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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

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California's Air Quality and Climate Goals

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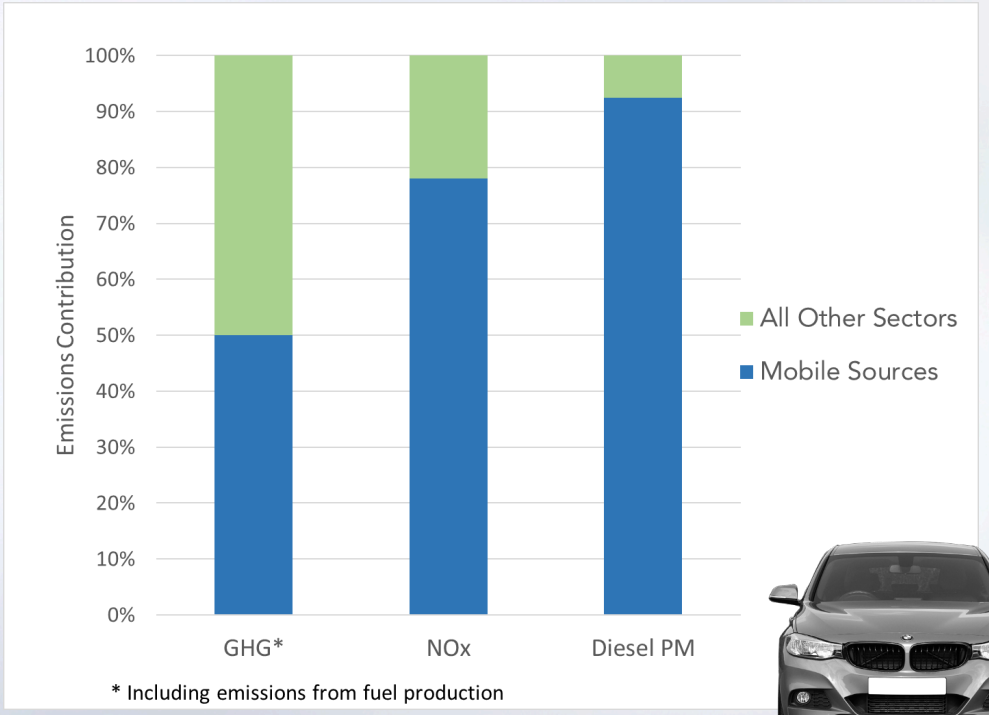
Mobile Source Reductions are Key

- 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



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

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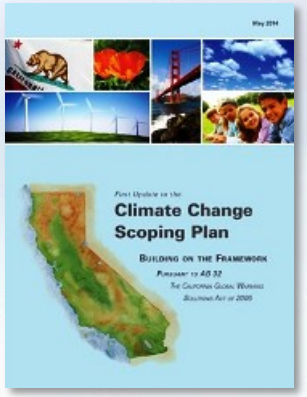
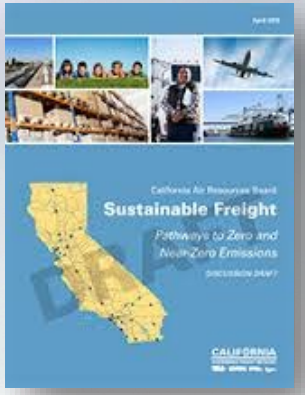
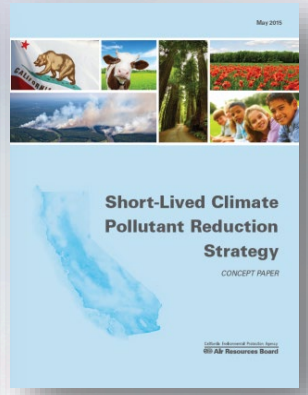
Supports Multiple Planning Efforts

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







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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

