CALIFORNIA
AIR RESOURCES BOARD

# CARB Long-Term Heavy-Duty Investment Strategy

Work Group #2
August 22, 2023

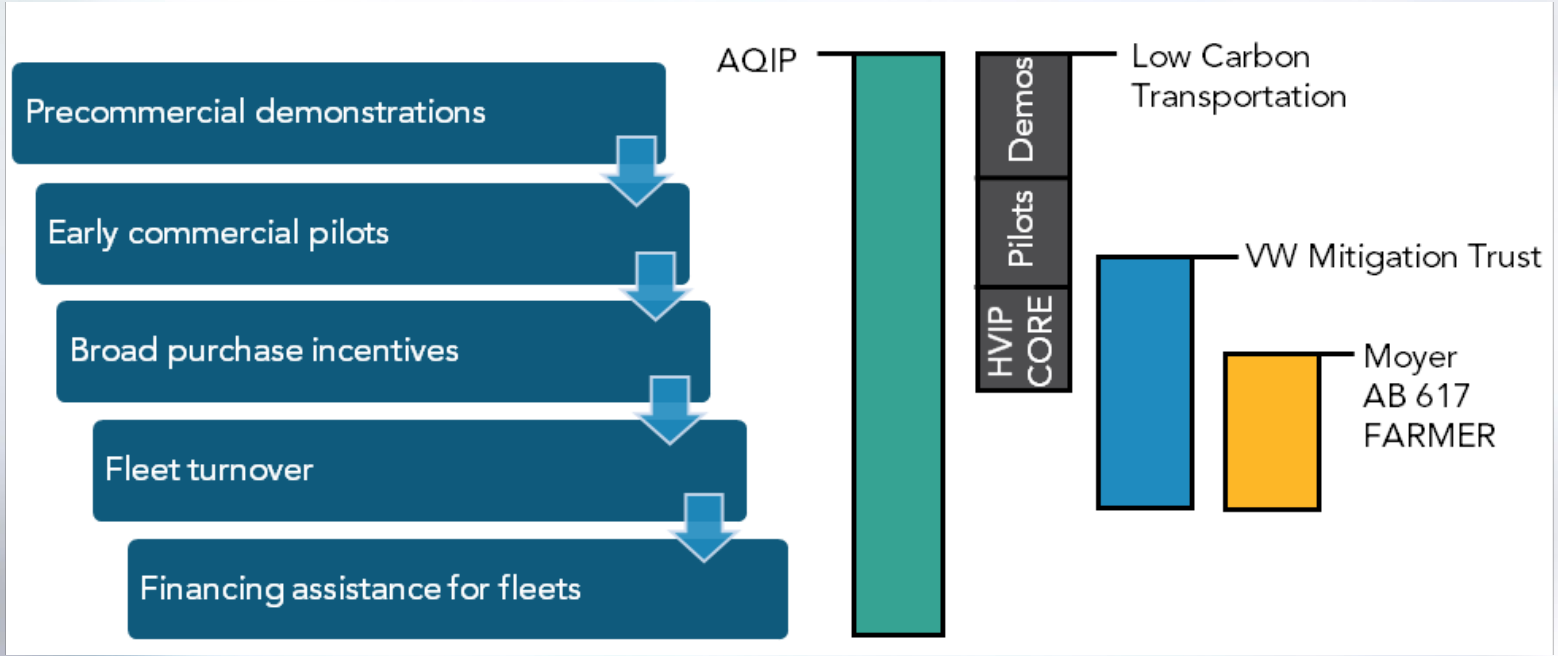
# Agenda

- Introductions, Background, and Purpose
- Heavy-Duty Investment Strategy Overview
- Technology Status Updates
- Market Readiness Updates
- Metrics of Success
- Priority Funding Areas
- Next Steps

# Long-Term Heavy-Duty Investment Strategy

- Annual three-year investment strategy for Clean Transportation Incentives
- Roadmap for transforming the heavy-duty transportation sector
- Outlines priorities for investment
- Focus on equity and small businesses
- Includes annual report on the State's school bus fleet

