

Heavy-Duty Technology Advancement: Interagency Collaboration for Public Health

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Region 9: Air Division

Technology & Partnerships Office

US EPA

US DOE Hydrogen & Fuel Cells Program

Annual Merit Review

April 30, 2019



1) NAAQS Nonattainment & Emissions Inventory Data

2) Mobile Source Technology Activities:

- a) Rulemaking
- b) Funding
- c) Technical Assistance
- d) NAAQS SIP Review

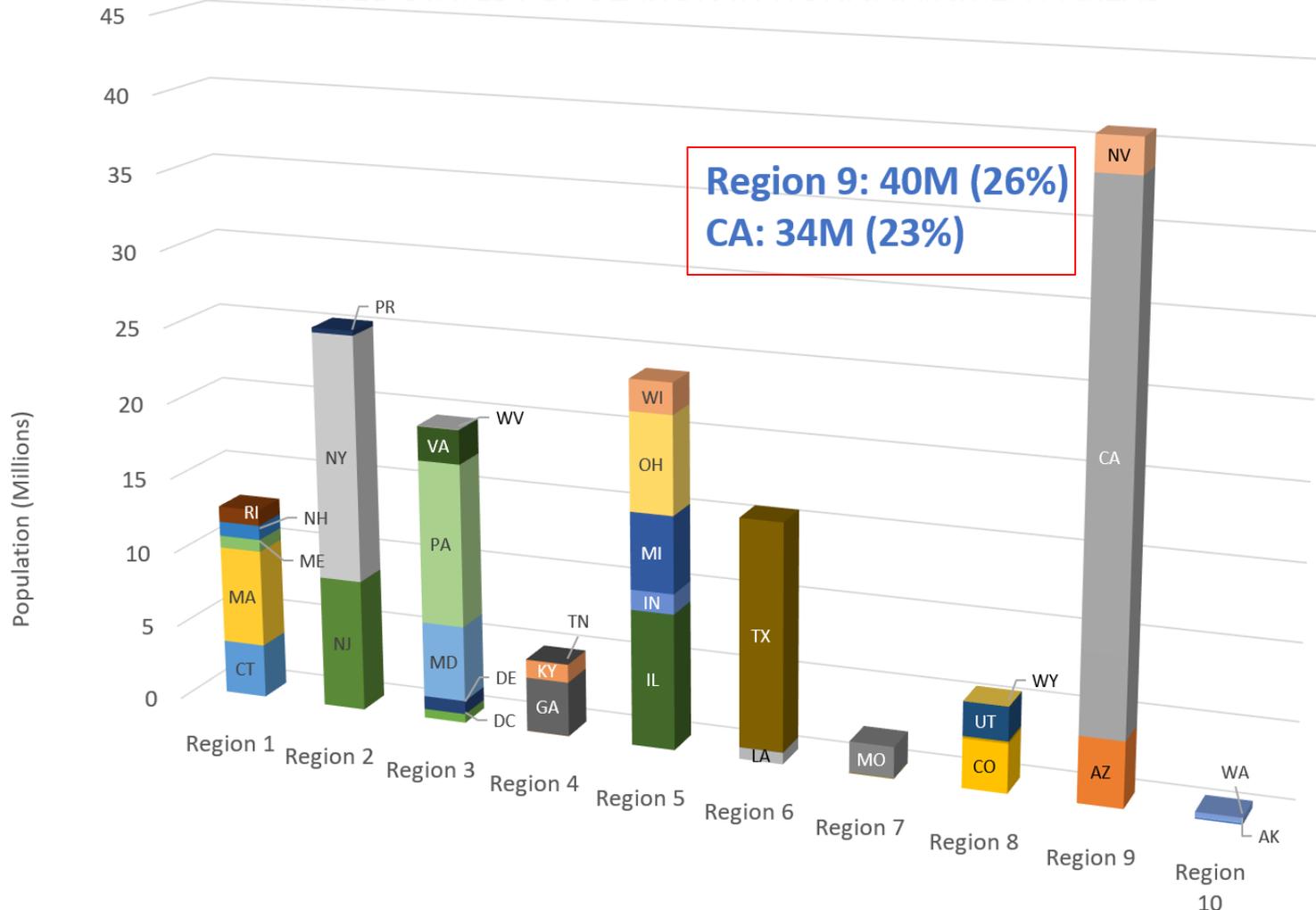
3) Fuel Cell Technology Partnerships

*Appendix: Mobile Source Funding Opportunities

NAAQS Nonattainment Population



UNITED STATES POPULATION IN NONATTAINMENT AREAS

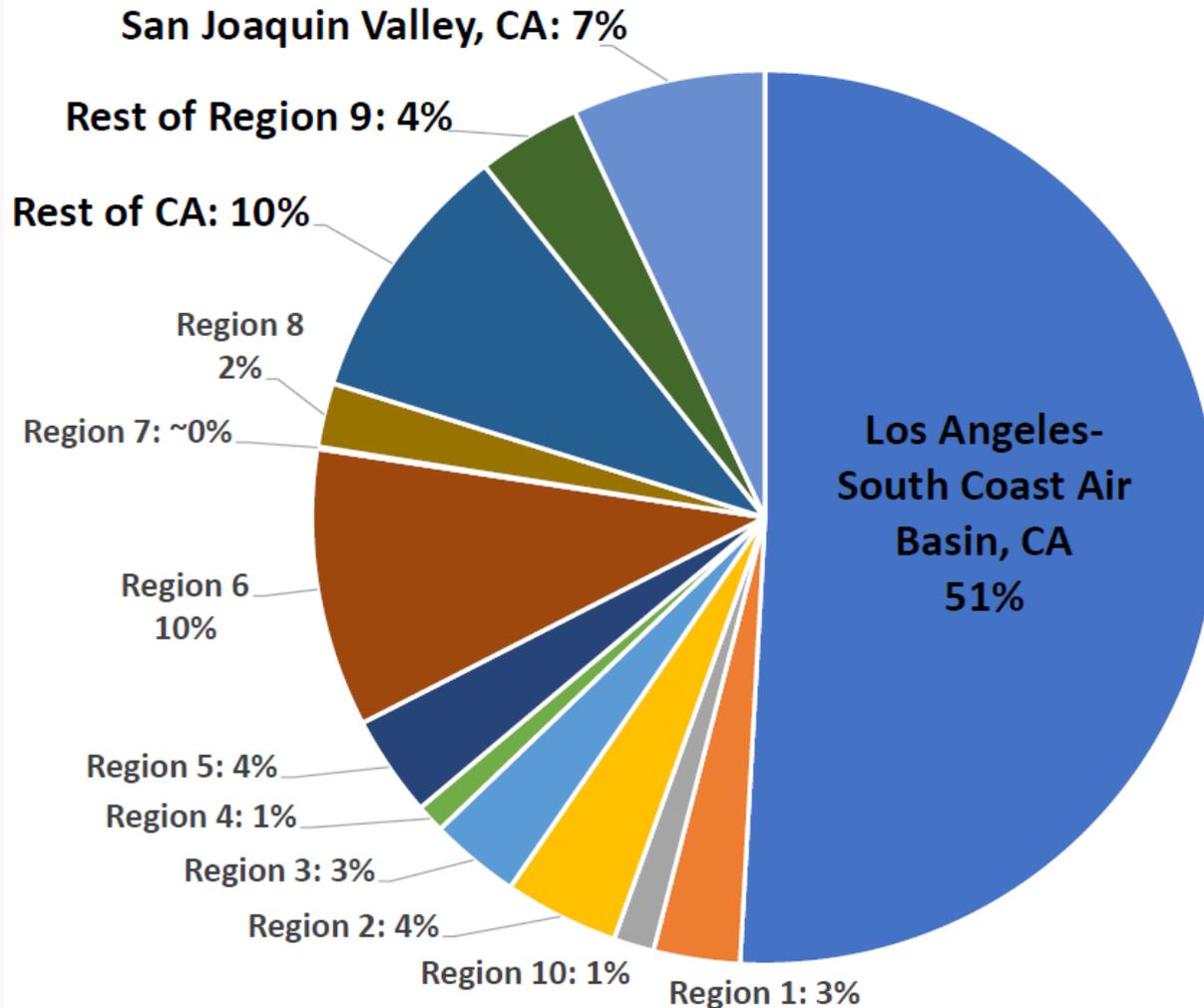


