CALIFORNIA
AIR RESOURCES BOARD

Drive Forward Light-duty Vehicle Program

Third Public Workshop

November 17, 2026

Tech Support and Reminders

Reach out for help if you have any technical challenges



- **Contact: cleancars@arb.ca.gov**

Reminders

- Meeting materials available at: Drive Forward Program webpage
- Find the Zoom recording at the link above

How to Participate Virtually



Email questions to the **Clean Cars** email box

Public Comment and Engagement

- Submit written comments through the Drive Forward Light-duty Vehicle Standards informal comment submittal form
  - Comment period will close December 18, 2026, at 11:59 p.m.

- View submitted comments at:
  - Workshop comments log webpage
  - Do not include PII or CBI in comments
- Reach out to us at Clean Cars (cleancars@arb.ca.gov)

Acronyms and Terminology

Acronym/Term	Definition
GVWR	Gross vehicle weight rating
LDV	Light-duty vehicle (=<8,500 lbs. GVWR)
MDV	Medium-duty vehicle (8,501–14,000 lbs. GVWR)
NMOG+NOx	Non-methane organic gases and oxides of nitrogen
PM	Particulate matter
ZEV	Zero-emission vehicle
PHEV	Plug-in hybrid electric vehicle
HEV	Hybrid electric vehicle
ICEV	Internal combustion engine vehicle
OEM	Original equipment manufacturer
MY	Model year
Legacy OEM	OEM that produces some internal combustion engine vehicles
ZEV-only OEM	OEM that only produces vehicles without any exhaust emissions

Workshop Agenda

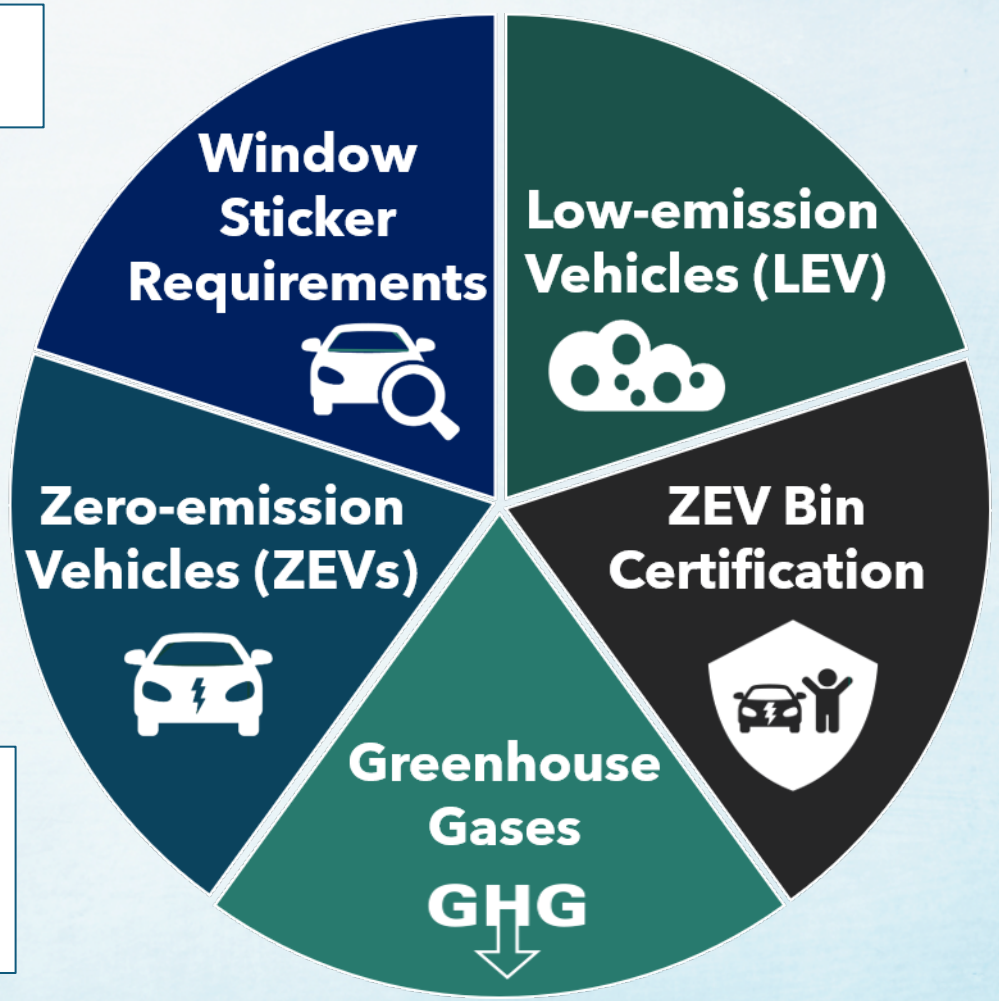
- Summary
- Criteria air pollutant standards
  - *Q&A*
- Greenhouse gas standards
- Treatment of plug-in hybrids
  - *Q&A*
  - *10-minute break*
- Early action concepts
- Flexibilities for small volume manufacturers
  - *Q&A*
- ZEV certification
- BEV window sticker
- Total cost of ownership analysis inputs
- Next Steps
  - *Q&A*