# Heavy-Duty Technology Progression Through CARB Incentive Programs



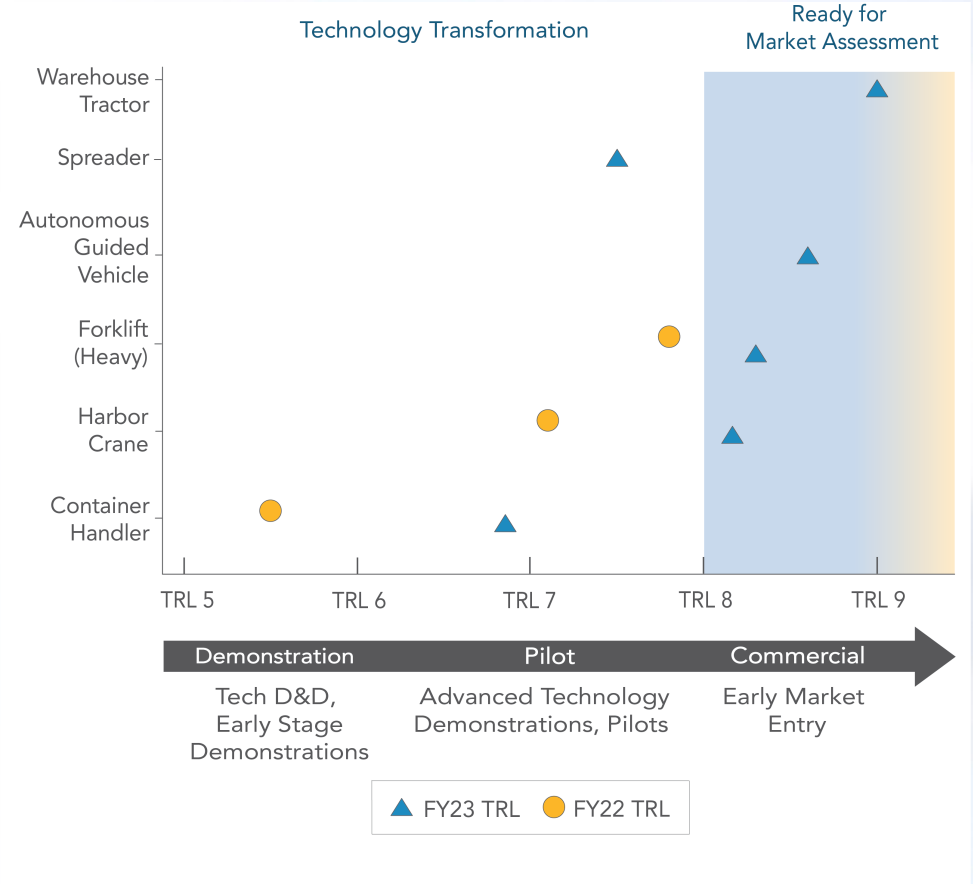
# Technology Status Updates

- Tracks progress toward commercialization for each critical pathway and technology category
  - Technology applications characterized by commercialization stage: demonstration, pilot, and commercial
  - Based on “technology readiness levels”
- Complements Market Readiness Indicators

# Technology Status Snapshots – On-road BEVs

- All on-road battery-electric vehicle (BEV) platforms have achieved technology readiness (TRL of 8+).
- Beginning with the FY23-24 HD Investment Strategy, platforms that have achieved technology readiness will only be evaluated for market readiness.

# Technology Status Snapshots – BE CHE

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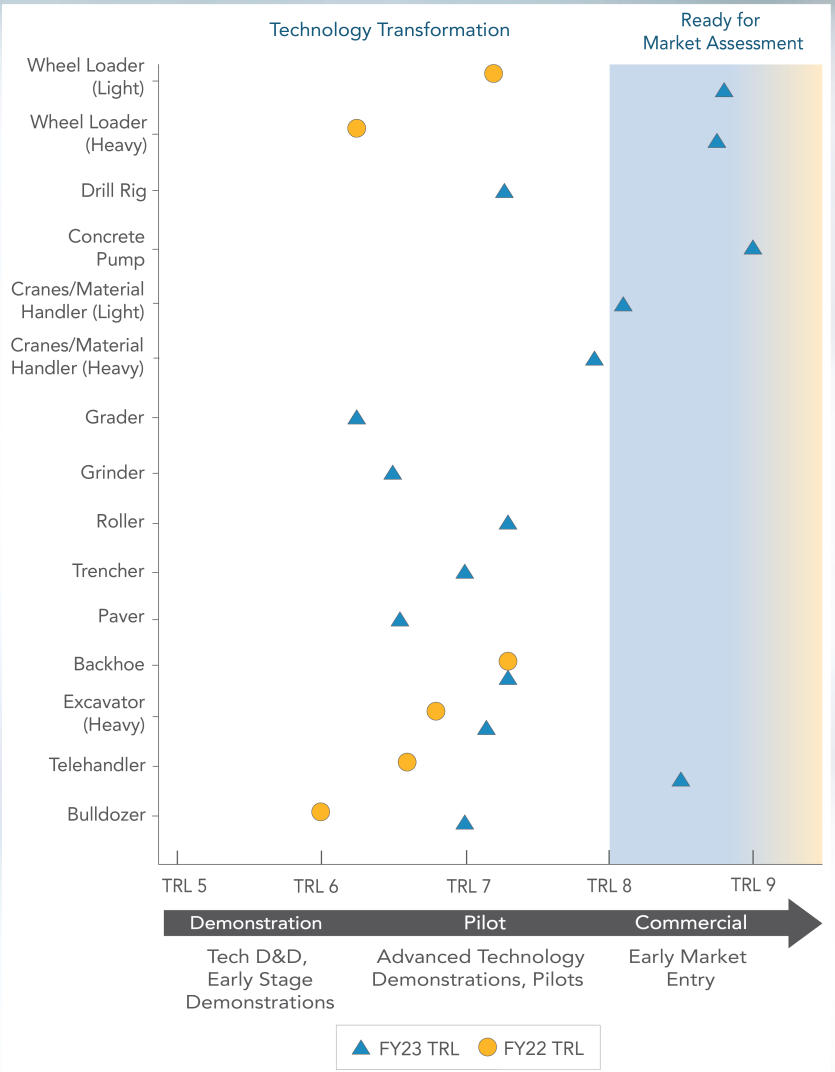
# Technology Status Snapshots – BE Construction