Sources: American Community Survey 2006-2010 File Geodatabase for Block Groups, U.S. EPA Office of Environmental Information (OEI) - Office of Information Analysis and Access (OIAA) (2011), U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards (OAQPS) (2015). Columns consist of summaries of populations of 2010 U.S. Census block groups which have centroids inside nonattainment area boundaries. Populations inside revoked 1-hour ozone nonattainment areas and populations inside nonattainment areas of former air quality standards are included; Guam excluded.
AIR18074 (June 18, 2018)

Unhealthy Ozone Exposure



POPULATION-WEIGHTED INCREMENTAL EXPOSURE ABOVE THE 2015 8-HOUR OZONE STANDARD



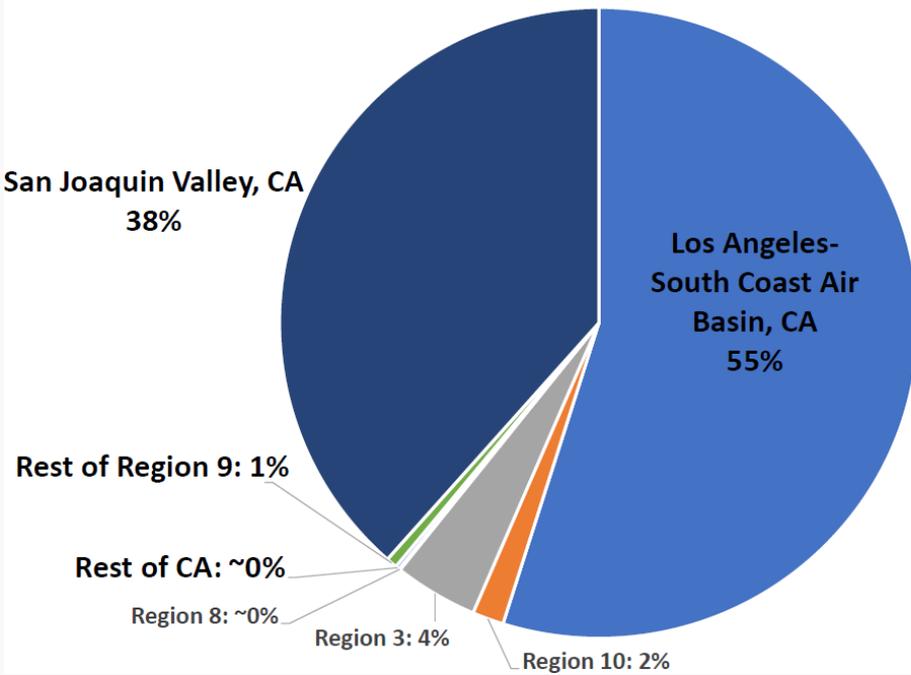
Finding: 72% of Americans exposed to unhealthy levels of ground level ozone pollution reside in Region 9.

