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| **Project Title:** | Transportation |
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| **Document Title:** | Presentation - 2020 Mobile Source Strategy - A Vision for Clean Air |
| **Description:** | Public Webinar Presentation on March 25, 2020 at California Air Resources Board |
| **Filer:** | Raquel Kravitz |
| **Organization:** | California Energy Commission |
| **Submitter Role:** | Commission Staff |
| **Submission Date:** | 11/16/2020 10:18:51 AM |
| **Docketed Date:** | 11/16/2020 |
2020 Mobile Source Strategy: A Vision for Clean Air

Public Webinar
March 25th, 2020
Today’s Webinar

• Background
• 2016 Mobile Source Strategy Progress
• Scenarios
• South Coast & San Joaquin Valley
• Wrap-up

Questions?
Email us at MSS@arb.ca.gov
## Timeline

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Event</th>
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<tbody>
<tr>
<td>Scenario Modeling</td>
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<td>Board Consideration</td>
<td>Late 2020</td>
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</tbody>
</table>
2020 Mobile Source Strategy: 
A Vision for Clean Air

A conceptual scenario approach to identifying the technology mixes needed to meet California’s goals
Background

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California’s Goals

2023:
- South Coast & SJV Ozone

2030:
- GHG 40 percent below 1990

2037:
- South Coast & SJV Ozone

2050:
- GHG 80 percent below 1990

2024/25:
- AB 617 Communities
- South Coast & SJV PM2.5

2031:
- South Coast & SJV Ozone

2045:
- Carbon Neutrality

CARB
Integrated Planning

Criteria Pollutants
State Implementation Plans

Toxics
Community Risk Reduction

Greenhouse Gases
Scoping Plan
2020 Mobile Source Strategy will Support Multiple Planning Efforts

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<thead>
<tr>
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<th>Timeline</th>
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<tr>
<td>70 ppb Ozone Standard SIPs</td>
<td>2020-2022</td>
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<tr>
<td>Scoping Plan Update</td>
<td>2022</td>
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<td>Community Emission Reduction Plans</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Sustainable Communities Strategies</td>
<td>Ongoing</td>
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</tbody>
</table>
Mobile Source Contribution

2017 Statewide NOx Emissions
Total = 1294 tons per day

2017 Statewide GHG Emissions
Total = 424 MMTCO2e
Health Cost of Pollution

Annually, PM$_{2.5}$ exposure results in:

- 5,400 premature deaths due to cardiopulmonary causes*
- 2,800 hospitalizations for cardiovascular and respiratory diseases*
- 6,700 emergency room visits for asthma*

Diesel PM also increases cancer risk

*Based on California 2014-2016 air quality data
Health Cost of Pollution

Disadvantaged communities and people of color are highly affected by mobile pollution

- 46% of disadvantaged census tracts in 75th percentile for Diesel PM

- Black and Hispanic communities exposed to PM$_{2.5}$ at concentrations 18% above average (on-road sources)
2016 Mobile Source Strategy - Progress

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2016 Mobile Source Strategy

- Released May 16, 2016
- Elements incorporated into:
  - 2016 State SIP Strategy
  - 2017 Scoping Plan
  - CA Sustainable Freight Action Plan
  - Short-Lived Climate Pollutant Reduction Strategy
# Regulatory Items Adopted

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Adopted</th>
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<tbody>
<tr>
<td>Medium- and Heavy-Duty GHG Phase 2</td>
<td>February 2018</td>
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<tr>
<td>Lower Opacity Limits for HD Vehicles</td>
<td>May 2018</td>
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<td>Amended Warranty Requirements for HD Vehicles</td>
<td>June 2018</td>
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<td>Innovative Clean Transit</td>
<td>December 2018</td>
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<td>Zero-Emission Airport Shuttle Buses</td>
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## Regulations In Development

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<td>Spring 2020</td>
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<td>2021</td>
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Scenarios
Achieving Air Quality and Climate Goals Requires Multiple Tools

- Enhanced Enforcement
- End User Requirements
- Outreach & Education
- Facility Requirements
- Manufacturer Requirements
- Incentive Programs
- Infrastructure Development
On-Road Sector

- In 2017, on-road mobile sources contributed to 45% of statewide NOx emissions and 37% of statewide GHG emissions.