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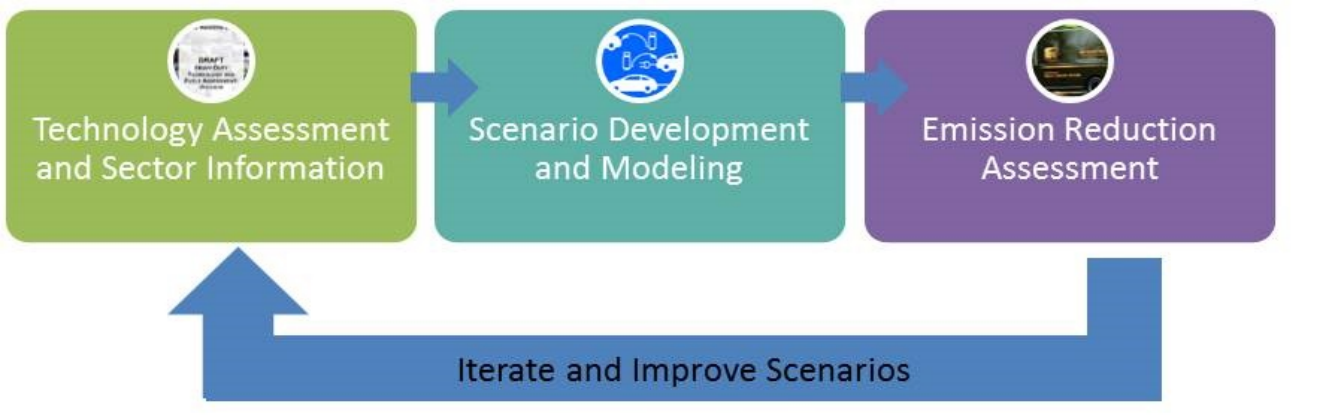
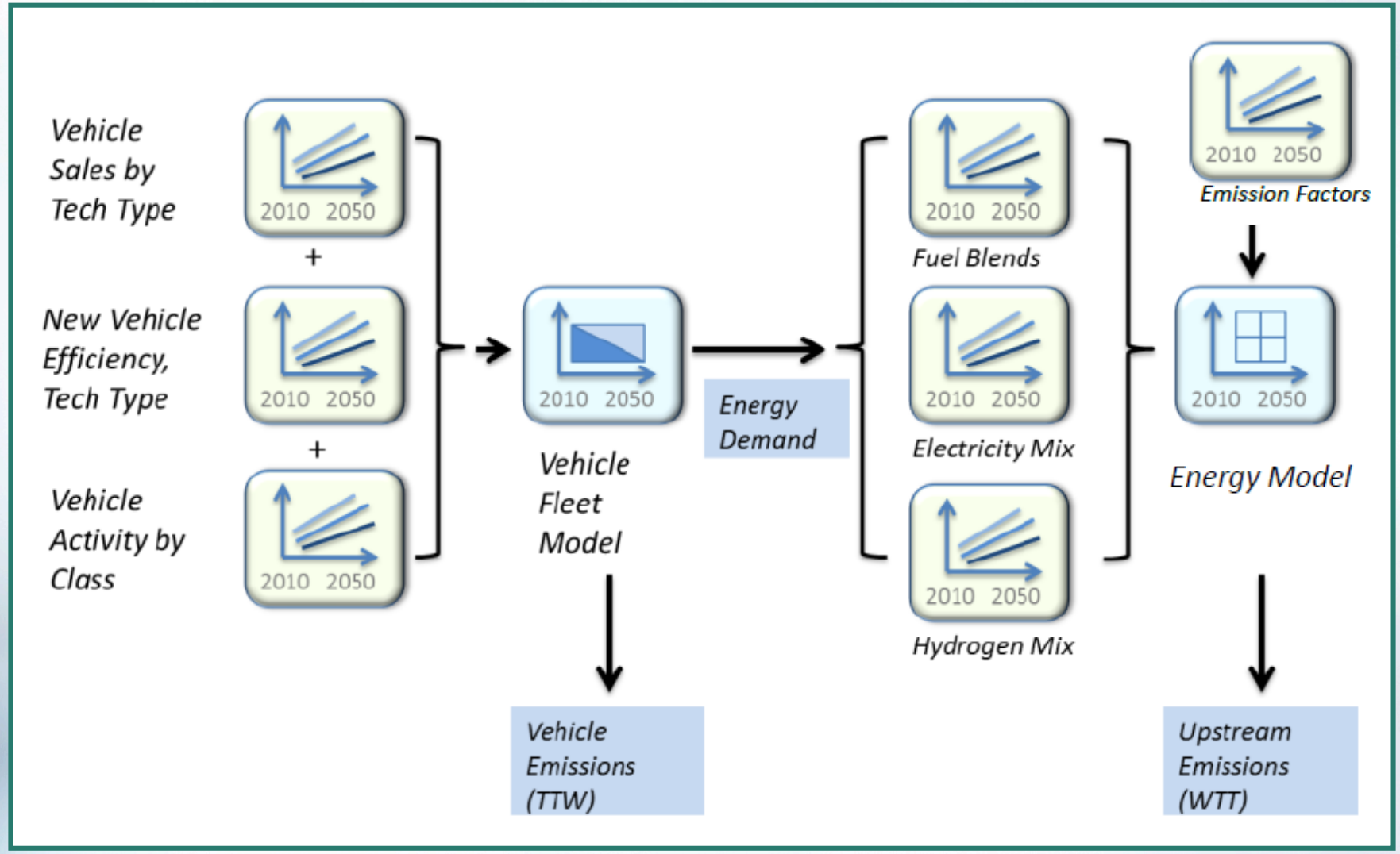
Scenario Development