Recap of Prior Workshop Preliminary Proposals

- BEV window sticker design
- Metrics and calculation methods

- ZEV minimum applicable to legacy OEMs only
- Only vehicles without any exhaust emissions count
- Limited trading

- More stringent LDV GHG standards
- Fleet utility factor proposal
- Changes to off-cycle and air conditioning leakage credits



- More stringent LDV and MDV NMOG+NOx fleet average standards
- 0.5 mg/mi LDV and MDV PM standard (FTP, Cold FTP, US06)
- Additional LEV emission standards
- New brake wear PM standards
- More stringent evaporative emissions standards
- E15 emissions compliance

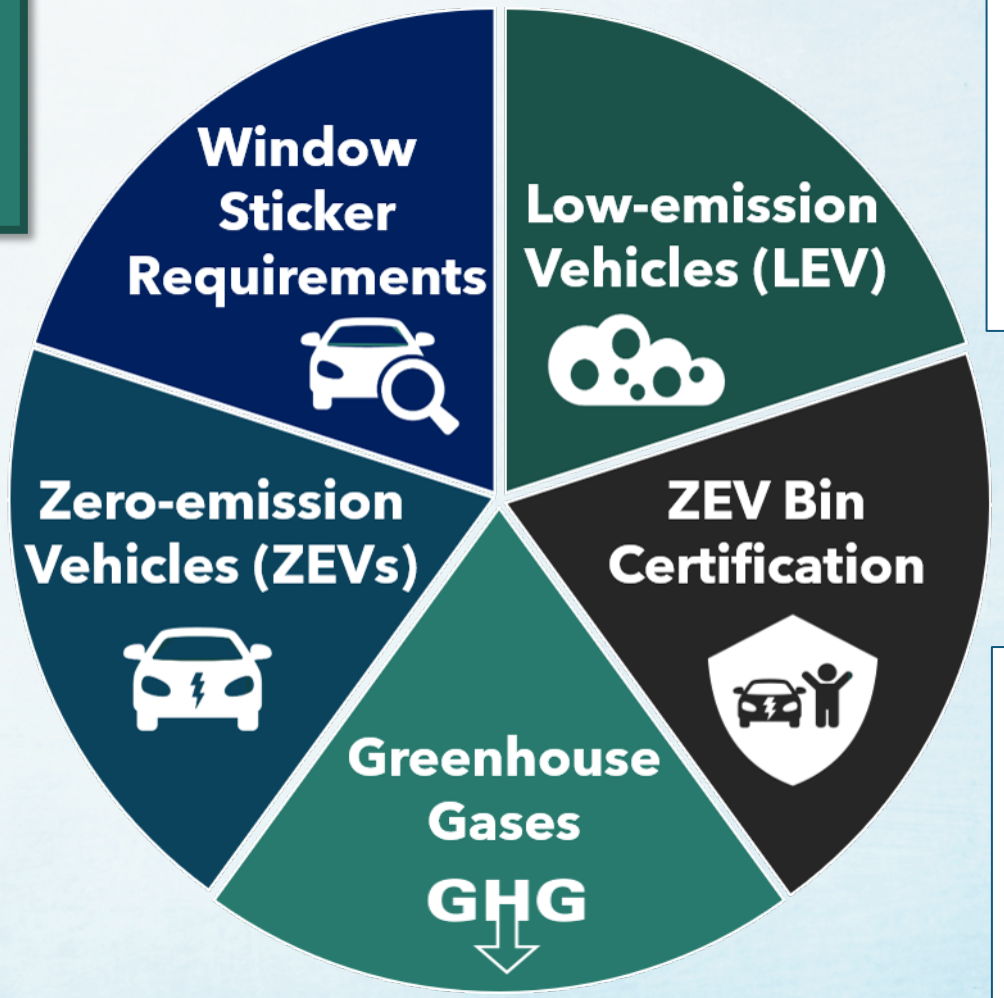
Minimum requirements for:
- Range
- Durability
- Warranty
- Data standardization
- Charging
- Service information

