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The Need for EV Charging Infrastructure Assessments to Inform Policies

March 11, 2019
Sacramento, CA
Outline

• Integrated transportation planning – an integrated strategy for multiple goals
  • Strategy development
  • Strategic vision for mobile sources
• Development of light-duty vehicle regulations
  • Advanced Clean Cars II (post 2025)
  • Clean Miles Standard for ride hailing (SB 1014)
• Zero Emission Truck and Bus Regulations
  • Innovative Clean Transit
  • Advanced Clean Trucks
California’s Air Quality and Climate Goals

- Federal Air Quality Standards
- Greenhouse Gas Reduction Targets
- Community Risk Reduction
- Renewable Energy Targets
- Petroleum Reduction Target
- 5 Million Zero Emission Vehicles
- 2023/2030/2031
Mobile Source Reductions are Key

- Largest contributor to smog-forming, greenhouse gas, and diesel PM emissions
- Requires integrated planning process to assess combination of cleaner technologies, fuels, and system efficiencies to meet multiple goals

* Including emissions from fuel production
Importance of Integrated Planning

- Consider how actions can best meet multiple goals
- Assess scope and timing of needed change
- Identify interactions between measures
- Maximize program effectiveness
Supports Multiple Planning Efforts

- Strategy provides framework for ongoing planning efforts
  - State Implementation Plans
  - Scoping Plan Update
  - California Freight Action Plan
  - Short Lived Climate Pollutant Plan
Building Blocks of Planning Process

- Current programs provide blueprint for successful strategies
- Technology assessments identify status of advanced technologies and fuels
- Scenario analysis provides framework for coordinated air quality and climate assessment
Technology Assessments

- Comprehensive review conducted by CARB, South Coast, US EPA
- Assessments identify
  - Technology performance
  - Necessary fuels
  - Market readiness
  - Cost
  - Current deployment challenges
Scenario Development

• Scenario development informed by foundational technical work and technology assessments
• Initial scenario results provide feedback to understand the interplay between strategies and their impact on emissions

• Through this iterative process, the Vision Tool provides a unique opportunity to understand the intertwined nature of different policies
Vision Model Framework

- Vehicle Sales by Tech Type
- New Vehicle Efficiency, Tech Type
- Vehicle Activity by Class

Vehicle Fleet Model → Energy Demand

- Fuel Blends
- Electricity Mix
- Hydrogen Mix

Energy Model

- Emission Factors
- Upstream Emissions (WTT)

Vehicle Emissions (TTW)
Key Strategy Actions Identified

• Increase penetration of zero emission technologies
• Curb growth in vehicle miles travelled
• Establish cleaner engine performance standards
• Expand use of cleaner renewable fuels
• Ensure durability of emission control systems
• Conduct pilot studies to demonstrate new technologies
• Incentivize deployment of cleanest technologies
Transformation of Passenger Vehicle Fleet Technology Mix

- 2025: 0.7M ZEVs, 1.7M ZEVs+PHEVs
- 2030: 1.7M ZEVs, 4.2M ZEVs+PHEVs
- 2050: 15M ZEVs, 24M ZEVs+PHEVs

Statewide Population

Calendar Year

CARB

Current Control Program
Transformation of Heavy Duty Truck Fleet Technology Mix
Outline

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ZEVs Gaining Momentum & Market Share

Annual California Light-Duty ZEV and PHEV Sales

Sources: Auto Alliance Sales Dashboard for 2011 through August 2018, Veloz Sales Dashboard for September 2018 through December 2018

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The Importance of Electric Vehicles

• Why ZEVs?
  • Zero (or near zero) tailpipe emissions
  • Higher vehicle efficiency
  • Low carbon electricity
• Market barriers
  • Upfront vehicle costs
  • Fueling infrastructure
  • Consumer awareness

New passenger cars, on-road, full well-to-wheel

<table>
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<tr>
<th>Grams CO2 equivalent per mile (gCO2e/mi)</th>
<th>GAS</th>
<th>PHEV 2020</th>
<th>BEV</th>
<th>GAS</th>
<th>PHEV 2030</th>
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<td>100</td>
<td>50</td>
<td>200</td>
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75% lower
85% lower
Advanced Clean Cars II Guiding Principles

• High assurance of real-world emission reductions
• Increase certainty of future ZEV sales volumes and maximize zero emission miles traveled
• Ensure continued investments in innovation & advanced technologies
• Promote similar or lower system-wide emissions from new mobility options
• Consider global technology trends
• Assess implementation feasibility
ACC II ZEV Regulation Preliminary Analysis

- Update electric vehicle technology assumptions
- Continue studies of consumer acceptance
- Re-examine role of PHEVs
- Consider electrification requirements on AVs
- Assess other market factors
  - Sufficiency of fueling infrastructure
  - Total cost of operation
Innovations and Disruption Trends

- Transportation Network Companies (TNCs) and Autonomous Vehicles (AVs) evaluation
  - Total VMT potential implications
    - “Dead-head” miles
    - Mode shift away from transit
    - Ridership levels (pooling)
  - LDV fleet-wide potential implications
    - Shift VMT to more cars (vs. light trucks)
    - Reduced average age of fleet
    - Fewer cold starts, more idling, and lower average speeds
Clean Miles Standard (SB 1014)

SB 1014 requires CARB and CPUC to adopt and implement a program to reduce GHG emissions from transportation network companies (TNCs).