Statewide NOx Emissions
- Off-Road Mobile: 35%
- Light Duty Vehicles: 13%
- Medium Duty Vehicles: 2%
- Heavy Duty Vehicles: 26%
- Stationary: 17%
- Areawide: 3%

Statewide GHG Emissions
- Off-Road Mobile: 4%
- Light Duty Vehicles: 28%
- Medium Duty Vehicles: 2%
- Heavy Duty Vehicles: 7%
- Other Sectors (industrial, electricity generation, etc.): 59%
On-Road Light-Duty Sector

- Advanced Clean Cars 2 – Post 2025 automaker rules
  - Enhanced ZEV Regs – Moving beyond early adopters
  - Enhanced LEV Regs – Reducing real world emissions
  - Board to consider in 2021

- Clean Miles Standard (SB 1014) requires CARB to develop a GHG reduction program for ride hailing companies
  - Two targets: gCO2/passenger-mile; Minimum electric miles
  - Compliance strategies: Electrification; Pooling; Reduce deadhead miles; Connections to transit/active transportation
  - Emissions inventory complete; Board to consider in late 2020
2020 Mobile Source Scenario for LDV

- 100% sales ZEVs & PHEVs by 2035; Does not go far enough
- Half of fleet in 2045 still has combustion engine

Fuel Demand in 2045 (bil. gal. per year) gasoline – 2.22

Staff continue to evaluate more ambitious ZEV sales scenarios and the impact of high mileage vehicles
Transportation Sector VMT/GHG are Not on Track to Meet Targets

- Californians continue to drive alone as their primary mode of travel
- Transit ridership is falling
- RTP/SCSs include over $1.1 trillion in spending, but there has been remarkably little shift in spending by mode
- Housing cost burden continues to increase
Opportunity Areas

State Funding for Transp. and Dev. Projects
Growth & the Housing Crisis
New Mobility
Transportation Pricing
Traveler Incentives
Under-Served Communities
Update & Strengthen SB 375
On-Road Medium-Duty Sector

- Medium-duty vehicles (8,501 – 14,000 lbs. GVWR) are responsible for 7% of statewide mobile source NOx and 5% of statewide mobile source GHG emissions.

- **Strategies** for on-road medium-duty vehicles (MDVs) include:
  - Zero-emission technology transformation starting in 2024
  - Enhanced LEV regulations through Advanced Clean Cars 2.0
  - Continued energy efficiency improvements
    - Phase 3 Greenhouse Gas Standards for Medium/Heavy-Duty Vehicles
2020 Mobile Source Scenario for MDV

- Considered a scenario to achieve long-term climate goals
- Strategy: Ambitious ZEV penetration for newer vehicles

Statewide On-Road Population

- ICE:
  - 2020: 800,000
  - 2025: 1,000,000
  - 2030: 1,200,000
  - 2035: 1,400,000
  - 2040: 1,600,000
  - 2045: 1,800,000

- Total ZEVs:
  - 2020: 370,000
  - 2025: 560,000
  - 2030: 740,000
  - 2035: 920,000
  - 2040: 1,100,000
  - 2045: 1,280,000

- ZEVs
  - 2020: 6%
  - 2025: 94%
  - 2030: 25%
  - 2035: 75%
  - 2040: 60%
  - 2045: 40%

Fuel Demand in 2045 (bil. gal. per year):
- Gasoline: 0.27
- Diesel: 0.16
On-Road Heavy-Duty Sector

• Heavy-duty vehicles (above 14,000 lbs. GVWR) are responsible for 33% of statewide mobile source NOx and 16% of statewide mobile source GHG emissions

• Strategies for on-road heavy-duty vehicles (HDVs) include:
  ✓ Zero-emission technology penetration starting in 2024
  ✓ Cleaner diesel technology (i.e., Low NOx diesel) starting in 2024
  ✓ Use of renewable fuels where electrification is not feasible
  ✓ Continued energy efficiency improvements
    ➢ Tractor-Trailer Greenhouse Gas (TTGHG)
    ➢ Phase 3 Greenhouse Gas Standards for Medium/Heavy-Duty Vehicles
  ✓ In-use performance measures
    ➢ Heavy-duty inspection and maintenance (HD I/M) program starting in 2023
    ➢ More Stringent in-use performance standards
    ➢ Lengthening engine useful life, warranty, and durability requirements
Meeting Midterm Goals

• To achieve NOx reduction needed to meet the air quality goals over the next two decades while also charting a course to achieve longer-term climate change goals
• Ambitious ZEV penetration for newer vehicles combined with accelerated turnover of older vehicles (e.g., 2010-certified)