Today's Topics

New Overarching Topics
- Early action concepts
- Flexibilities for small volume manufacturers
- Total cost of ownership inputs

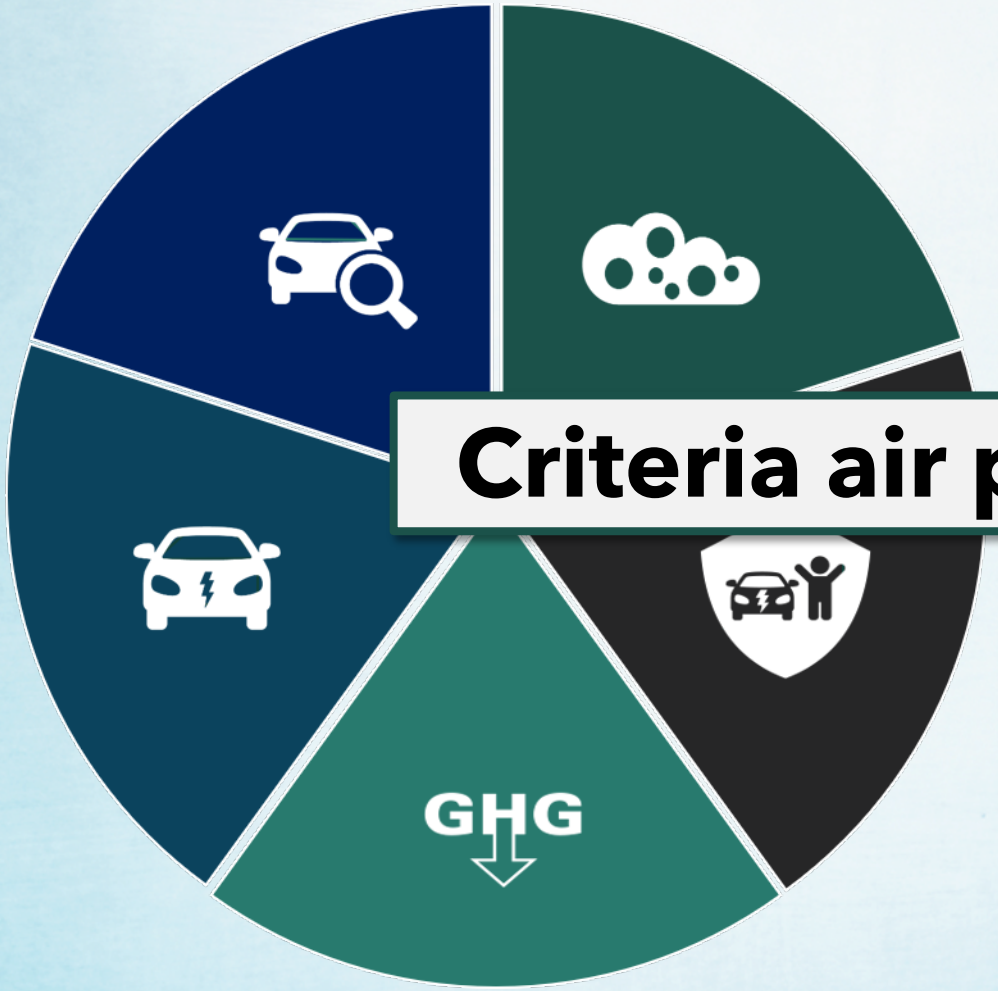
- Revised window sticker
- Updates on calculation methods