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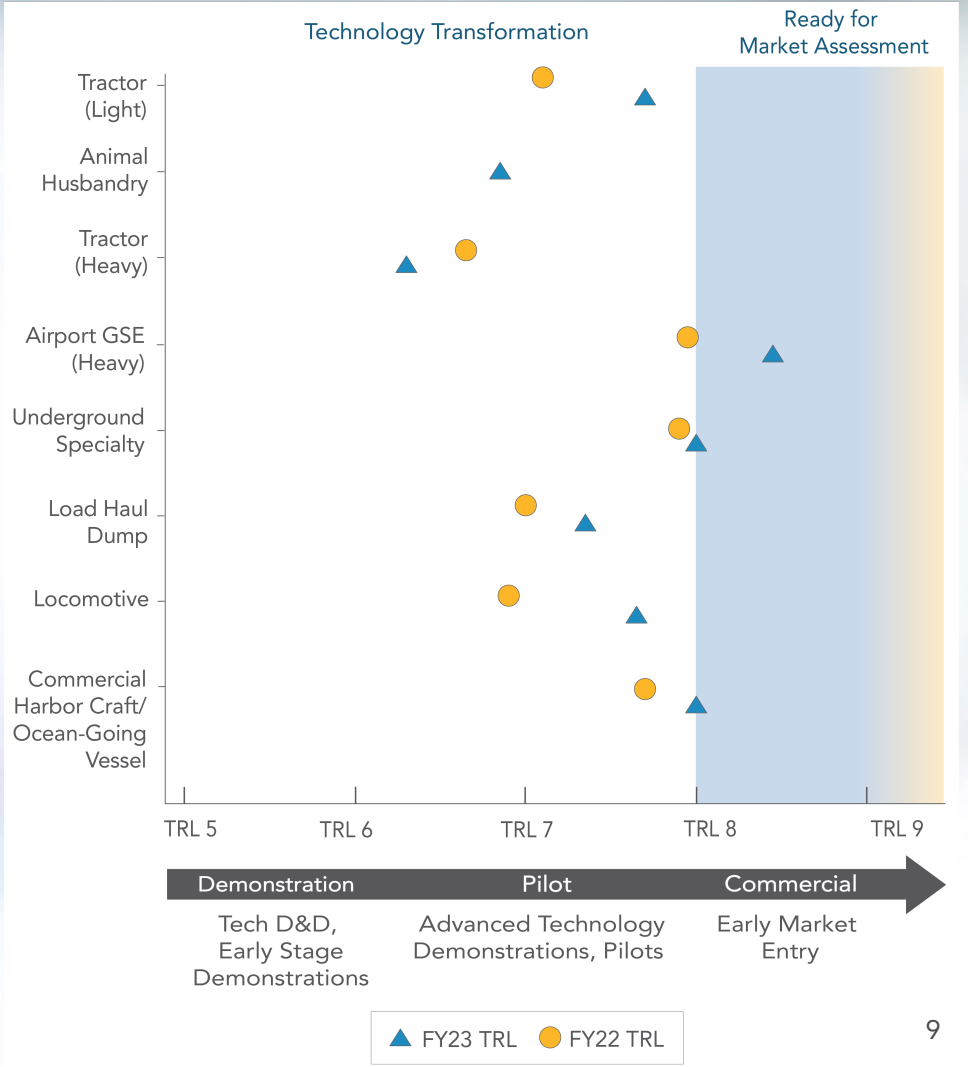
# Technology Status Snapshots – BE Other Off-road

