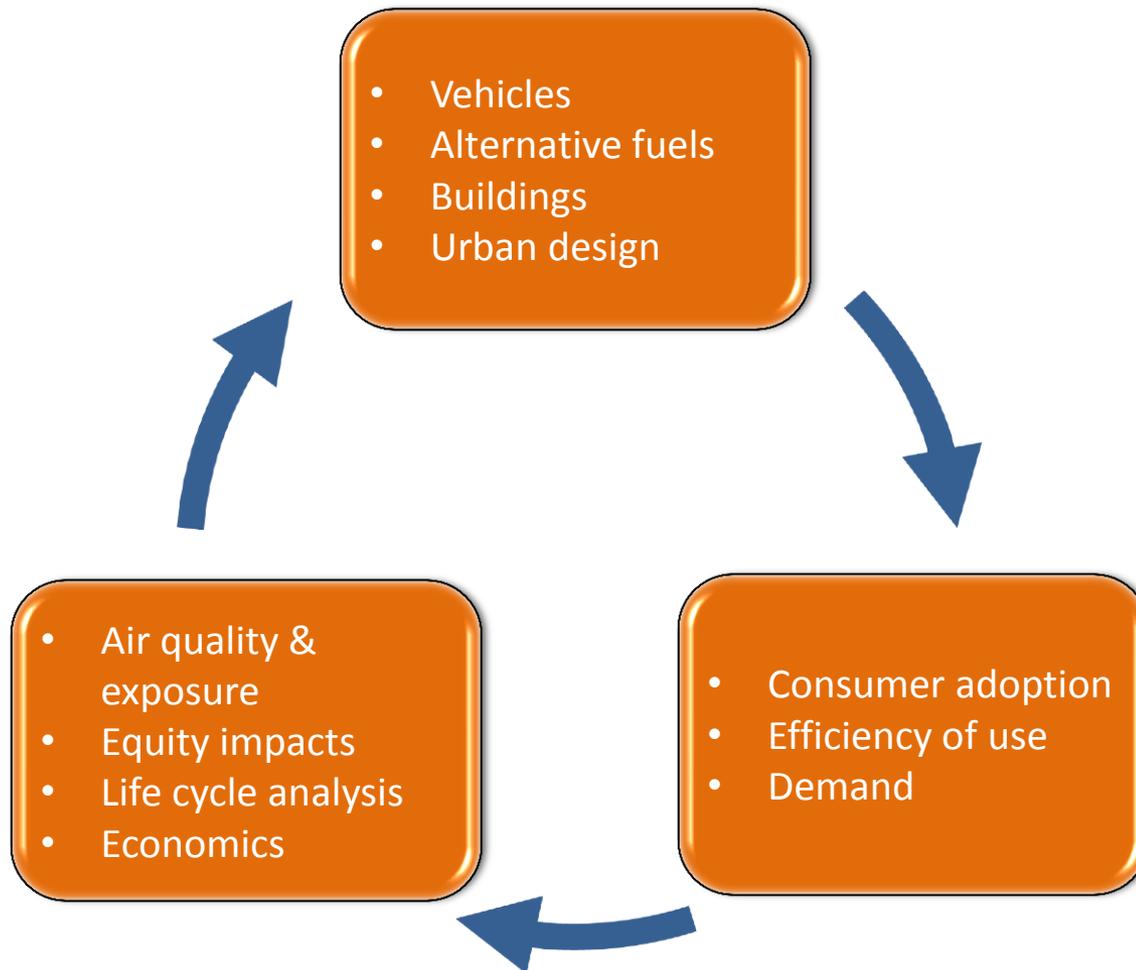
# Climate Change



# Climate Change Research Topics

- Transportation Technology and Infrastructure (4 projects)
- Short-lived Climate Pollutants and Nitrous Oxide (2 projects)