- Update on GHG emissions trends
- ICEV technology assessment
- Strategies to improve implementation
- Updated PHEV fleet utility factor



- ICEV certification data analysis
- PHEV contribution factor
- Brake wear PM testing procedures
- NIRCOS leak test procedure

- MDV ZEV certification requirements
- Alternative certification pathway
- Updated ZEV certification fees



Criteria air pollutant standards

Proposed Light-duty NMOG+NOx Fleet Average Standards

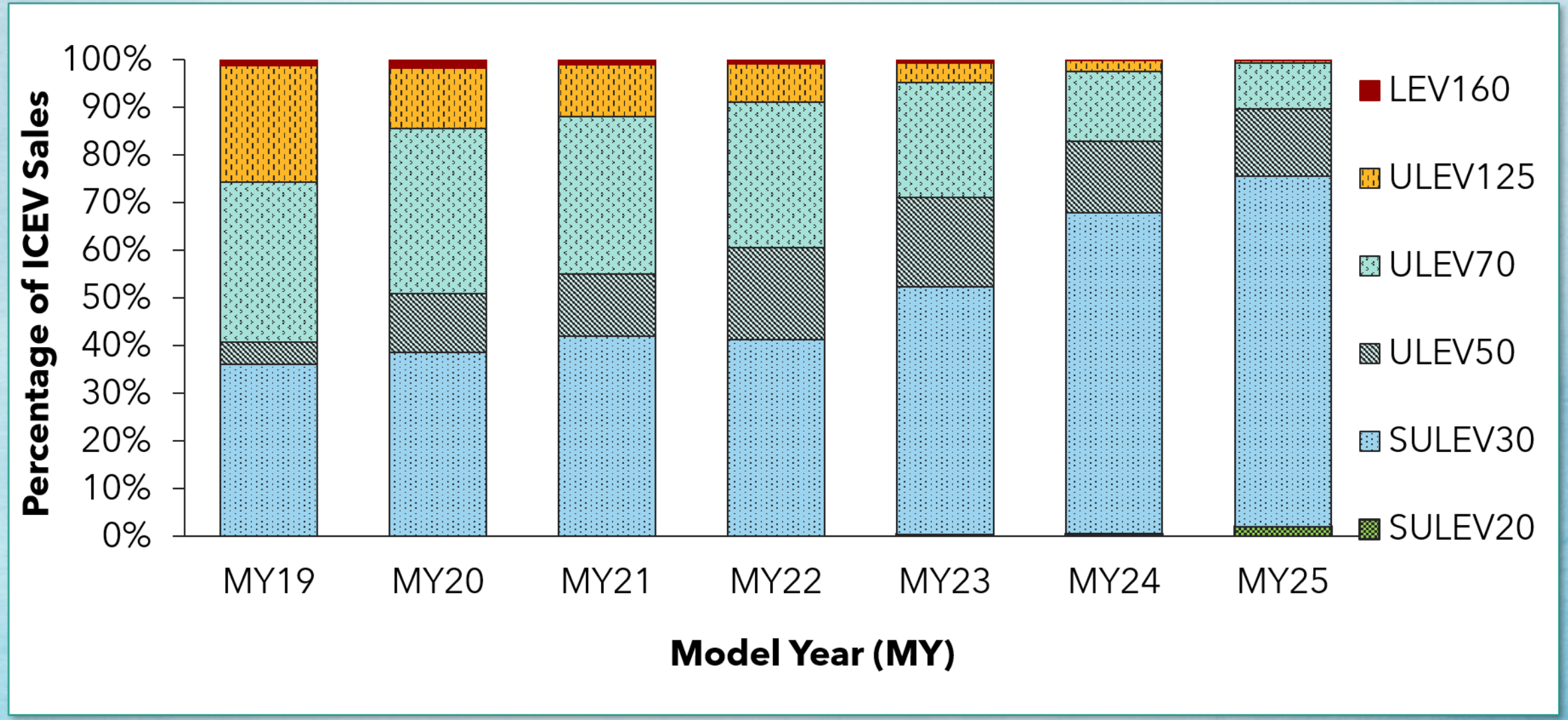
Prior Workshops