US EPA (2019) USA Population Weighted Design Values 2017

Unhealthy PM2.5 Exposure

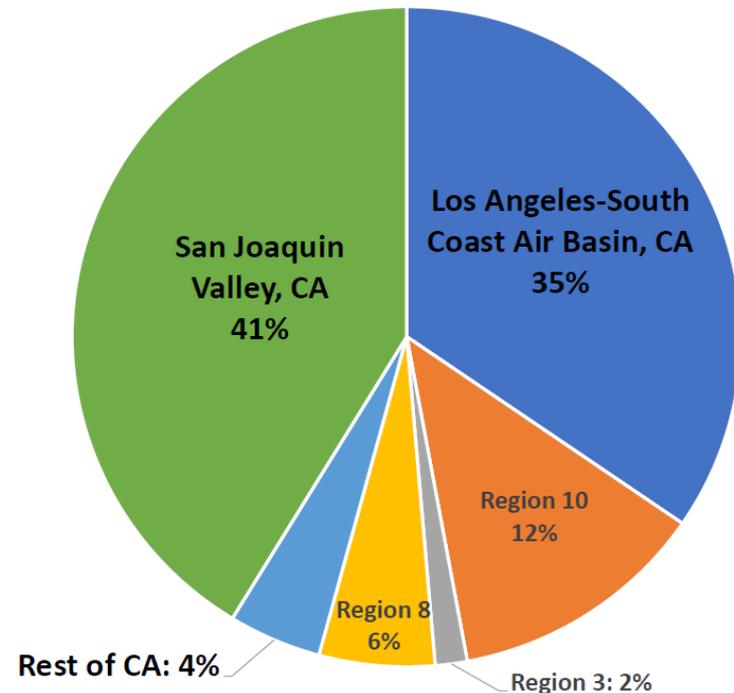


POPULATION-WEIGHTED INCREMENTAL EXPOSURE
ABOVE THE 2012 ANNUAL PM_{2.5} STANDARD

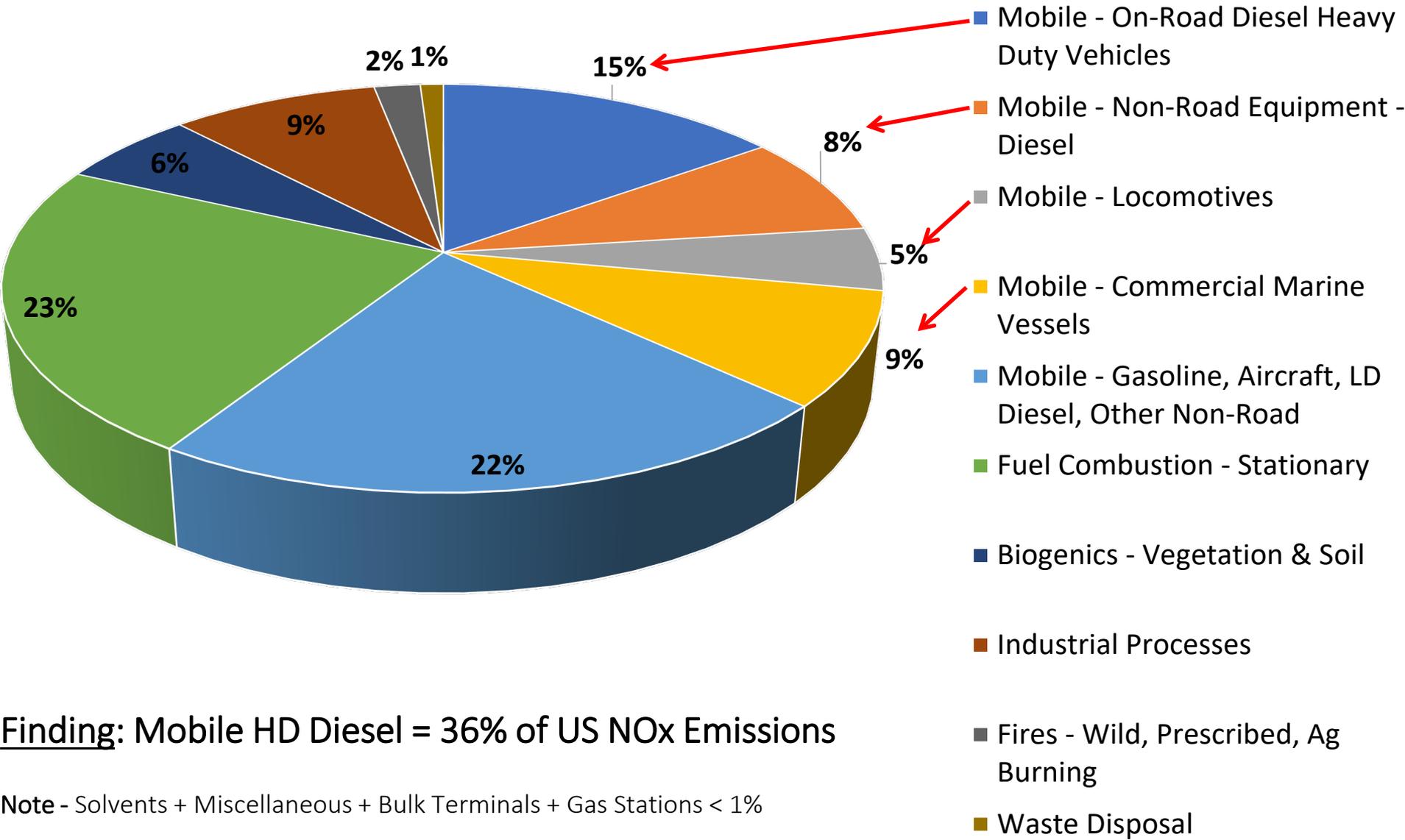