New regulation will encourage zero-emission vehicles and VMT reduction strategies and account for automated vehicles in TNC fleets.
Clean Miles Standard Guiding Principles

- Regulation Design
  - Decrease GHG emissions and increase zero-emission miles
  - Encourage pooling, active transport, and transit usage
  - Forward-looking with automated vehicles
  - Aligned with other State policies
  - Maximize transportation access and equity

- Development Process
  - A synergistic process
  - Data-driven
  - Encourage ZEV infrastructure
  - Maximize benefits to low- and moderate-income drivers

Statute direction:
- gCO₂/passenger-mi
- % electric mile target
Regulatory Timelines

Advanced Clean Cars II
- Board proposal in 2020 or 2021
- Consistent lead time with prior vehicle rulemakings for 2026 MY program start

Clean Miles Standard
- Board proposal fall 2020
- Statute driven timing
LCFS Opportunity: ZEV Infrastructure

- New provision to credit hydrogen stations and direct current fast chargers based on fueling capacity minus any dispensed fuel
- Previously, credits only eligible for dispensed fuel
- Crediting unused refueling capacity encourages rapid deployment of zero emission infrastructure
EV Charging Infrastructure Assessments

- Re-evaluate EV projections
  - Current market conditions under current programs
  - New regulations to strive for 5 million ZEV target or more
  - Longer range batteries and fewer PHEVs potentially
- Develop scenarios for regional EV usage in ride hailing
  - Higher mileage fleets in urban areas
- Partner with CEC on EVSE assessments
  - Informs decisions on vehicle regulation stringency
New CARB Division Created for Multi-Disciplinary Transportation Strategies

• Integrated approach to address barriers and opportunities at the nexus of transportation, communities, equity, and the environment
• Division Programs
  • Transportation research and analysis
  • Advanced vehicle and mobility regulations
  • Climate incentives
  • State and regional transportation and land use planning
  • Project review and local decision-support tools
Outline

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Emerging Zero-Emission Truck Market

• Wide range of zero emission (ZE) buses and manufacturers
• Growing battery electric truck market (Class 3-8)
  • Nearly all conventional truck manufacturers have zero emission truck commercialization plans by 2021
  • New ZE truck and bus entrants coming into market
• Total cost of ownership comparable to diesel for ZE buses now and most ZE trucks in 5 years
Multiple Zero Emission Bus Types and Models

- **Battery Electric**
  - Standard Bus: 8 OEM's and 22 models
  - Articulated Bus: 3 OEM's and 3 models
  - Double-Decker Bus: 1 OEM and 1 model
  - Coach Bus: 3 OEM's and 5 models
  - Cutaway Bus: 2 OEM and 2 Models

- **Fuel Cell Electric**
  - Standard Bus: 2 OEM's and 2 models
  - Articulated Bus: 2 OEM's and 2 models

CARB
# Heavy-duty Electric Market Growing

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<th>6-7</th>
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## Commercial
- Lightning Systems
- GP
- BYD
- Charge
- AmeriPride
- JAC
- CNG
- Daimler
- Nikola
- Tesla
- Volvo
- NIKOLA
- JOOLEY
- PETERBILT
- TOYOTA

## Demonstrations
- ISUZU
- B
- ELDEN
Zero Emission Truck and Bus Regulatory Strategies

- Increase penetration of first wave of zero emission heavy-duty technology
- Focus on near term candidates for zero emission technologies
  - Centrally fueled, low average speed, urban, stop-and-go duty cycles
- Experiences benefit the market for the same technologies in other applications to support commercialization
Timeline for Zero Emission Trucks, Buses and Freight Movement

Planned Board consideration relating to zero emission vehicles and equipment

- Phase 2 GHG Innovative Clean Transit
- ZE Airport Shuttles Advanced Clean Trucks
- ZE forklifts ZE TRUs
- ZE fleet rules
- ZE drayage trucks
- ZE cargo equipment

Updated 1/28/19
Innovative Clean Transit Regulation

- ZEB rollout plan
  - July 2020 for large fleets
  - July 2023 for small fleets
- ZEB purchase requirement
- ZE mobility option
- Low NOx engines and renewable fuels
- Approved December 14, 2018
ZEB Purchase Schedule