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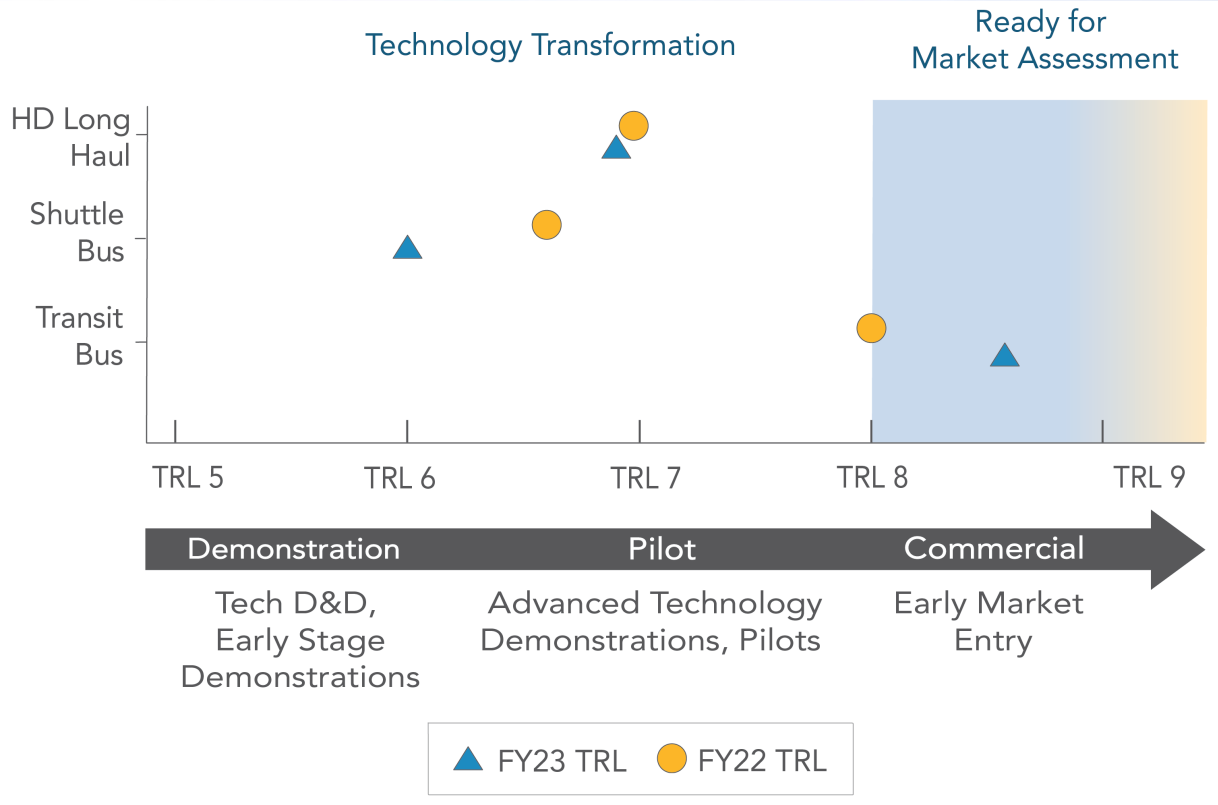
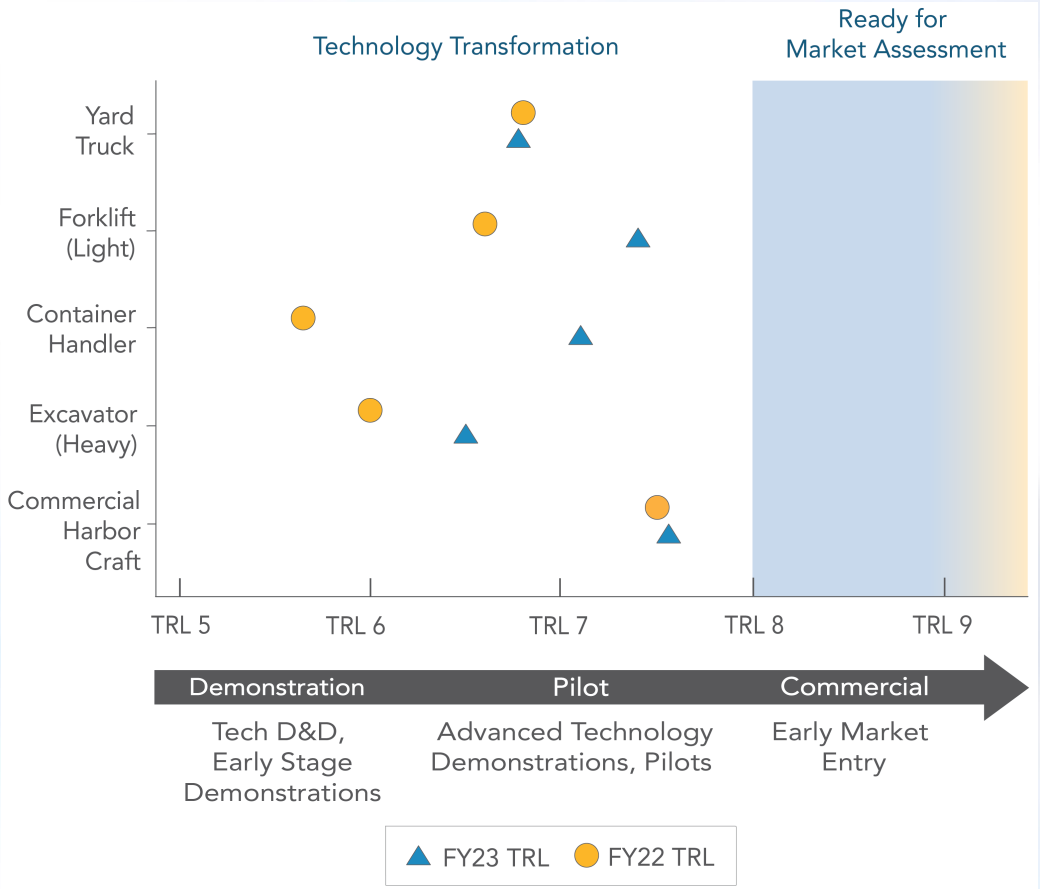
# Technology Status Snapshots – FC On-road



# Technology Status Snapshots – FC Off-road

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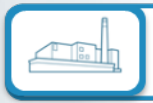
# Market Readiness Indicators



**Production Capacity –** Is this technology in commercial production, or is it limited to prototypes, retrofits, and upfits? Is commercial production significant?