Finding: >80% of Americans exposed to unhealthy levels of fine particulate pollution reside in Region 9.

POPULATION-WEIGHTED INCREMENTAL EXPOSURE
ABOVE THE 2012 24-HOUR PM_{2.5} STANDARD



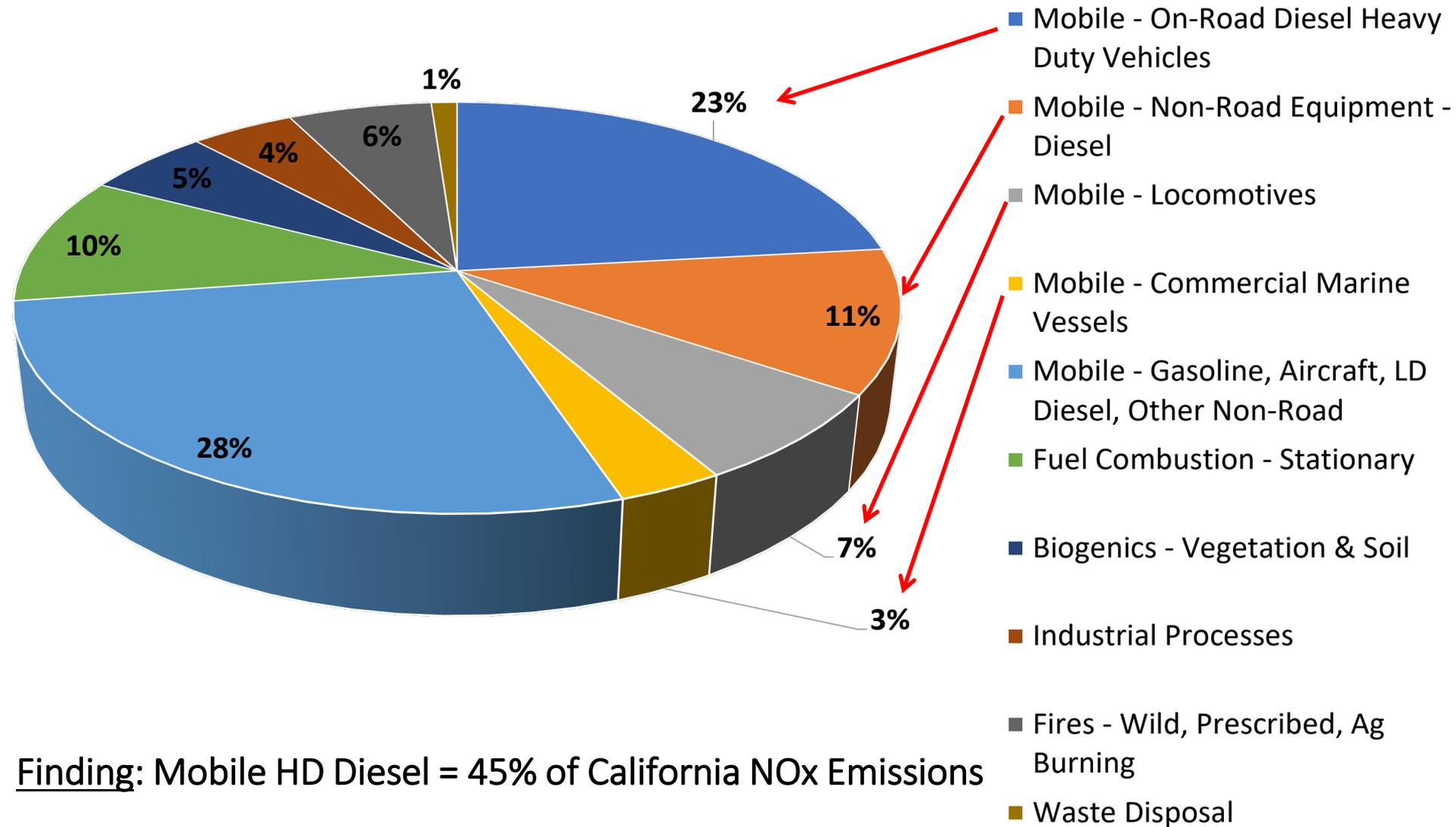
US NOx Inventory (2014)