- Reviewed available emission control technologies
- Proposed LDV NMOG+NOx fleet average standards
  - 22 mg/mi in 2031 to 12 mg/mi by 2038 model year
  - Removing higher bins (ULEV125 and LEV160)
  - Including ZEVs in the fleet average

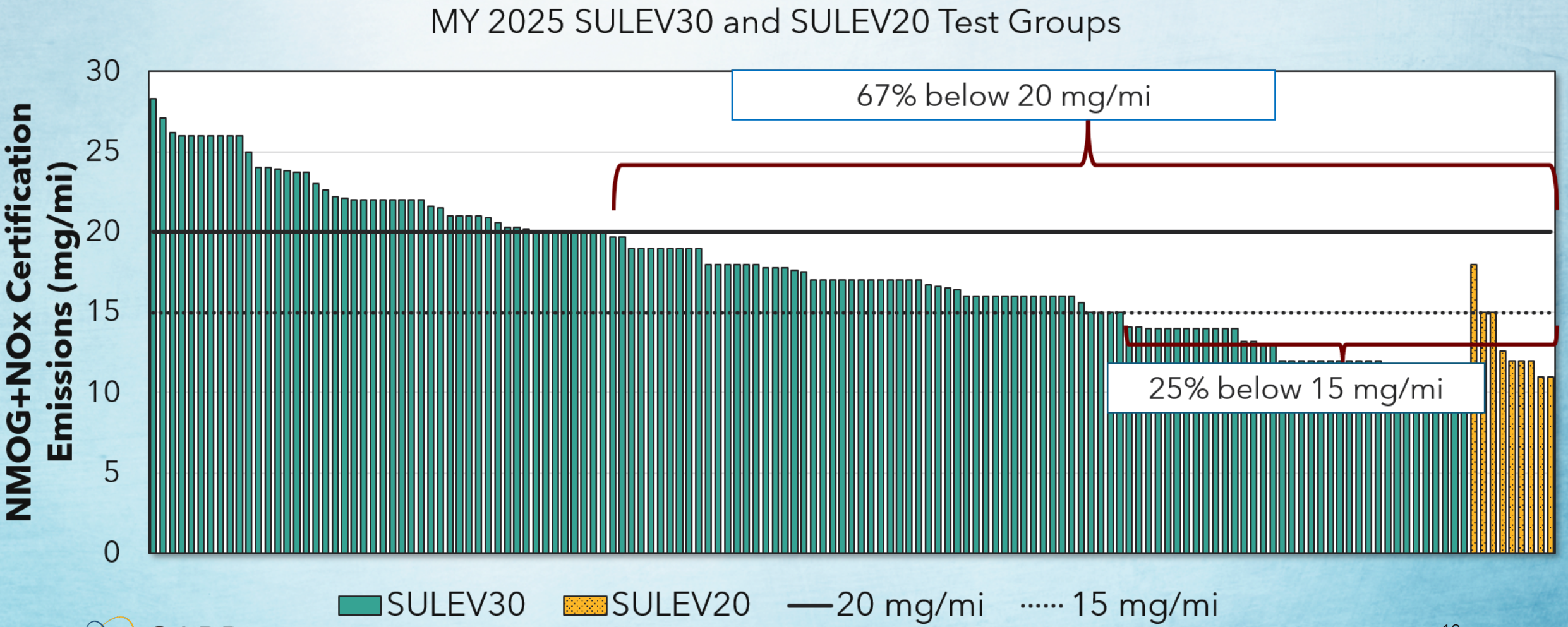
Today's Workshop

- Updated NMOG+NOx certification data and emissions
- Proposal for additional certification bins
- Discussion of technical feasibility of low emissions levels
- Request for input on compliance margins and available technologies