**Cost Parity –** Is the total cost of ownership (TCO) of this technology comparable to internal combustion alternatives (without incentives)?

**Cost Parity with Incentives –** When factoring in available incentive programs (e.g., HVIP, CORE), is the TCO of this technology comparable to internal combustion alternatives?

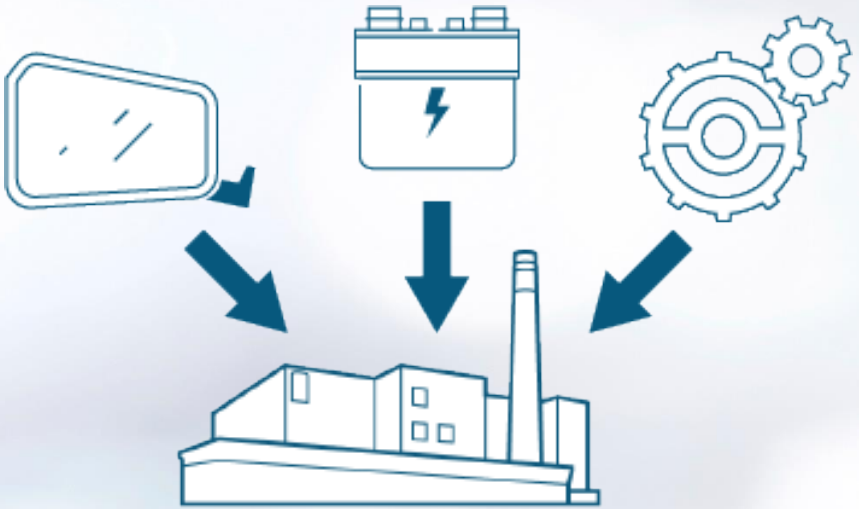
**Duty Cycle Applicability –** Can this technology sufficiently meet the range, payload capacity, and power requirements of common duty cycles within this application?

**Infrastructure –** Is appropriate charging/refueling infrastructure commercially available? Does it face challenges such as cost, permitting, utility connection/coordination, and/or electricity/fuel prices?

**Workforce/Service Network –** Are professional technicians capable of repairing and/or maintaining ZEVs readily available?

# Supply Chain Indicator

- Evaluates on-road technology platforms for their vulnerability to ongoing supply chain disruptions and constraints.
  - Component supply/demand
  - Parts and materials market volatility
- Vehicle delivery time as a proxy for supply chain fragility



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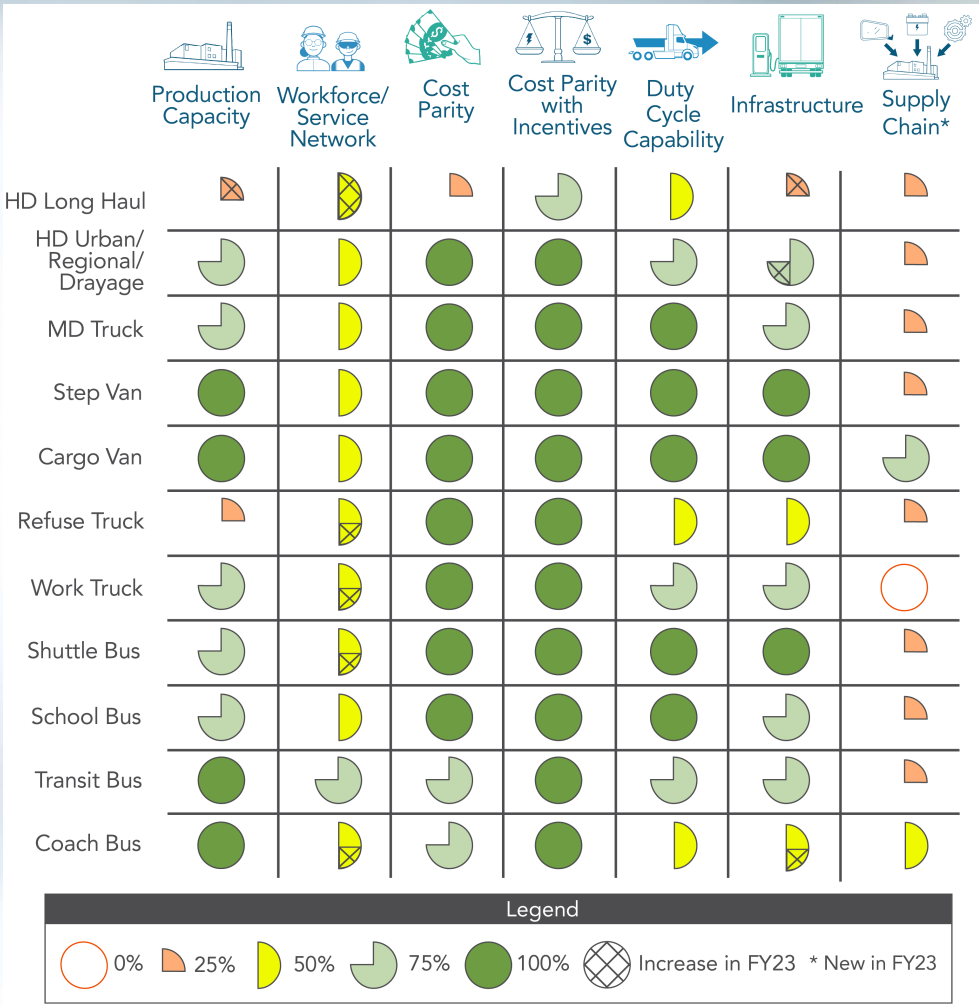
# On-Road BEVs Market Readiness Snapshot (2023)