- 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

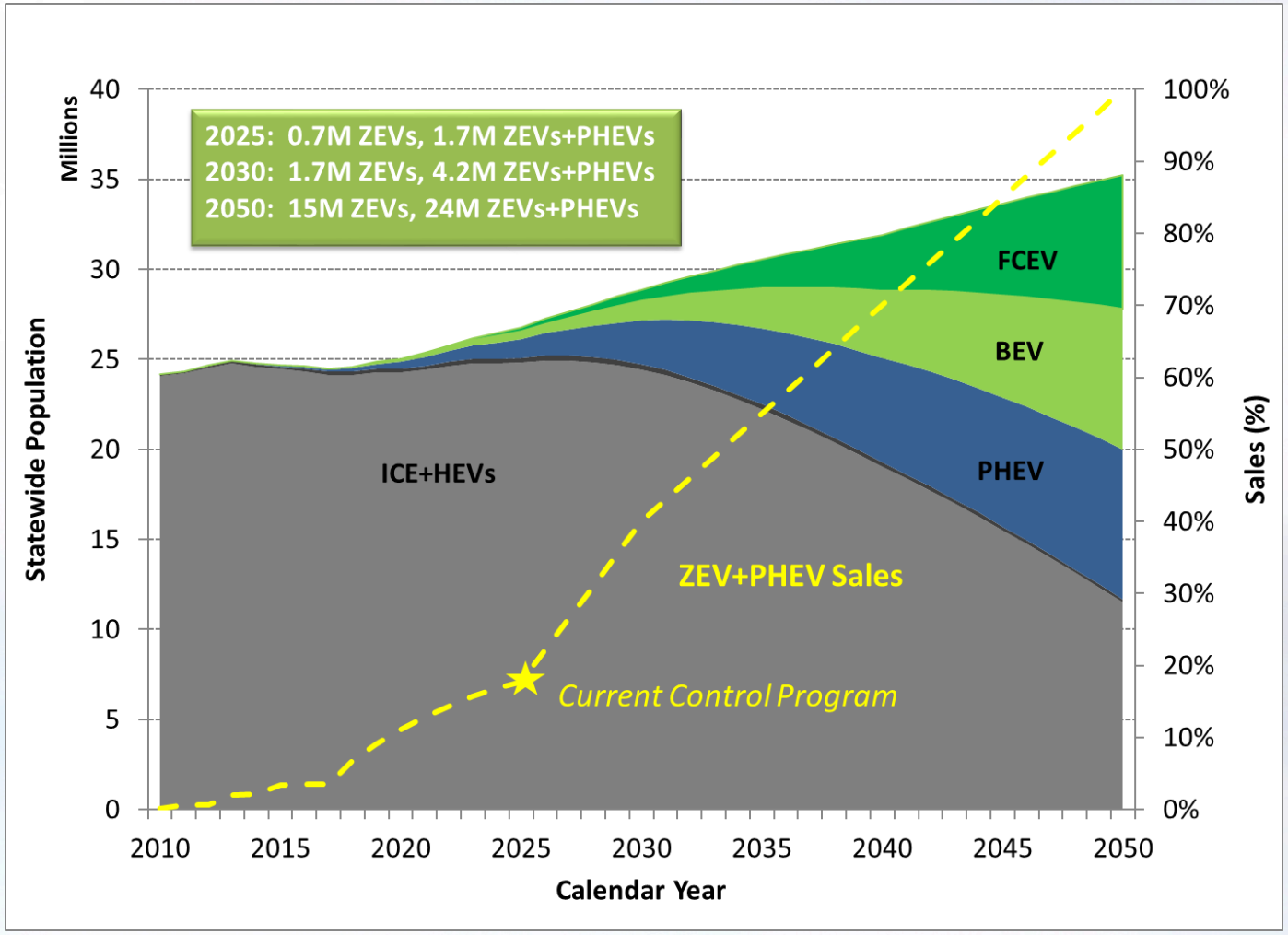
Vision Model Framework



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



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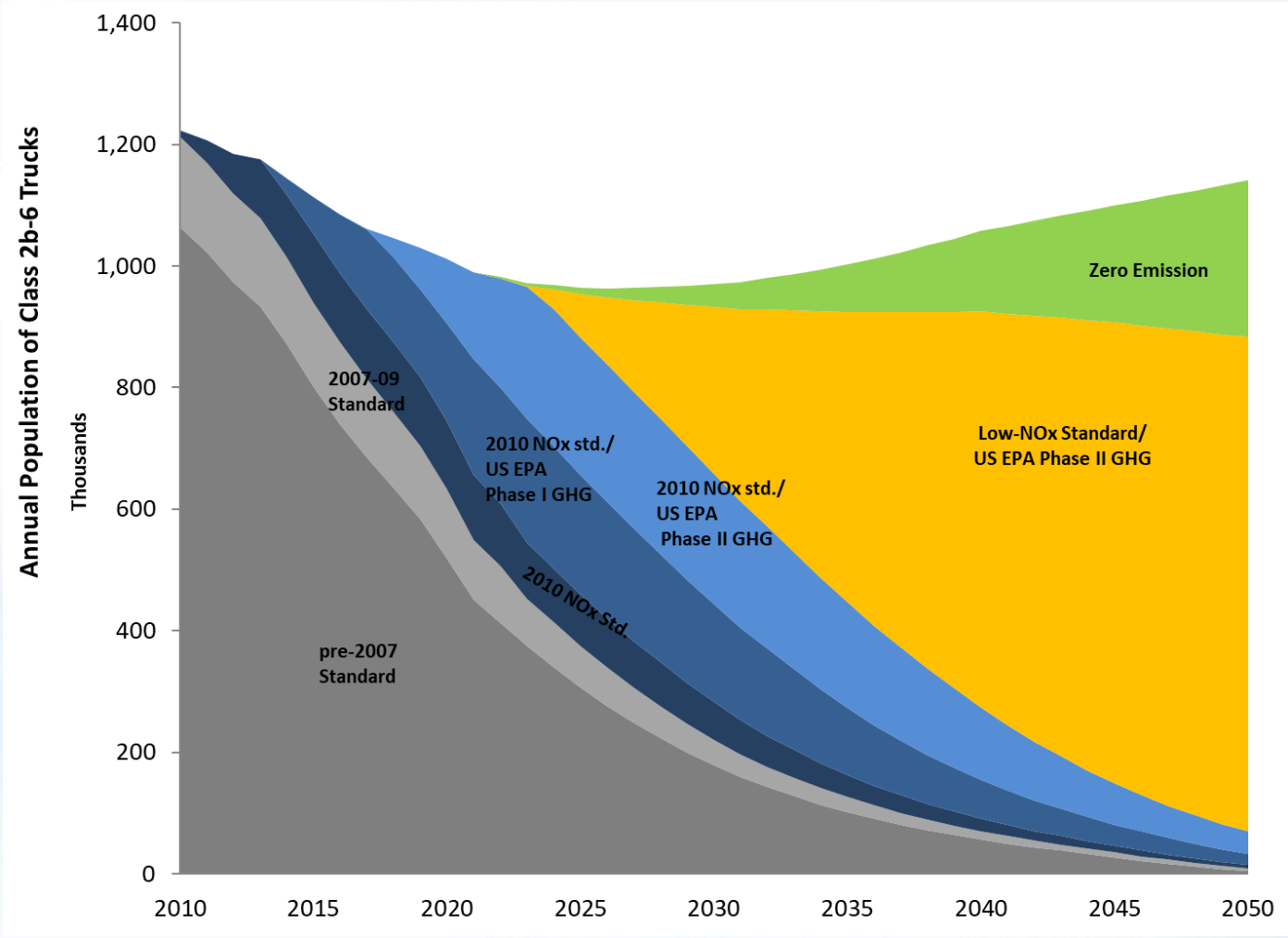
Transformation of Heavy Duty Truck Fleet Technology Mix