Updated NMOG+NOx ICEV Certification Trends



NMOG+NOx emission levels consistent with Drive Forward are achievable today



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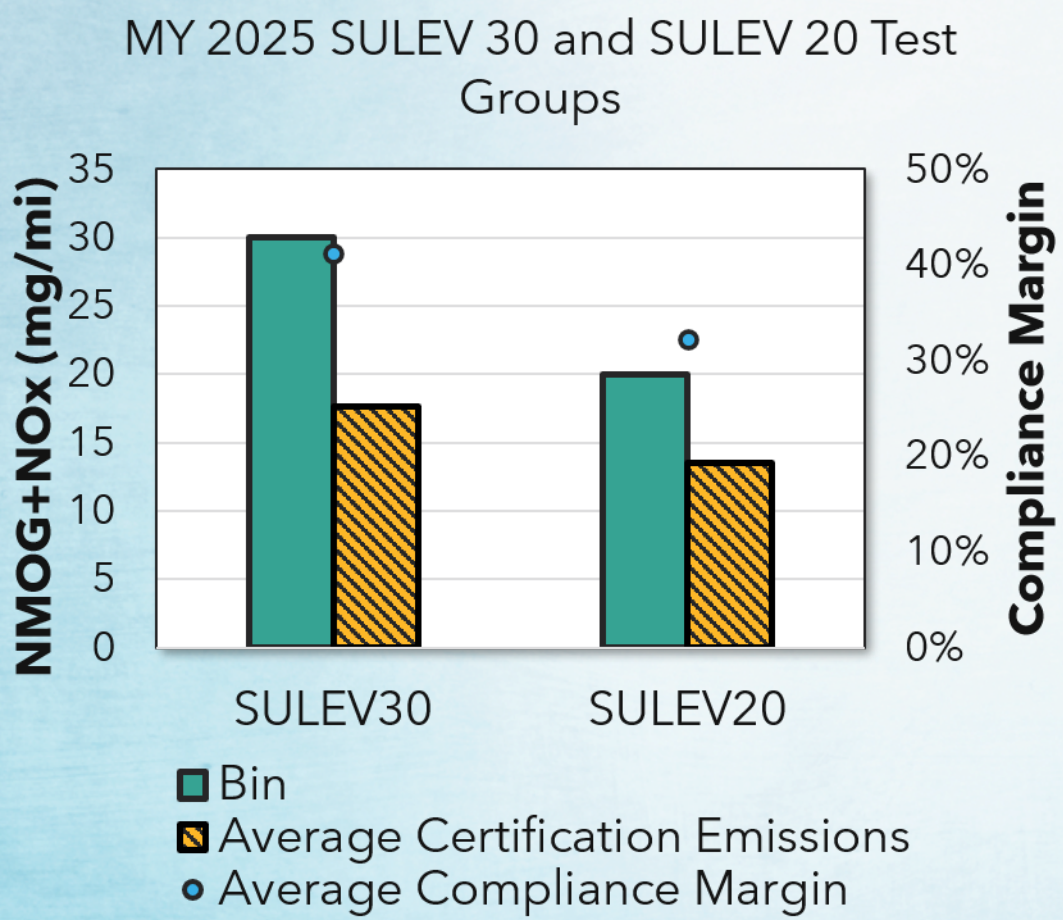
CARB is proposing new certification bins to accommodate lower ICEV emissions levels