Finding: Mobile HD Diesel = 36% of US NOx Emissions

Note - Solvents + Miscellaneous + Bulk Terminals + Gas Stations < 1%

California NOx Inventory (2014)

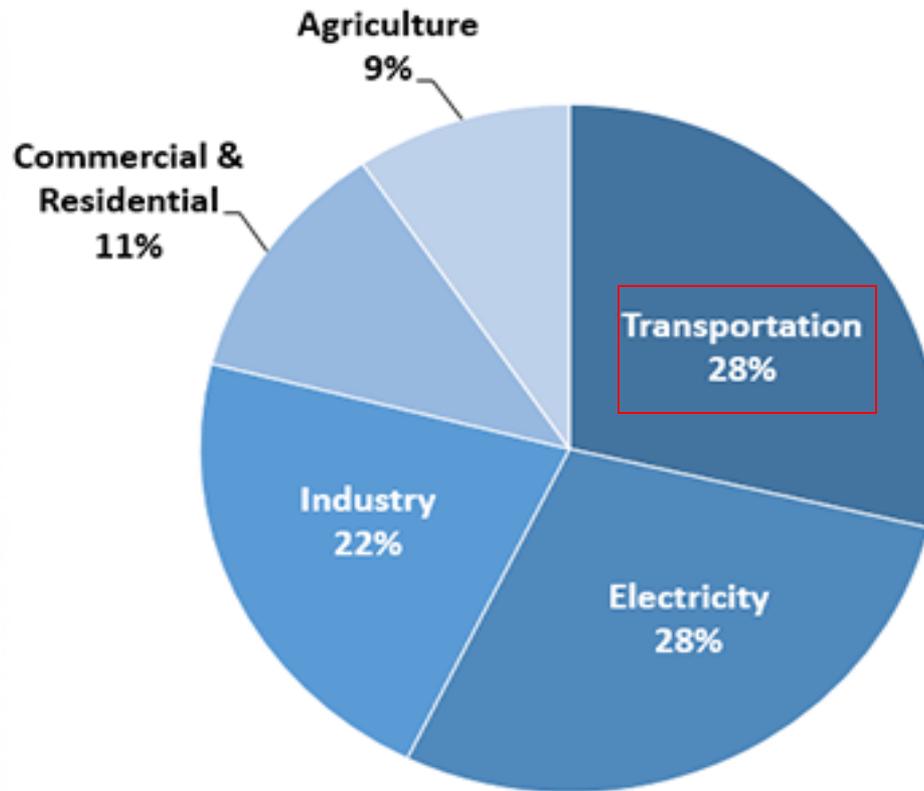


Finding: Mobile HD Diesel = 45% of California NOx Emissions

Note - Solvents + Miscellaneous + Dust + Bulk Terminals < 1%



Sources of Greenhouse Gas Emissions in 2016



U.S. Environmental Protection Agency (2018). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016



- **Challenge:** Heavy-duty mobile source NO_x and PM_{2.5} reductions needed to attain NAAQS.
- **Rulemaking:** Cleaner Trucks Initiative (*TBA*), Tier 4 Locomotive (final), Tier 4 Nonroad (final), Tier 4 Marine (final), Tier 3 Light-Duty (final), HD GHG Phase 2 (final, *next slide*)
 - <https://www.epa.gov/regulations-emissions-vehicles-and-engines/cleaner-trucks-initiative>
 - <https://www.epa.gov/emission-standards-reference-guide>
- **Funding:** DERA, Targeted Airshed
- **Technical Assistance & Partnerships:** Emissions testing/verification, planning, R&D
- **NAAQS SIP:** Credit for mobile source incentive programs (*review pending*)



- **Advanced Technology Multipliers:** Intended to incent OEM's to produce zero emission capable drivetrain technologies for Class 2b-8 on-highway vehicles through MY2027.
- **Cost Analysis:** Credit values based on CARB analysis that compared costs to conventional ICEV technologies. Analysis showed that adopting multipliers in this range would make ZEV technologies much more competitive with ICEV technologies, and could allow OEMs to more easily generate a viable business case to develop ZEV technologies and bring them to the heavy-duty market at a competitive price.
- **Zero Upstream Emissions:** Rule does not account for upstream emissions for BEVs and FCEVs.