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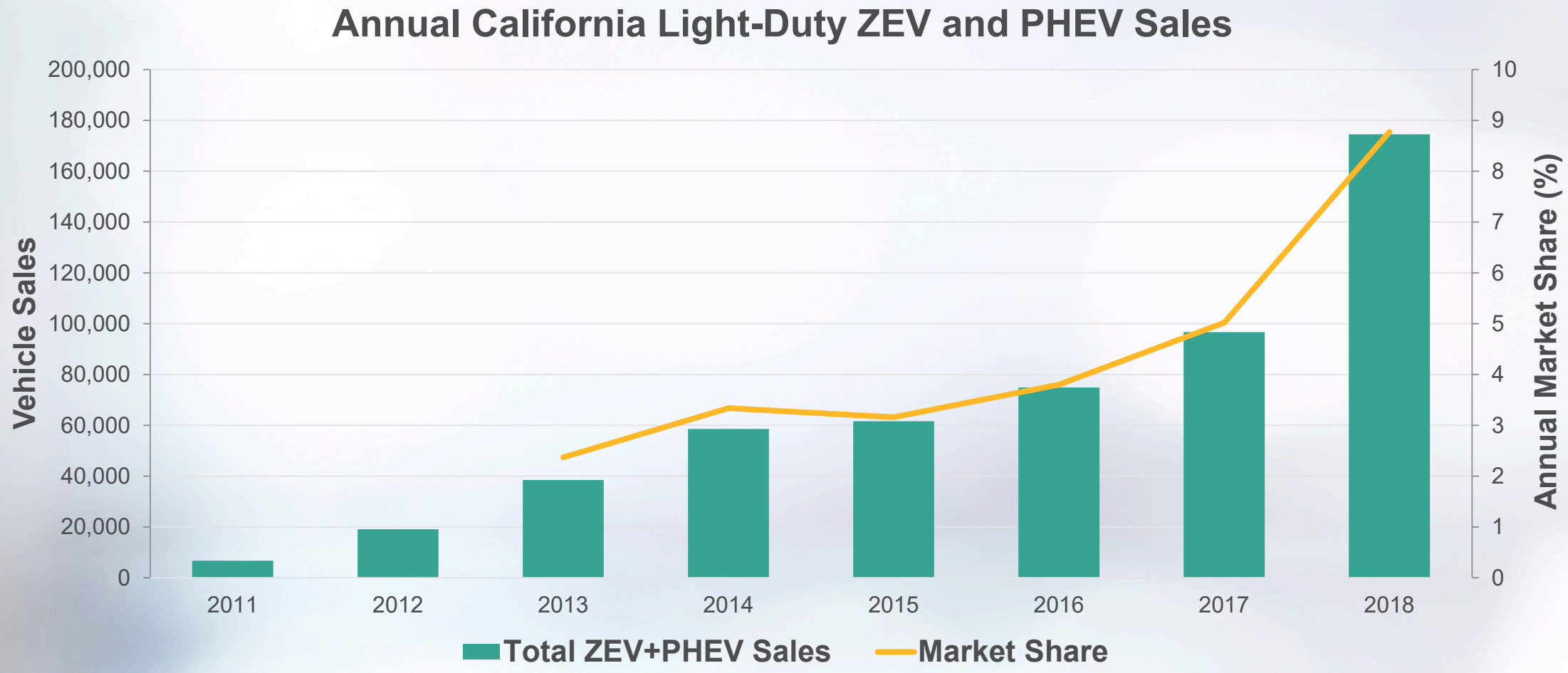
ZEVs Gaining Momentum & Market Share