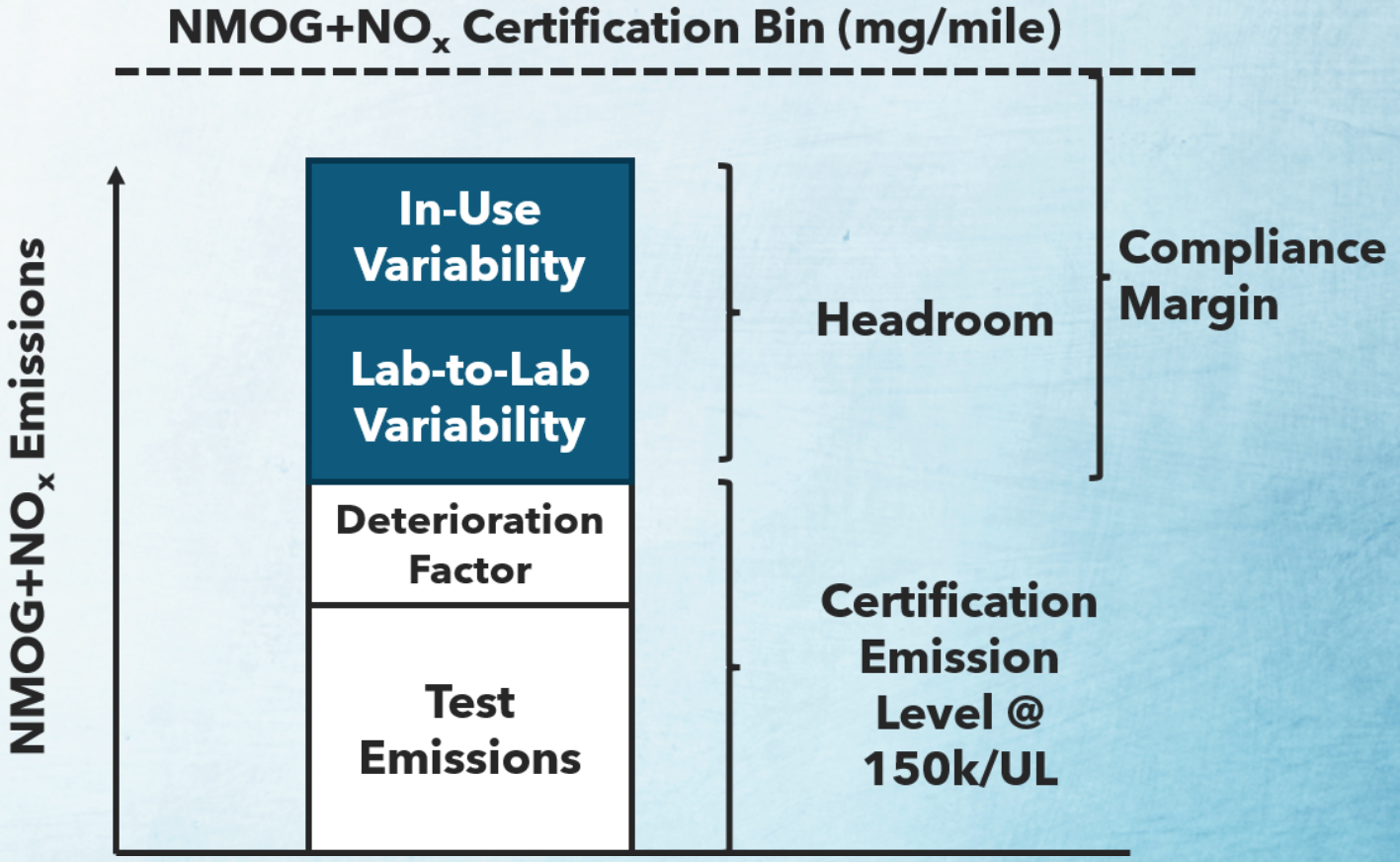
- Drive Forward proposal includes new emission certification bins (SULEV15, SULEV25 ULEV40, ULEV60) to provide flexibility to OEMs
- With the proposed contribution factor, PHEVs can receive compliance values well below SULEV15