# Current Transportation Research



# Heavy-Duty Trailers Covered by the GHG Rule



# Heavy-Duty Trailers *not* Covered by the GHG Rule



# Emission Reduction Assessment of Trailers Pulled by Heavy-Duty Tractors

- Assess the potential GHG emission benefits from improved HD trailer aerodynamics and reduced trailer tire rolling resistance for exempt trailers (< 53')
- Conduct wind tunnel testing of trailers with aerodynamic technologies to determine if trailers with these technologies have reduced fuel consumption
- Proposed funding: \$500,000



# The Resale Market for Plug-in Electric Vehicles

- Evaluate the long-term emissions benefits of PEVs based on the dynamics of the secondary market and identify the need for incentives, durability requirements, or vehicle crediting
- Examine vehicle and market data on PEVs and determine the implications for vehicle demand, durability and emissions
- Proposed funding: \$300,000



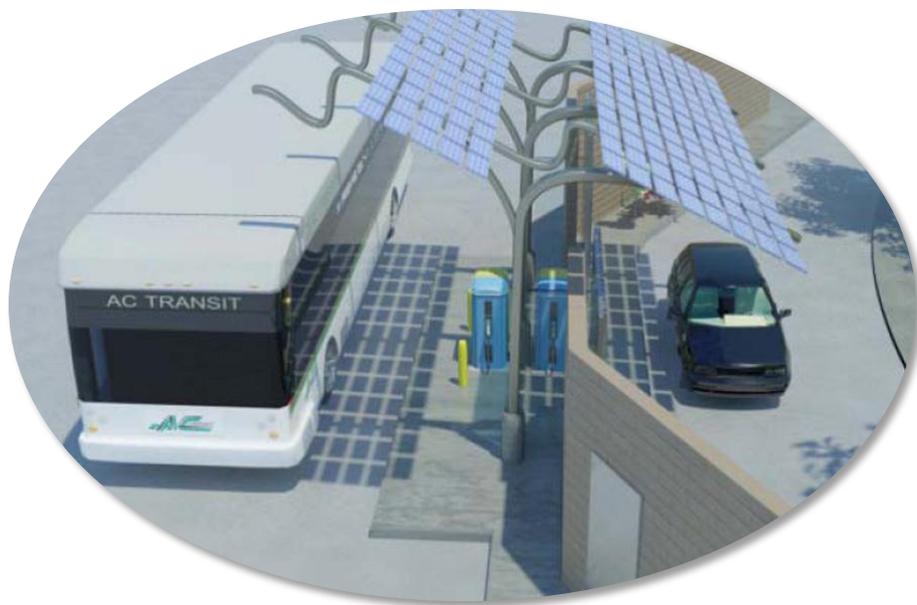
# Natural Gas Transportation Fueling Infrastructure and Future Heavy-Duty Near-Zero Technology

- Investigate how the near-term development of natural gas transportation fueling infrastructure can facilitate future heavy-duty near-zero technology
- Develop strategies to overcome barriers to the availability of multi-use infrastructure
- Proposed funding: \$250,000



# “Well to Wheel” Pathways for Zero and Near Zero Technology in the Heavy-Duty Sector

- “Well to wheel” emissions take into account the production and distribution of hydrogen fuel in HD sector
- Develop pathways with the least GHG and criteria pollutant emissions
- Proposed funding: \$250,000



# Short-lived Climate Pollutants and Nitrous Oxide Research



- Short-lived Climate Pollutants:**
- Black Carbon
  - Hydrofluorocarbons
  - Methane

# Impacts of Brown Carbon in California

- Identify and characterize the contribution of BrC to air quality and climate forcing in CA to improve global climate models
- Determine the chemical composition, optical properties, source types and the climate response to BrC
- Determine benefits of BrC emission mitigation
- Proposed funding: \$450,000



# Nitrous Oxide from Soils

- Develop a robust modeling tool that will quantify the N<sub>2</sub>O emission reduction potentials from mitigation strategies
- Estimate the mitigation potential of N<sub>2</sub>O at the state level to support long-term climate goals
- Proposed funding: \$200,000



# **Recommended Board Action**

Approve Fiscal Year 2014-2015 Research  
Plan