- 2023 requirement discharged if 850 ZEBs purchased by 12/31/2020
- 2024 requirement discharged again if 1,250 ZEBs purchased by 12/31/2021
- Early ZEB purchases count towards future compliance

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<th>Small Transit Agency</th>
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<tr>
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<tr>
<td>2028</td>
<td>50%</td>
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<tr>
<td>2029+</td>
<td>100%</td>
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Transit Agencies Lead the Way

• More than 50 transit agencies making zero emission bus (ZEB) purchases
  • Fuel cell and battery electric buses
  • 153 in operation
  • 433 placed orders
  • 729 awarded or planned
Transit Agencies Transitioning to Zero-Emissions Earlier than Required

- 16 transit agencies committed to making full transition to ZEBs
- Nearly 50 percent of all buses in California

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<tr>
<th>Agency</th>
<th>Total Buses</th>
<th>ZEB Target</th>
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<td>AC Transit</td>
<td>632</td>
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<tr>
<td>Anaheim Resort Transportation</td>
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<td>Antelope Valley Transit</td>
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<td>2019</td>
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<td>SFMTA</td>
<td>620(^c)</td>
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<td>Union City Transit</td>
<td>26</td>
<td>2028/29(^a)</td>
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\(^a\) Target not a directive from Board
\(^b\) Joint application with Arcata & Mad River Transit System
\(^c\) 327 trolley buses not included in total
ZE Airport Shuttle Proposal

• Final decision expected mid-2019

- Fleet annual reporting
- No-backsliding
- 33% of fleet must be ZEV
- 66% of fleet must be ZEV
- 100% of fleet must be ZEV
Advanced Clean Trucks

• Foster early ZE truck development and market
• Manufacturer requirement from 2024 – 2030
  • 2018 draft proposal target of 38,000 ZE trucks
• Fleets must report information
  • Used to support future ZE truck fleet requirements
• Board consideration late 2019
Zero Emission Drayage Trucks

• Participate in the San Pedro Bay Ports’ determination of drayage truck rates to incentivize ZE/near-zero emission truck trips

• Transition drayage trucks to ZE or ZE operation

• Key considerations
  • Demonstrations underway
  • Cost & innovative financing
  • Preferred access (ports, I-710)
SB 350 Transportation Electrification for Medium and Heavy Duty

- California utilities supporting site upgrades and design
  - $579 million approved over the next 5 years (PG&E, SCE)
  - Additional $107 million under review (SDG&E)
- New rates being designed to encourage electric vehicles
Low Carbon Fuel Standard (LCFS)

- Lowers carbon intensity (CI) of California transportation fuels 20% by 2030
- Fleets earn credits if dispensing H2 or electricity
  - Valued at $0.16 per kWh (at $125/credit)
  - Offsets most electricity costs

LCFS program: [https://www.arb.ca.gov/fuels/lcfs/lcfs.htm](https://www.arb.ca.gov/fuels/lcfs/lcfs.htm)
CARB’s Suite of Projects

**Demonstration Projects**
- Zero-Emission Drayage Truck - $23.7 million
- Multi-Source Facility - $23.6 million
- On-Road and Off-Road Advanced Technology - $31.9 million

**Pilot Projects**
- Zero-Emission Truck and Bus Pilot Projects - $80 million
- Zero- and Near-Zero Emission Freight Facilities - $205 million

**Commercialization**
- Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) - $125 million in 2018-19
- Volkswagen Beneficiary Trust - $423 million
Support for ZE Truck and Bus Deployments
Shape Future Regulations

• Substantial incentives to encourage early actions
• Vehicles and infrastructure investments
• Charging and hydrogen fueling standards
• Continued progress needed for full transition
  • Technology advancement
  • Cost reductions
  • Training and education
  • Broader access to infrastructure
Contact Information

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Advanced Clean Cars Branch
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Tony Brasil, Chief
Transportation and Clean Technology Branch
tony.brasil@arb.ca.gov
(916) 323-2927
Thank you!
Backup / additional slides
After 50 years of standards, mobile source emissions are still a significant share of inventory. 

Mobile Sources >80%

*South Coast Air Basin NOx Emissions (2017)*

- Heavy-Duty Vehicles 35%
- Other Mobile Sources 30%
- Light-Duty Vehicles 18%
- Stationary 13%
- Areawide 4%

*California GHG Emissions (2017)*

- Industrial 21%
- Electric Power 16%
- Residential & Commercial 10%
- Agriculture 9%
- High GWP 5%
- Recycling and Waste 3%
- All Other Transportation 7%
- Light-Duty Vehicles 29%

Mobile sources represent ~50% of GHG inventory when including emissions from fuel production.