Classes 4-8 HDV Population

Fuel Demand in 2045 (bil. gal. per year):
diesel – 1.37
gas – 0.10

Federal Low NOx

CA Cert. Low NOx

HD ZEV

HD ZEV & Accelerated Turnover

2010 Cert.

Sales & Accelerated Turnover

Pre-2010

2020 2025 2030 2035 2040 2045 2050

2031 2037 2045

2010 Cert. 25% 39% 42%
18% 35% 58%

1.200,000
1.000,000
800,000
600,000
400,000
200,000
0

1.200,000
1.000,000
800,000
600,000
400,000
200,000
0
Meeting Long Term Goals

- To achieve NOx reduction needed to meet near term air quality goals, and also maximize the number of zero-emission trucks for longer term climate goals
- A hyper ambitious ZEV penetration combined with accelerated turnover of older vehicles

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<td>21%</td>
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<tr>
<td>1,000,000</td>
<td>23%</td>
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<tr>
<td>800,000</td>
<td>31%</td>
</tr>
<tr>
<td>600,000</td>
<td>44%</td>
</tr>
<tr>
<td>400,000</td>
<td>24%</td>
</tr>
<tr>
<td>200,000</td>
<td>76%</td>
</tr>
</tbody>
</table>

HD ZEV & Accelerated Turnover

Sales & Accelerated Turnover

Fuel Demand in 2045 (bil. gal. per year):
- diesel – 1.01
- gas – 0.08
More Information

On-Road Programs

Advanced Clean Cars
https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program

Clean Miles Standard
https://ww2.arb.ca.gov/our-work/programs/clean-miles-standard

Heavy-Duty Inspection & Maintenance
https://ww2.arb.ca.gov/our-work/programs/heavy-duty-inspection-and-maintenance-program

Heavy-Duty Low-NOx
https://ww2.arb.ca.gov/our-work/programs/heavy-duty-low-nox

Medium- & Heavy-Duty GHG Regulation
https://ww2.arb.ca.gov/our-work/programs/ghg-std-md-hd-eng-veh

Advanced Clean Trucks
https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks

Advanced Clean Truck Fleets
https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets
Off-Road Sector

Statewide NOx Emissions

- Off-road mobile sources contribute to 35% of Statewide NOx and 4% of GHG emissions in 2017
- Off-road NOx contribution will grow to 37% (largest) by 2022
- Off-road annual diesel consumption will reach 2.13 billion gallons by 2045
Strategies for Off-Road Sector

• General principles:
  ✓ Zero-emission technology wherever possible
  ✓ Remaining combustion engines as low-emitting as technically feasible, throughout entire service lives (Tier 5, OBD and GHG standard)
  ✓ Use of renewable fuels where electrification is not feasible
  ✓ Accelerated turnover of older equipment to cleanest available technology, including hybridization
  ✓ Retrofit with after-treatment technologies
Cargo Handling Equipment

- Important due to proximity of communities and at-risk population centers, primarily significant in SC and Bay Area
- **Concept**: Begin transition to full electric operation beginning in 2026

Statewide CHE Population Projection Under Concept

- Electric
- Tier 4f
- Tier 4i
- Tier 3
- Tier 2
- Tier 1
- Tier 0

CARB
Small Off-Road Engines

- Significant source of statewide ROG emissions
- **Types:** Lawn & Garden (L&G) equipment, light commercial equipment such as generators, compressors, etc.
- **Concepts:**
  - Tighten emission standards
  - Full transition to zero-emission equipment

### 2018 Household L&G Equipment

- **Blower**
- **Chainsaw**
- **Mower**
- **Trimmer**
- **Other L&G**

### Timeline
- **2020**
  - Adopt new emission standards
- **2020**
  - Reduced emission standards
  - Zero-emission standards:
    - $0 \text{ g} \cdot \text{kWh}^{-1} \text{ (exh)}$
    - $0 \text{ g} \cdot \text{day}^{-1} \text{ (evap)}$
- **2031**
  - All new sales must be zero-emission
  - Ozone SIP attainment deadline
Off-Road – Cleaner Engine Standards

Off-Road Engine Standards: Tier 5

- Would achieve additional NOx and PM reductions for all off-road engines (excluding marine and locomotives) when introduced in mid 2020s
- Explore zero-emission and hybridization wherever feasible
- Additional concepts:
  - Off-Road on-board diagnostic (OBD) standards: ensure emissions reduction equipment is working
  - More stringent exhaust standards for spark-ignition recreational marine engines
  - Potential for off-road diesel GHG standards
Construction, Industrial, Mining (In-Use Off-Road)

• Significant NOx contributor in SJV and SC
• **Needed:** Implement full turnover of Tier 0/1/2 following existing In-Use Regulation by 2031
  • Current regulation allows continued use of Tier 0 to Tier 2 indefinitely if meeting Fleet Average requirements
Agriculture