Table I-2 Advanced Technology Multipliers

| Technology | Multiplier |
|----------------------------------|-------------------|
| Plug-in hybrid electric vehicles | 3.5 |
| All-electric vehicles | 4.5 |
| Fuel cell vehicles | 5.5 |



National Clean Diesel Campaign

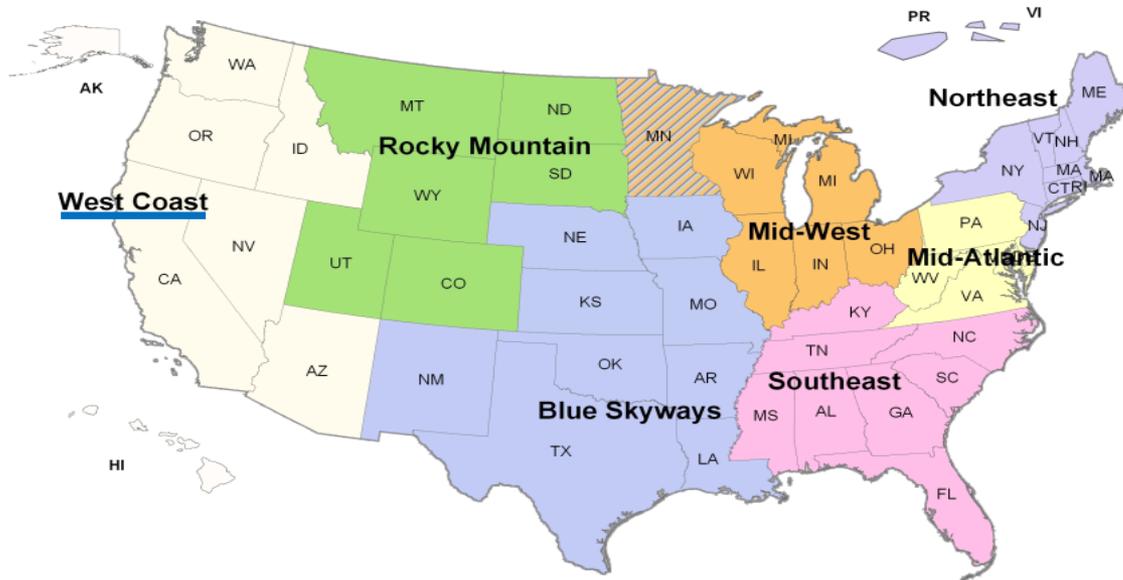


Regional Clean Diesel Collaboratives

❖ EPA Regions 9 & 10 →
AK, AZ, CA, HI, ID, NV, OR,
WA, Pacific Islands & 419
Native Tribes

❖ Public-Private
Partnership

❖ Over 1,000
Partners










WEST COAST COLLABORATIVE
A public-private partnership to reduce diesel emissions





West Coast Collaborative Goals

- 1) Help meet National Ambient Air Quality Standards (NAAQS).
- 2) Reduce diesel particulate emissions in impacted communities, and leverage emission reduction co-benefits.
- 3) Support technology advancement and deployment to increase energy efficiency, energy security, and economic growth.



Picture: Pre-1980 school bus exhaust

<https://westcoastcollaborative.org>



- **Purpose:** Funding assistance to retrofit, repower, or replace legacy heavy-duty diesel vehicles and equipment.
- **Goal:** Reduce diesel emissions and exposure, particularly from fleets operating in areas with poor air quality.
- **Appropriation:** FY18 = \$75M; FY19 = \$87M
 - FY19 RFA closed 3/26/19
 - Project selections TBA Fall 2019



- **Eligible Fuel Cell Applications:***
 - Urban Buses
 - Drayage Trucks
 - Terminal Tractors
 - Stationary Generators
 - Forklifts
- **US EPA Cost-Share Caps:***
 - Repower $\leq 60\%$
 - Replacement $\leq 45\%$
 - Drayage Trucks $\leq 50\%$

**Requires diesel engine scrappage*

Targeted Airshed Program



- **Purpose:** Funding assistance for local, state and/or tribal air pollution control agencies developing plans, conducting demonstrations, and implementing projects to reduce air pollution in the top five most polluted areas relative to ozone and PM2.5 NAAQS.
- **Goal:** Reduce air pollution in the nation's most polluted airsheds.
- **Appropriation:** FY18 = \$40M; FY19 = \$52M
- **US EPA Cost-Share:** $\leq 100\%$ for all projects
 - *All zero emission technologies are eligible*



WEST COAST COLLABORATIVE

A public-private partnership to reduce diesel emissions

Medium & Heavy-Duty Alternative Fuel Infrastructure Corridor Coalition (AFICC)

<https://westcoastcollaborative.org/workgroup/wkgrp-fuels.htm>

FAST Act: Section 1413

Alternative Fuel Corridor Designations

- **National electric vehicle charging, hydrogen, propane, and natural gas fueling corridors.**
 - Directs US DOT to designate alternative fuel corridors that identify the near and long-term need for, and location of fueling infrastructure at strategic locations along major national highways to ***improve the mobility of passenger and commercial vehicles that employ electric, hydrogen fuel cell, propane, and natural gas fueling technologies*** across the United States.