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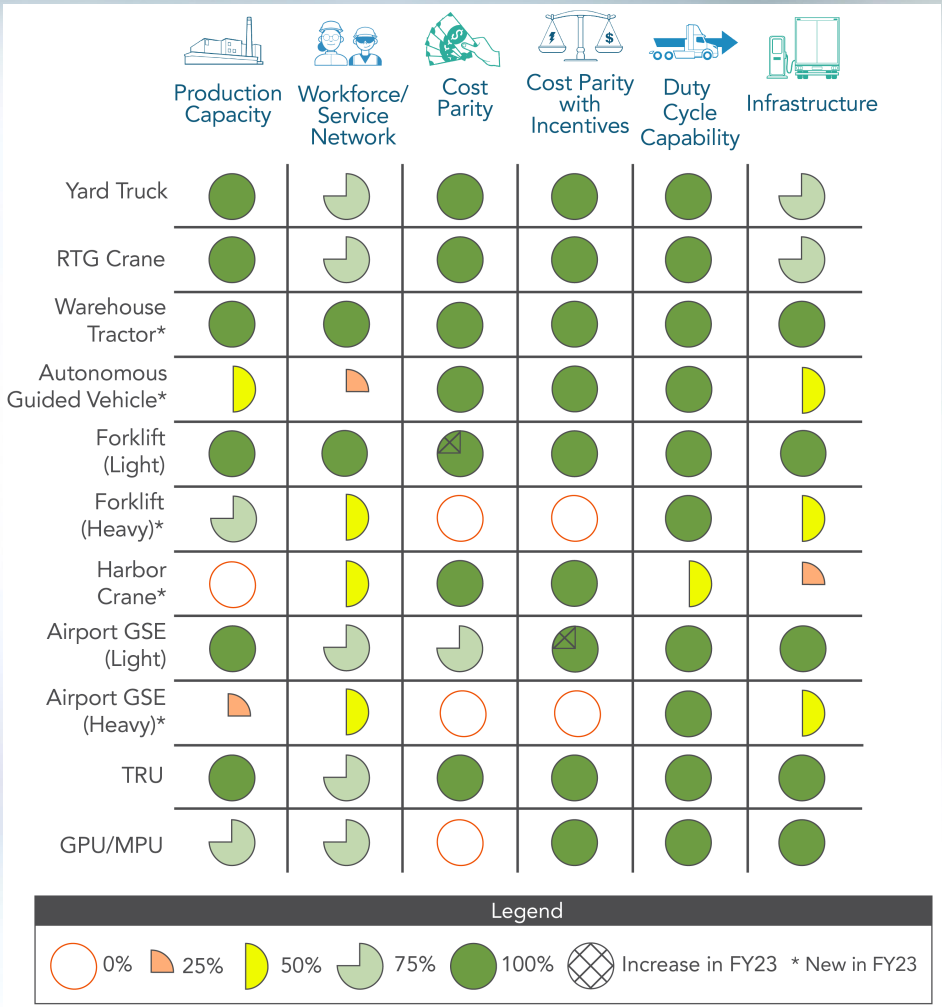