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

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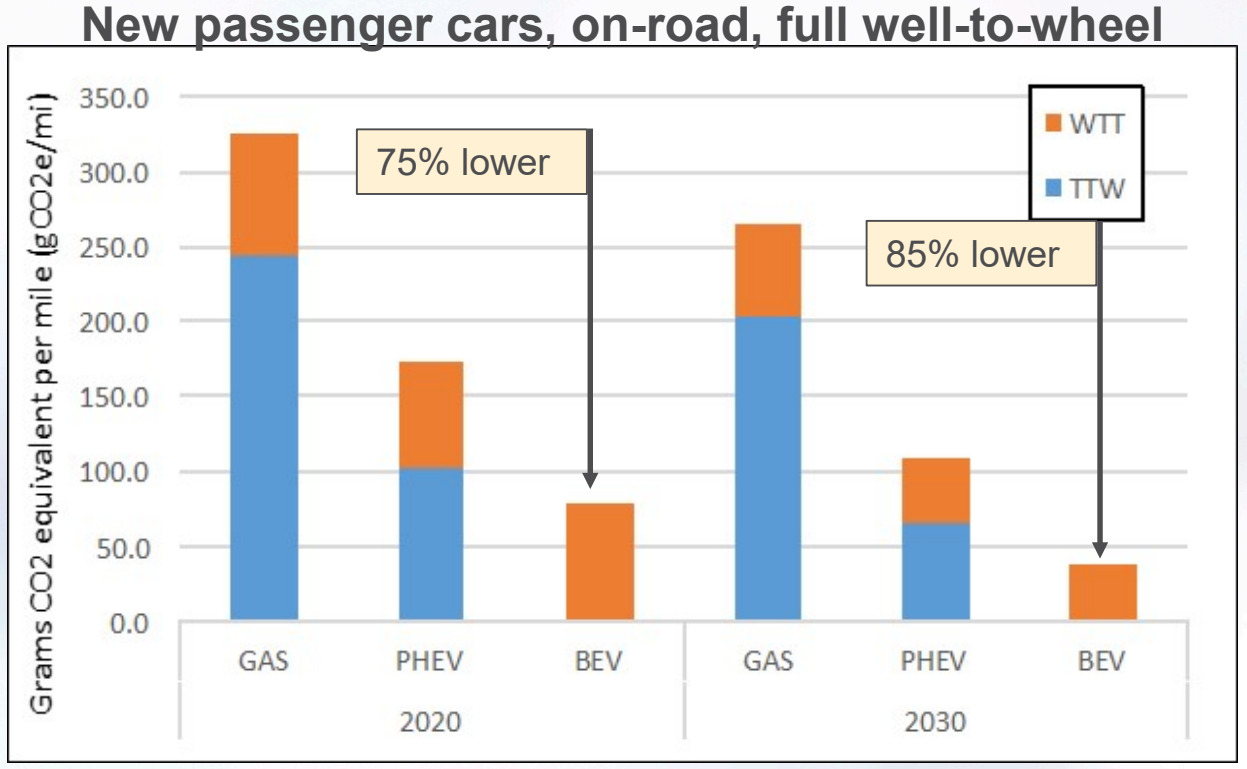
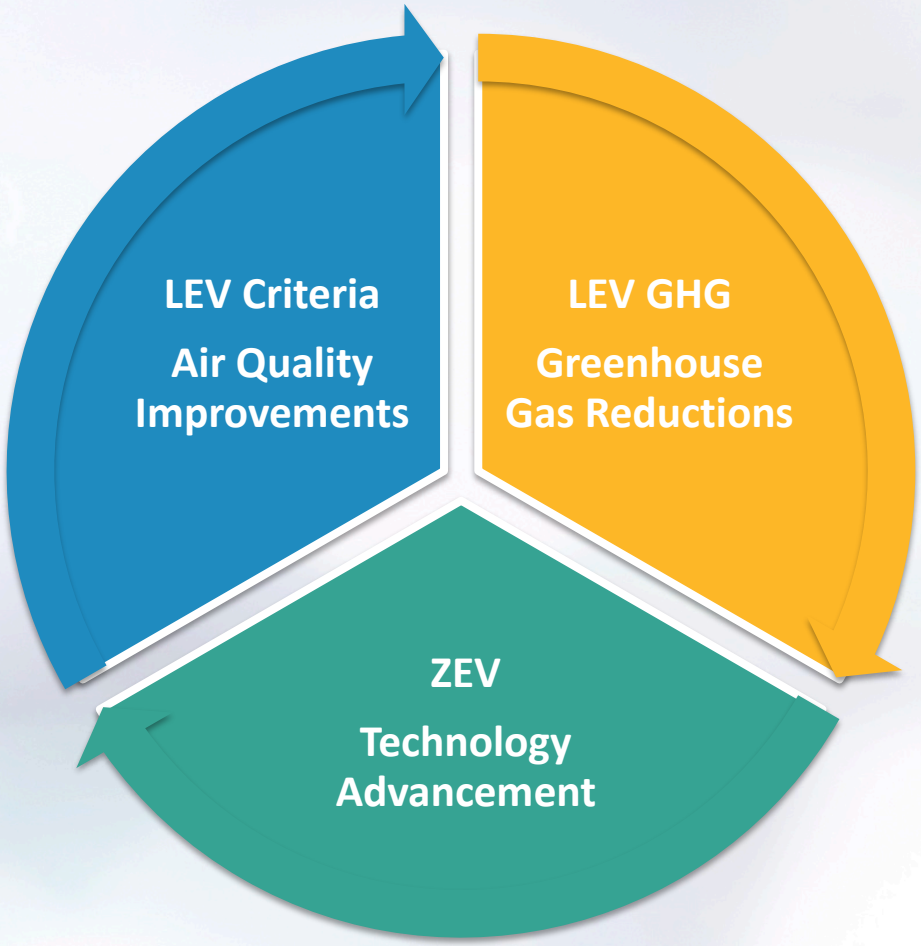
The Importance of Electric Vehicles