Source: Federal Highway Administration (2019) https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/

West Coast M/HD Alternative Fuel Corridors

Zero Emission Corridor Nomination — I-5 & US-101
Part of the West Coast Electric Highway

- Interstate collaboration is needed to develop west coast corridors for M/HD AFV fueling similar the one shown here for LD ZEVs. This would help to address:
 - Emission reductions
 - Fuel supply diversity
 - Sustainable freight, public works, refuse collection, transit & school bus
 - Local job creation and economic development



WCC AFICC Steering Team Members

Federal: US EPA, US DOT, US DOE

California: GO-Biz, Caltrans, CARB, CEC,
CAPCOA, CALCOG

Oregon: ODOT, ODEQ, ODOE, CWCCC, Oregon
Metro, RVMPO

Washington: WSDOT, WDOE, WSEO, PSCAA,
PSRC

Clean Air Technology Initiative (CATI)

- **Purpose:** Coordinate public sector development of and investments in advanced clean air technologies.
- **Goal:** Reduce emissions from major contributors to ambient PM2.5 and ozone in San Joaquin Valley and South Coast.
- **Stakeholder Partnerships:** CA Fuel Cell Partnership, CA Natural Gas Vehicle Partnership, Veloz/CA Plug-in Electric Vehicle Collaborative, CA Environmental Dialogue, DOE Clean Cities Coalitions, etc.
- *Partner agencies include:*



United States
Environmental Protection Agency



California
Air Resources Board



South Coast
Air Quality Management District



San Joaquin Valley
Air Pollution Control District



Focus of the CATI

Demonstrating and accelerating the deployment of the cleanest technologies in the South Coast and San Joaquin Valley to meet NAAQS goals by:

- ❑ Determining targeted sectors
 - ❑ Identifying technology options for priority sources
 - ❑ Providing funding for technology testing and deployment
 - ❑ Identifying & pursuing policy options
 - ❑ Enhancing outreach and education

CA Fuel Cell Partnership



- **US EPA Participation:** Charter member (1999), Region 9 has represented the agency since 2011.
- **Priority Issue:** Accelerating development & deployment of M/HD FCEV & H2 technologies to help address NAAQS nonattainment challenges.
- **M/HD Activities:** https://cafcp.org/buses_trucks
 - Fuel Cell Electric Bus Roadmap (2013, *update TBA*)
 - <https://cafcp.org/sites/default/files/A%20Roadmap%20for%20Fuel%20Cell%20Electric%20Buses%20in%20California.pdf>
 - Fuel Cell Electric Truck Action Plan for California (2016)
 - <https://cafcp.org/mdhd-action-plan-2016>
 - California Fuel Cell Revolution (2018)
 - <https://cafcp.org/sites/default/files/CAFCCR.pdf>
- **Interagency Engagement:** US DOE, US EPA, CA GO-Biz, CARB, CEC, CDFA, SCAQMD, BAAQMD





- **Sustainable Transportation Energy Pathways (STEPS):** Multidisciplinary research consortium, part of the Institute of Transportation Studies at the University of California, Davis.
- **Principles:**
 - Generate new insights and tools to understand the transitions to a sustainable transportation energy future for California, the US and the world (Research)
 - Disseminate valued knowledge and tools to industry, government, the environmental NGO community, and the general public to enhance societal, investment, and policy decision making, (Outreach)
 - Support the training of the next generation of transportation and energy leaders and experts. (Education)
- **Interagency Engagement:** US DOE, US DOT, US EPA, Caltrans, CEC, CARB, SCAQMD



US EPA's Assessment of Fuel Cells at Ports

- US EPA's Office of Transportation and Air Quality (OTAQ) established the US EPA Ports Initiative in part to identify advanced technologies and strategies to reduce emissions at ports.
- Partnered w/ ERG to develop a research report that characterizes fuel cell technology systems and how they can be utilized at ports.
- Fuel cell technologies have the potential to replace diesel engines across a variety of sectors (i.e. marine, rail, and nonroad) and thus significantly reduce diesel emissions at ports.

Objective: Support stakeholders with a better understanding of the technical specifications as well as the current and future opportunities for fuel cell applications at ports.



Fuel Cells at Ports Research Project

Report Contents:

- Detailed background information on fuel cells
- Identify current applications of fuel cells across U.S. marine ports
- Emissions and cost effectiveness analysis of fuel cells
- Economic analysis of fuel cells (port focused)
- Future projection geared to commercial viability of fuel cells



Expected Outcomes:

- Used to assist US EPA and port stakeholders in evaluating fuel cell technologies.
- Estimate potential emissions impacts/benefits for nonroad, marine, and heavy-duty applications.
- Guide the use of fuel cell technologies in the DERA program.