- Important contributor in SJV: 18 percent of NOx emissions in 2019
- **Concepts:** Incentive-driven programs (e.g., FARMER)
  - Replacing Tier 0/1/2 tractors with Tier 4-Final tractors; significant acceleration of Tier 0/1/2 has been underway since 2009
  - Replacing diesel all terrain vehicles (ATVs) with electric
Off-Road – Accelerated turnover & Electrification

Transport Refrigeration Units

- Significant to all local communities
- **Concepts:**
  - Zero emissions for truck TRUs
  - Zero-emission operation requirements while stationary for trailer TRUs
  - Less than 25 horsepower TRUs and TRU gensets meet standard for 25 to 50 horsepower

**Statewide NOx from TRUs Under Concepts**

Baseline emissions without concept

- OOS Trailer (>25 hp)
- OOS Trailer (23-25 HP)
- CA Trailer (>25 HP)
- CA Trailer (23-25 HP)
- CA Truck
- All Gensets
- All Rail

**Data:**

- 2019: 18
- 2020: 16
- 2021: 14
- 2022: 12
- 2023: 10
- 2024: 8
- 2025: 6
- 2026: 4
- 2027: 2
- 2028: 0
- 2029: 0
- 2030: 0
- 2031: 0
- 2032: 0
- 2033: 0
- 2034: 0
In the context of Off-Road - Accelerated turnover, the document highlights the significance of Locomotives:

- **Significant contributor in SJV and SC, and all communities near railyards**
- **Concepts:**
  - Increase purchases of Tier 4 locomotives, reduce use of pre-Tier 3 locomotives by mid-2020s
  - Increase turnover of Tier 0/0+ switchers in railyards
- **Needed:** Tier 5 locomotive standards and significant penetration of Tier 4/5

**SC Locomotive Energy Use by Tier Standard**

- Tier 5
- Tier 4
- Tier 2/2+
- Tier 1/1+
- Tier 0/0+

**SC NOx from Locomotives: Needed Reduction**

- Tier 5
- New Baseline
- SIP Emissions

- Tier 5 only accounts for 4% of activity in 2018
Off-Road – Accelerated turnover & Electrification

Commercial Harbor Craft

• Important due to proximity of communities and at-risk population centers, primarily significant in South Coast and Bay Area

• Concepts:
  • In-use short run ferries become zero-emission by 2028 (9% of ferries)
  • Turn over all vessels except for commercial fishing to cleanest engines and retrofit with DPF
  • Enhanced efficiency for new tugs and zero-emission capabilities for new excursion vessels

• Needed:
  • Include commercial fishing; introduce Tier 4 standard to all vessels in 2024 and Tier 5 in 2027
  • Plug-in hybrid for excursions and diesel-electric for tugs by 2030
Ocean-Going Vessels At Berth

- **Concepts:**
  - Focused on diesel PM exposure in local communities, expansion of at-berth regulation to cover more vessel types and locations. Advocate at IMO for Tier 4 vessel standards

- **Needed:**
  - Address transit, anchorage and maneuvering emissions – Tier 4 marine standards in 2028 and significant penetration of Tier 3/4 beginning 2025. Expanded at-berth coverage for non-covered visits.

![Graph showing NOx emissions over time for various tiers and modes of operation.](attachment:image.png)
More Information

Off-Road Programs

Zero-Emission Cargo Handling Equipment
https://ww2.arb.ca.gov/our-work/programs/cargo-handling-equipment

Small Off-Road Engines
https://ww2.arb.ca.gov/our-work/programs/small-off-road-engines-sore

Locomotive Emission Reduction Measure
https://ww2.arb.ca.gov/our-work/programs/reducing-rail-emissions-california

OGV At-Berth Regulation
https://ww3.arb.ca.gov/ports/shorepower/shorepower.htm

Transport Refrigeration Unit Regulation

FARMER Program
https://ww2.arb.ca.gov/our-work/programs/farmer-program

Commercial Harbor Craft
https://ww2.arb.ca.gov/our-work/programs/commercial-harbor-craft
Energy and Infrastructure

• Zero-emission technology where possible
• Requires streamlined infrastructure build-out
• AB 2127: CEC to prepare infrastructure assessment
  • 5 million ZEVs by 2030
  • Reducing GHG 40% below 1990 by 2030
  • Including all vehicle categories (on-road and off-road)
• Significant investments being made in infrastructure
  • $100 million annually through CEC’s Clean Transportation Program
  • ~$1 billion in authorized IOU transportation electrification (TE) infrastructure spending through 2023
  • Requesting almost another $1 billion for future infrastructure programs
South Coast & San Joaquin Valley