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



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:
- gCO_2/passenger-mi
- % electric mile target

Regulatory Timelines

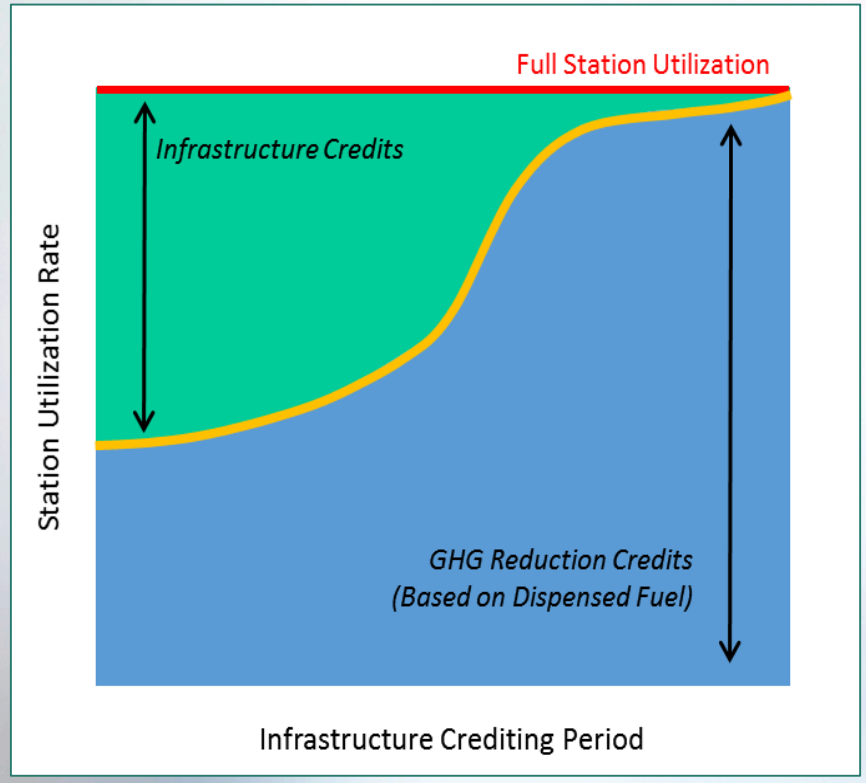
Advanced Clean Cars II

- 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

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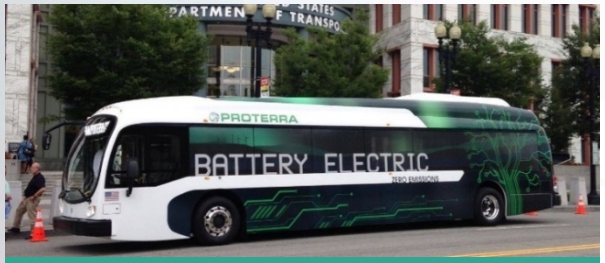
Emerging Zero-Emission Truck Market

- 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

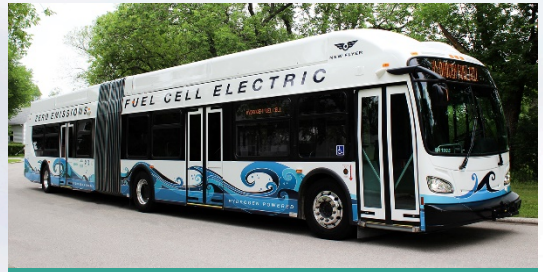
Double-Decker Bus
1 OEM and 1 model

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

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Heavy-duty Electric Market Growing

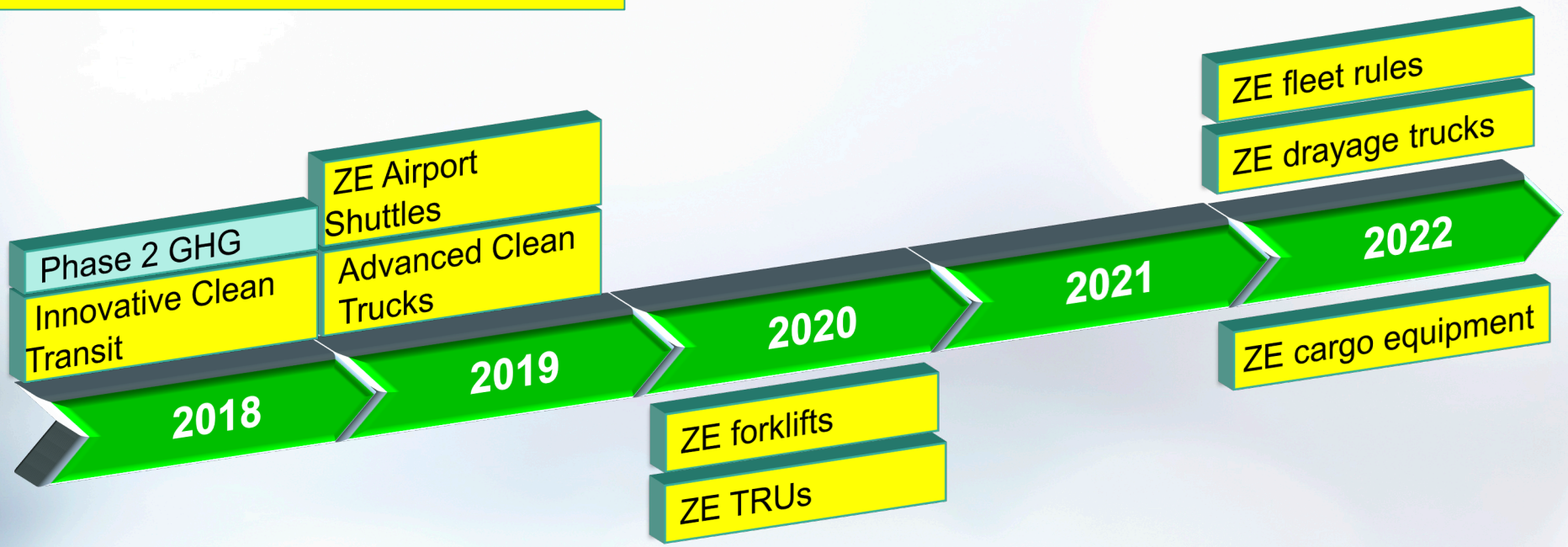
	2B-3	4-5	6-7	8
Commercial				
Demonstrations				