Completed report expected by Fall 2019

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<http://www.westcoastcollaborative.org/>

<https://www.epa.gov/cati/about-clean-air-technology-initiative-cati>

<https://www.epa.gov/aboutepa/epa-region-9-pacific-southwest>



Appendix: Mobile Source Funding Opportunities



- ZEV Investment Plans = \$800M in CA; \$1.2B in other 49 states
 - Focused on LD ZEV education and infrastructure deployment w/ some potential to support LD ICEV-to-ZEV replacements in CA.
- NOx Mitigation Trust = \$2.7B nationwide (over 10 yrs)
- NOx mitigation funds could be used for M/HD diesel-to-AFV replacements and repowers, including:
 - Class 4-8 trucks
 - Buses – school, shuttle and transit
 - Forklifts and other cargo handling equipment
 - Airport ground support equipment
 - Harbor craft
 - Switch locomotives

FAST Act: National Funding

CMAQ - Congestion Mitigation and Air Quality Improvement Program = ~\$2.4B/yr

https://www.fhwa.dot.gov/environment/air_quality/cmaq/

FASTLANE - Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies = ~\$900M/yr

<https://www.transportation.gov/buildamerica/FASTLANEgrants>

TIGER - Transportation Investment Generating Economic Recovery = ~\$500M/yr

<https://www.transportation.gov/tiger>

TIFIA - Transportation Infrastructure Finance and Innovation Act = ~\$300M/yr

<https://www.transportation.gov/buildamerica/programs-services/tifia>

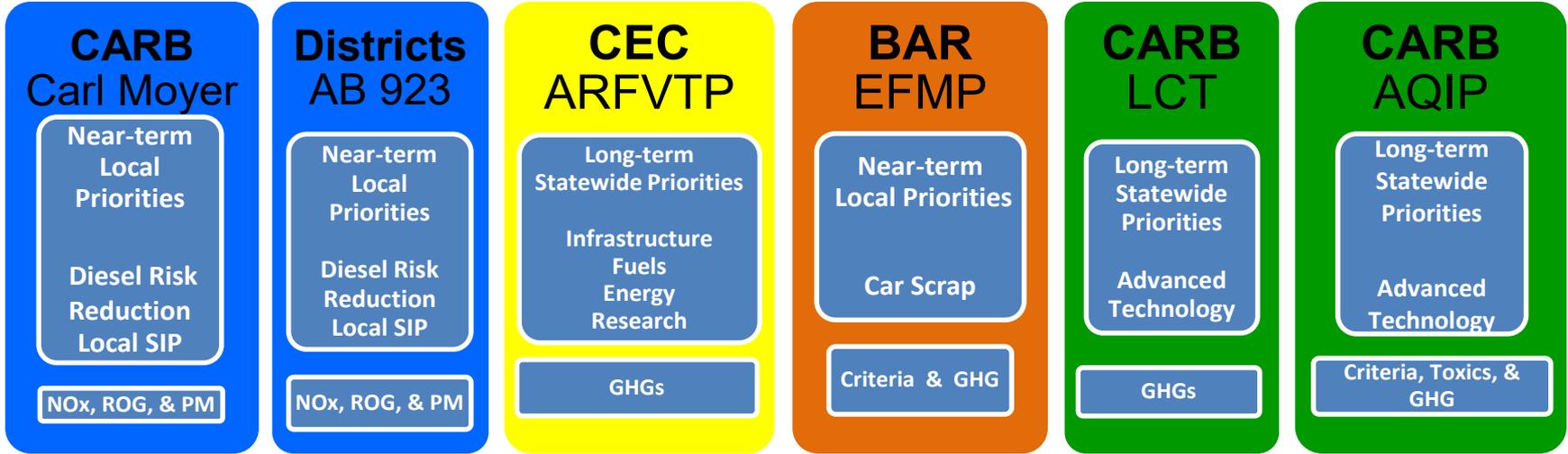
FTA Bus and Facility Competitive Grants = ~\$300M/yr

<https://www.transit.dot.gov/funding/grants/buses-and-bus-facilities-grants-program-5339>

FTA Low-No Bus Grants = ~\$55M/yr

<https://www.transit.dot.gov/funding/grants/low-or-no-emission-vehicle-program-5339c>

California Mobile Source Incentive Programs (2019)



| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------------------------------------|-----------|-------|--------|--------|--------|---------|------|------|------|----------|
| CARB Carl Moyer | \$69M/yr | | | | | | | | | \$48M/yr |
| Air Districts AB 923 | \$50M/yr | | | | | | | | | ? |
| CARB AQIP | \$25M/yr | | | | | | | | | ? |
| CARB Low Carbon Transportation | \$200M | \$90M | \$363M | \$560M | \$455M | \$412M* | ? | ? | ? | ? |
| CEC ARFVTP | \$100M/yr | | | | | | | | | ? |
| BAR EFMP | \$35M/yr | | | | | | | | | ? |
| CARB GMERP/Prop 1B | \$240M | | | | | | | | | |

*FY19-20 Governor's Budget Proposal

Other Mobile Source Funding



- US DOE EERE FCTO (Federal Appropriations) = ~\$100M/yr
- US DOE EERE VTO (Federal Appropriations) = ~\$300M/yr
- USDA NRCS (Farm Bill) = ~\$30M/yr
- US EPA Clean Air Technology Initiative (R9) = ~\$1M/yr
- CPUC SB350 TE (IOU ratepayers) = ~\$781M over 5 yrs
- BAAQMD MSIF & TFCA (fees) = ~\$33M/yr
- SMAQMD (fees) = ~\$4M/yr
- SJVAPCD TAP (fees) = ~\$5M/yr
- SCAQMD TAO (fees) = ~\$10M/yr
- WSEO ETS = ~\$11M in 2019
- WDOE Diesel (State Appropriations + DERA) = ~\$1M/yr