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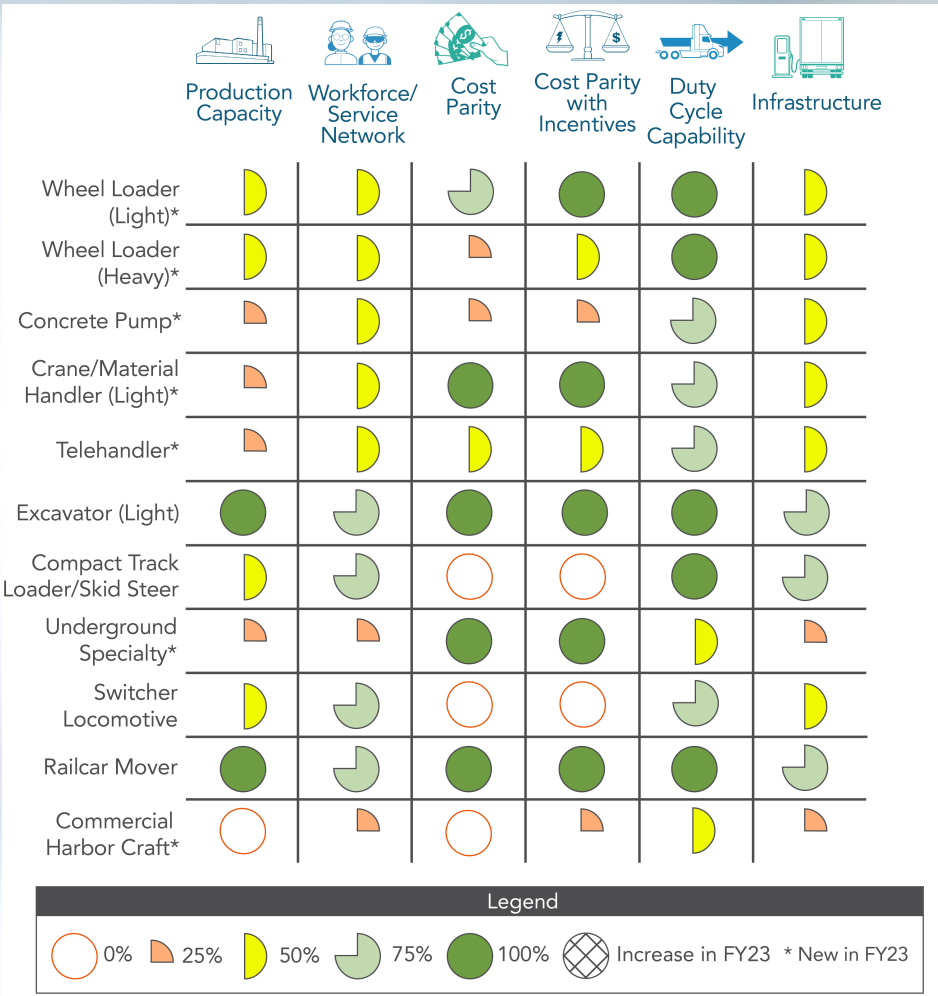


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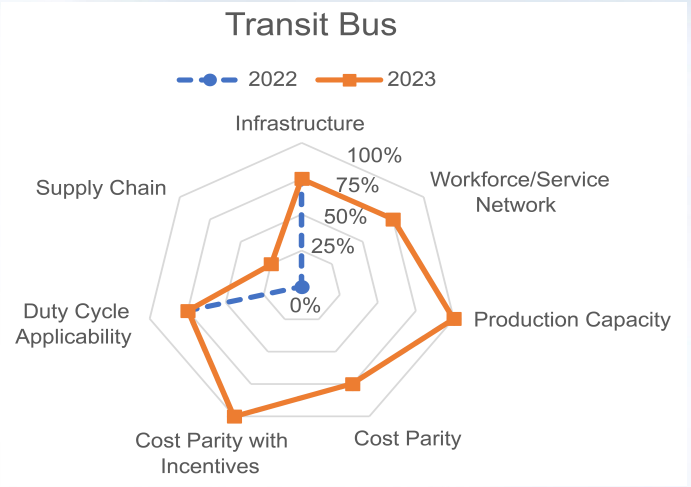
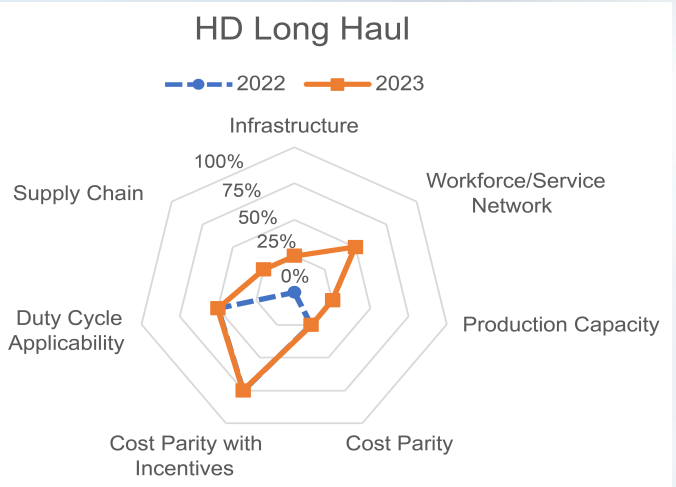
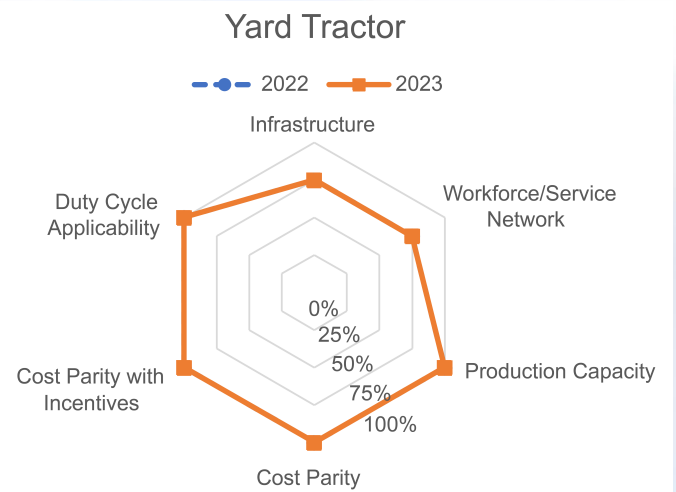
# Alternate Format: Market Readiness Snapshot

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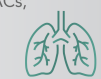
# Metrics of Success (2023)

## Creating Healthy Communities

**58**
PERCENT

### DAC VOUCHERS

Fifty-eight percent of vouchers (HVIP and CORE combined) have funded vehicles and equipment deployed in DACs, as identified in CalEnviroScreen.