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



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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

Year	ZEB Percentage of New Bus Purchases	
	Large Transit Agency	Small Transit Agency
2023	25%	-
2024	25%	-
2025	25%	-
2026	50%	25%
2027	50%	25%
2028	50%	25%
2029+	100%	100%

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

Agency	Total Buses	ZEB Target
AC Transit	632	2040[a]
Anaheim Resort Transportation	82	2019/2020
Antelope Valley Transit	77	2019
Foothill Transit	373	2030
GTrans	65	2035
Humboldt Transit Authority[b]	30	2030
LA Metro	2452	2030
LADOT	357	2030
Porterville Transit	20	2025
SamTrans	369	2033
San Joaquin RTD	111	2025
Santa Clara VTA	485	2033
Santa Cruz Metro	98	2040[a]
Santa Monica BBB	200	2030
SFMTA	620[c]	2035
Union City Transit	26	2028/29[a]

[a] Target not a directive from Board
[b] Joint application with Arcata & Mad River Transit System
[c] 327 trolley buses not included in total

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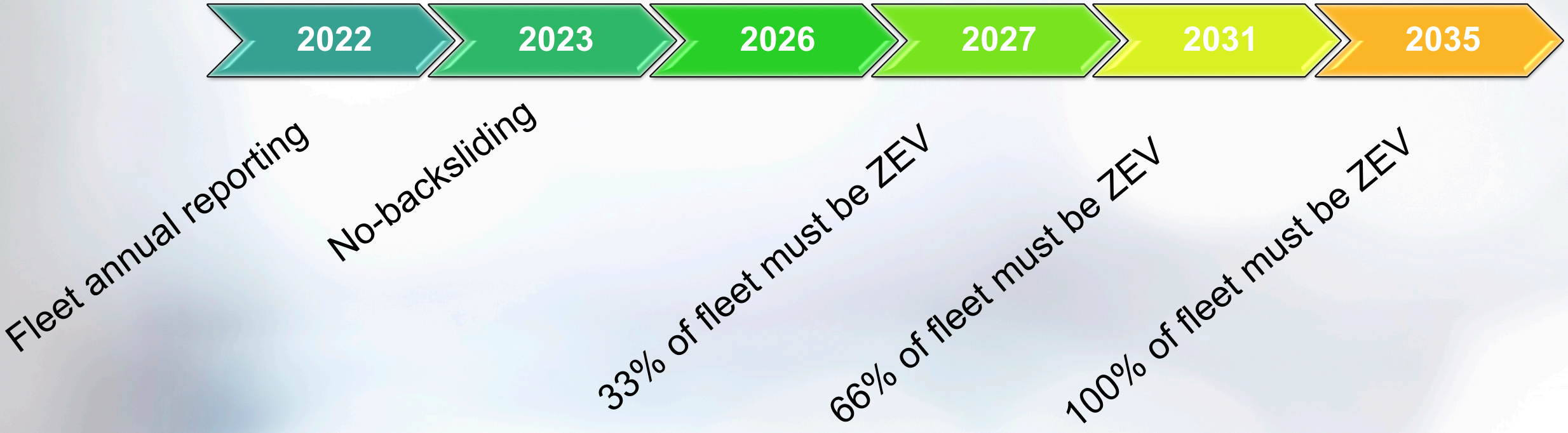
ZE Airport Shuttle Proposal