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## SIP & AB 617 Deadlines

### Ozone Attainment
- 80 ppb standard in 2023
- 75 ppb standard in 2031
- 70 ppb standard in 2037

### PM2.5 Attainment
- 24-hour 65 µg/m³ and Annual 15 µg/m³ standards in 2020
- 24-hour 35 µg/m³ standard in 2024
- Annual 12 µg/m³ standard in 2025

### AB 617 Targets
- Best Available Retrofit Control Technology (BARCT) on industrial sources by December 31, 2023
- Community emission reduction goals in 2024 & 2025
NOx Reductions Needed in the South Coast Air Basin for Attainment of Ozone Standards

Source: CARB. CEPAM 2016 SIP – Standard Emission Tool (v1.05)
South Coast AQMD. 2016 Air Quality Management Plan
NOx Reductions Needed in the San Joaquin Valley for Attainment of PM2.5 Standards

Source: CARB. CEPAM 2016 SIP – Standard Emission Tool (v1.05) San Joaquin Valley APCD. 2018 PM2.5 Plan
Federal Action is Critical

South Coast 2020 NOx Emissions
- California On-Road Mobile Sources: 31%
- California Off-Road Mobile Sources: 21%
- Ocean Going Vessels: 10%
- Aircraft: 5%
- Trains: 5%
- Federal On-Road Mobile Sources: 11%
- Stationary: 14%
- Areawide: 3%

SJV 2020 NOx Emissions
- California On-Road Mobile Sources: 29%
- California Off-Road Mobile Sources: 32%
- Ocean Going Vessels: 5%
- Aircraft: 5%
- Trains: 5%
- Federal On-Road Mobile Sources: 15%
- Stationary: 15%
- Areawide: 2%

Source: CARB. CEPAM 2016 SIP – Standard Emission Tool (v1.05)
Near-Term Funding is Important

South Coast for 2023 Attainment of 80 ppb Ozone

- AB 617
- Carl Moyer
- Mobile Source Air Pollution Reduction Review Committee
- AB 2766 Fund
- Other

San Joaquin Valley for 2024/25 Attainment of PM2.5 Standards

- AB 617
- Carl Moyer
- Other (including District funds)
- Targeted Air Shed Grant
- Diesel Emission Reduction Act
- FARMER

Dollars ($) for 2023 Attainment of 80 ppb Ozone:
- AB 617: 1,000,000,000
- Carl Moyer: 800,000,000
- Mobile Source Air Pollution Reduction Review Committee: 600,000,000
- AB 2766 Fund: 400,000,000
- Other: 200,000,000

Funding Current Allocations:
- 2016 AQMP, Minimal Annual Funding
- Annual Funding Based on Current Allocations
- 2018 PM2.5 Plan, Minimal Annual Funding
- Annual Funding Based on Current Allocations
# Meeting 2023-2025 SIP Needs

## 2016 State SIP Strategy

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## New Programs / Concepts

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<td>Zero-Emission Cargo Handling Equipment</td>
<td>Recreational Marine Boat Standards</td>
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Wrap-Up

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Federal Action is Increasingly Critical

South Coast Mobile Source NOx (tons per day)

California-Regulated Sources: Cars, Trucks, & Equipment

Primarily Federally-Regulated Sources: Interstate Trucks, Planes, Trains, & Ships

Reductions from California Sources:
- 75% as of 2019
- >85% by 2032

Emissions from Primarily Federally Regulated Sources Will Surpass California Source Emissions by 2030

Increased Funding is Needed

• South Coast and San Joaquin Valley’s near-term ozone and PM2.5 attainment requires increases in incentive funding

• AB 617 funding is important to provide critical near-term reductions in impacted communities
CARB Continues to Push Forward

- CARB continues to look for new control strategies in all mobile sectors
- New regulatory concepts have been identified
- Work will continue to develop concepts with ongoing public and stakeholder feedback
# Next Steps

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Contact us!

- General information: Ariel Fideldy, Ariel.Fideldy@arb.ca.gov
- Scenario modeling
  - On-Road: Sara Forestieri, Sara.Forestieri@arb.ca.gov
  - Off-Road: Liang Liu, Liang.Liu@arb.ca.gov

https://ww2.arb.ca.gov/resources/documents/2020-mobile-source-strategy
Questions?

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https://ww2.arb.ca.gov/resources/documents/2020-mobile-source-strategy