**198**
MILLION

### DAC MILES TRAVELED

HVIP-funded vehicles have traveled approximately 198 million miles in DACs, as identified in CalEnviroScreen.

## Supporting Technology Evolution

**78**
PERCENT

### FUTURE ZEV PURCHASES

Seventy-eight percent of HVIP voucher recipients surveyed plan to purchase additional medium- and heavy-duty zero-emission vehicles within the next five years.

**1**
TYPE

### NEW TECHNOLOGY

One new category of zero-emission vehicle (new fuel cell tractors) was eligible for vouchers for the first time this past year. New (non-conversion) fuel cell trucks now eligible for HVIP include: Hyundai XCIENT, Hyzon Motors HyHD8, and Nikola TRE FCEV.

## Growing the Green Economy

**509**
MODELS

### MANUFACTURERS

There are 88 HVIP- and/or CORE-eligible manufacturers offering 509 vehicle or equipment models.

**$3.4**
BILLION

### TOTAL INVESTMENT

Additional public and private spending toward these purchases totaled $3.4 billion--over $3 for every $1 of voucher investment. Leveraged private spending represents purchases redirected from traditional technologies to clean technologies.

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# Metrics of Success (2023)

**399 MILLION**

## MILES TRAVELED

There were 399,110,203 cleaner-than-diesel miles traveled in California by HVIP-funded vehicles between 2010 and 2023.

**895+ THOUSAND**

## EQUIPMENT RUNTIME

CORE-funded zero-emission off-road equipment has been used for 895,954 hours in California between 2020 and 2023.

# New Metric of Success

## Growing the Green Economy

**19**
PERCENT

### CALIFORNIA MANUFACTURING

Approximately 19 percent of HVIP and CORE funding (by dollar amount) has gone to OEMs with California manufacturing facilities.

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# Heavy-Duty Investment Priorities

| | FY 2024-25 | FY 2025-26 | FY 2026-27 |
|---|---|---|---|
| Demos | $55-$95 Million<br>Focus: ZE Construction and Mining Equipment, ZE Heavier Cargo Handling Equipment, ZE Line-Haul Rail, ZE Marine, ZE Aviation | $65-$100 Million<br>Focus: ZE Construction and Mining Equipment, ZE Heavier Cargo Handling Equipment, ZE Line-Haul Rail, Emergency and Heavy Specialty Equipment, ZE Aviation | $XX-$XXX Million<br>Focus: ZE Line-Haul Rail, Emergency and Heavy Specialty Equipment, ZE Heavy Aviation |
| Pilots | $200-$325 Million<br>Focus: ZE Ag-Construction-Heavier Cargo Handling Equipment, ZE/Hybrid Marine, Strategic Range Extenders, ZE Facilities/ Communities/Corridors | $225-$350 Million<br>Focus: FC Long Haul Trucks, ZE Ag-Construction-Mining-Heavier Cargo Handling Equipment, ZE/Hybrid Marine, Strategic Range Extenders, ZE Facilities/ Communities/Corridors | $XXX-$XXX Million<br>Focus: FC Long Haul Trucks, ZE Ag-Construction-Heavier Cargo Handling Equipment, ZE/Hybrid Marine, ZE Facilities/Communities/Corridors, ZE Light Aviation |
| Commercial | $1,210-$1,815 Million<br>Focus: ZE Drayage, BE Long Haul Trucks, ZE School/Transit, ZE Heavier Cargo Handling, ZE Switcher Rail, ZE/Hybrid Marine, Temp. Fueling, Financing and Insurance Assistance, ePTOs | $1,460-$2,170 Million<br>Focus: ZE Drayage, BE Long Haul Trucks, ZE School/Transit, ZE Heavier Cargo Handling, ZE Switcher Rail, ZE/Hybrid Marine, Temp. Fueling, Financing and Insurance Assistance, Heavy/Specialty ePTOs | $X,XXX-$X,XXX Million<br>Focus: ZE Drayage, BE Long Haul Trucks, ZE School/Transit, ZE Heavier Cargo Handling Equipment, ZE Construction and Mining Equipment, ZE Switcher Rail, ZE/Hybrid Marine, Heavy/Specialty ePTOs |
| Total Funding | $1,465-$2,235 Million* | $1,750-$2,620 Million* | $X,XXX-$X,XXX Million* |

# Next Steps

- Draft Funding Plan out now
- Final Funding Plan Workshop on Aug. 31
- Funding Plan and Heavy-Duty Investment Strategy posted in October
- Board consideration likely in November

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Cap and Trade Dollars at Work