- Final decision expected mid-2019



Advanced Clean Trucks

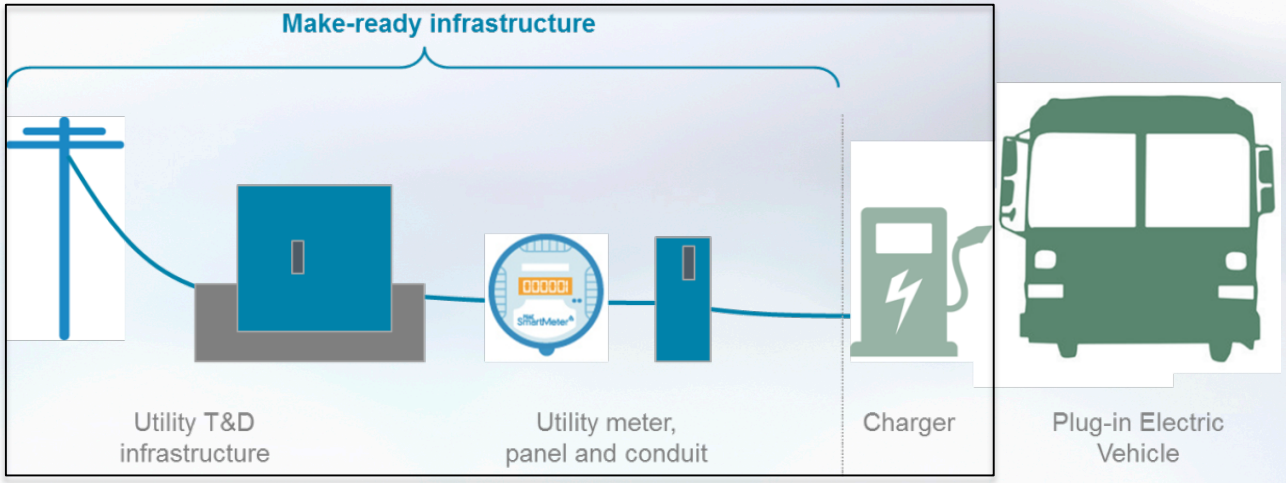
- Foster early ZE truck development and market
- Manufacturer requirement from 2024 – 2030
  - 2018 draft proposal target of 38,000 ZE trucks
- Fleets must report information
  - Used to support future ZE truck fleet requirements
- Board consideration late 2019

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



Transportation Electrification (SB 350) www.cpuc.ca.gov/sb350te/

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

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LCFS program: https://www.arb.ca.gov/fuels/lcfs/lcfs.htm

CARB's Suite of Projects

Path to Commercialization

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

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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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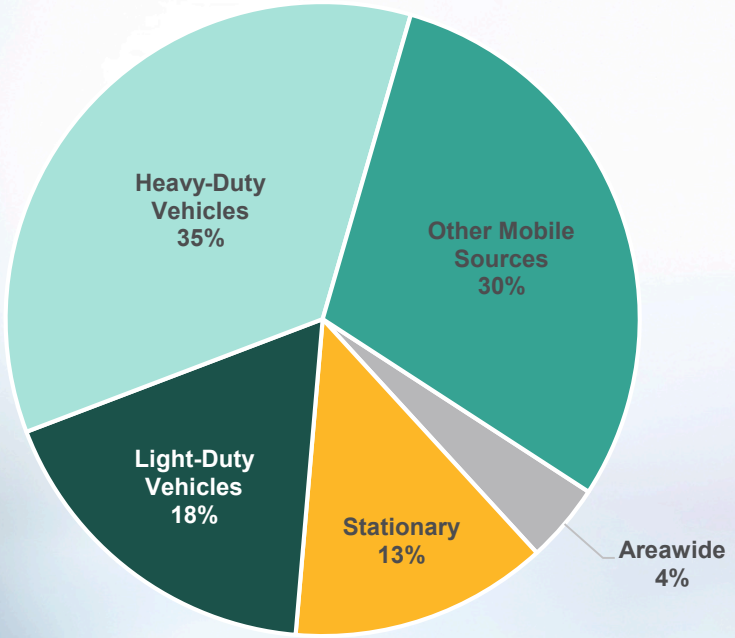
Thank you!

Backup / additional slides

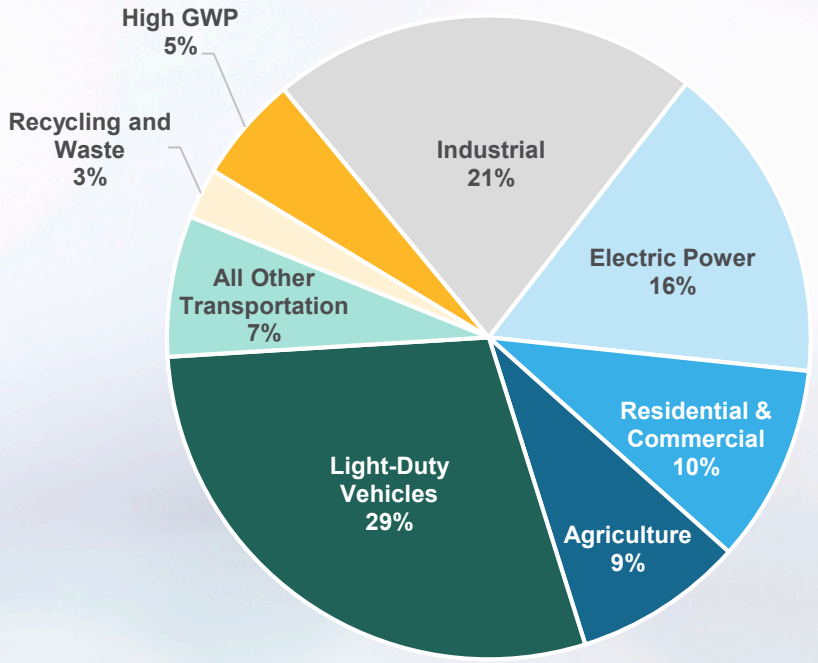
After 50 years of standards, mobile source emissions are still a significant share of inventory

South Coast Air Basin NOx Emissions (2017)



Mobile Sources >80%

California GHG Emissions (2017)



Mobile Sources ~35%

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

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