Drive Forward Proposed Bins*	FTP Emission Level (g/mile)
ULEV70	0.070
☆ **ULEV60**	**0.060**
ULEV50	0.050
☆ **ULEV40**	**0.040**
SULEV30	0.030
☆ **SULEV25**	**0.025**
SULEV20	0.020
☆ **SULEV15**	**0.015**
ZEV	0.000

*Proposing to retain ULEV125 for small volume manufacturers only

CARB recognizes the need for certification compliance margins





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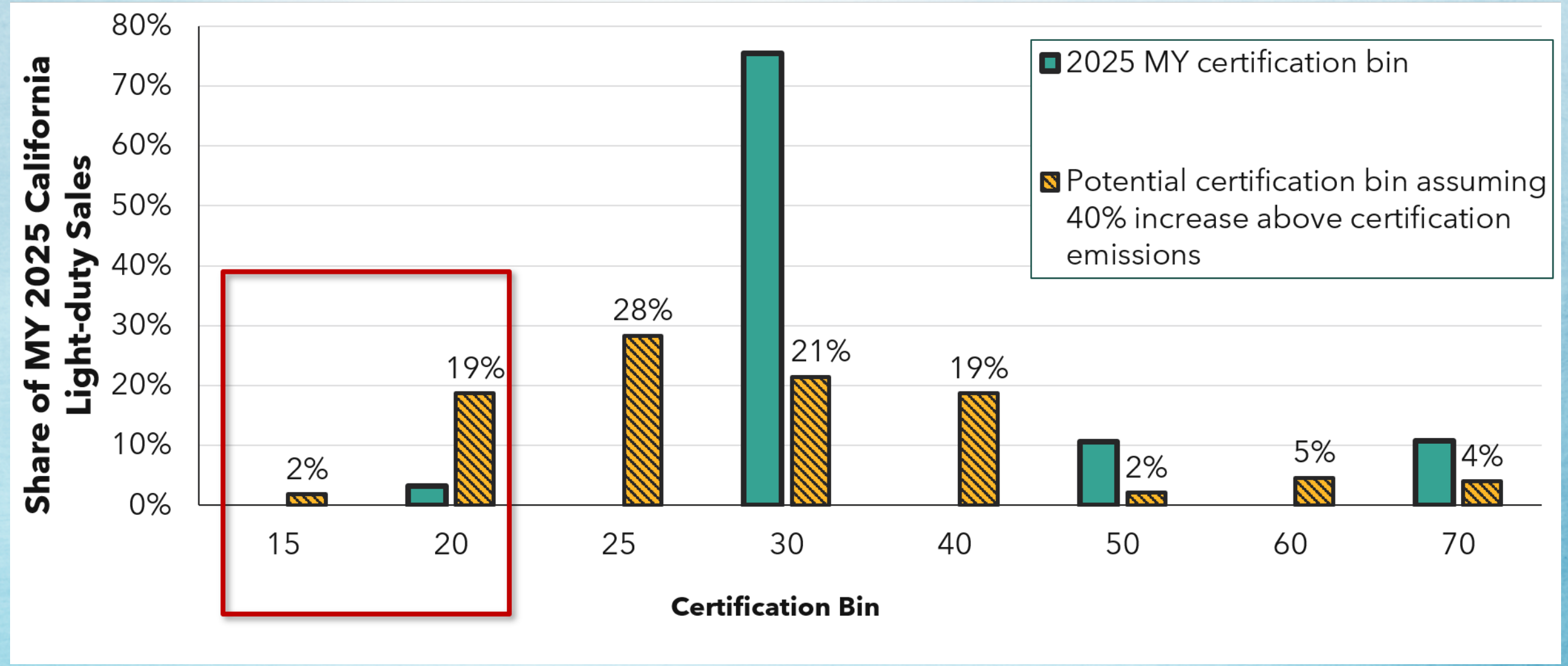
20% of today's ICEVs could potentially certify to SULEV20 and below



Seeking Input

- Reasonable compliance margin assumptions
- Strategies to address manufacturer concerns with certifying to new lower bins (e.g., potential interim in-use compliance standards)
- Costs and efficacy of emission reduction technologies

Proposed MDV Criteria Emission Standards

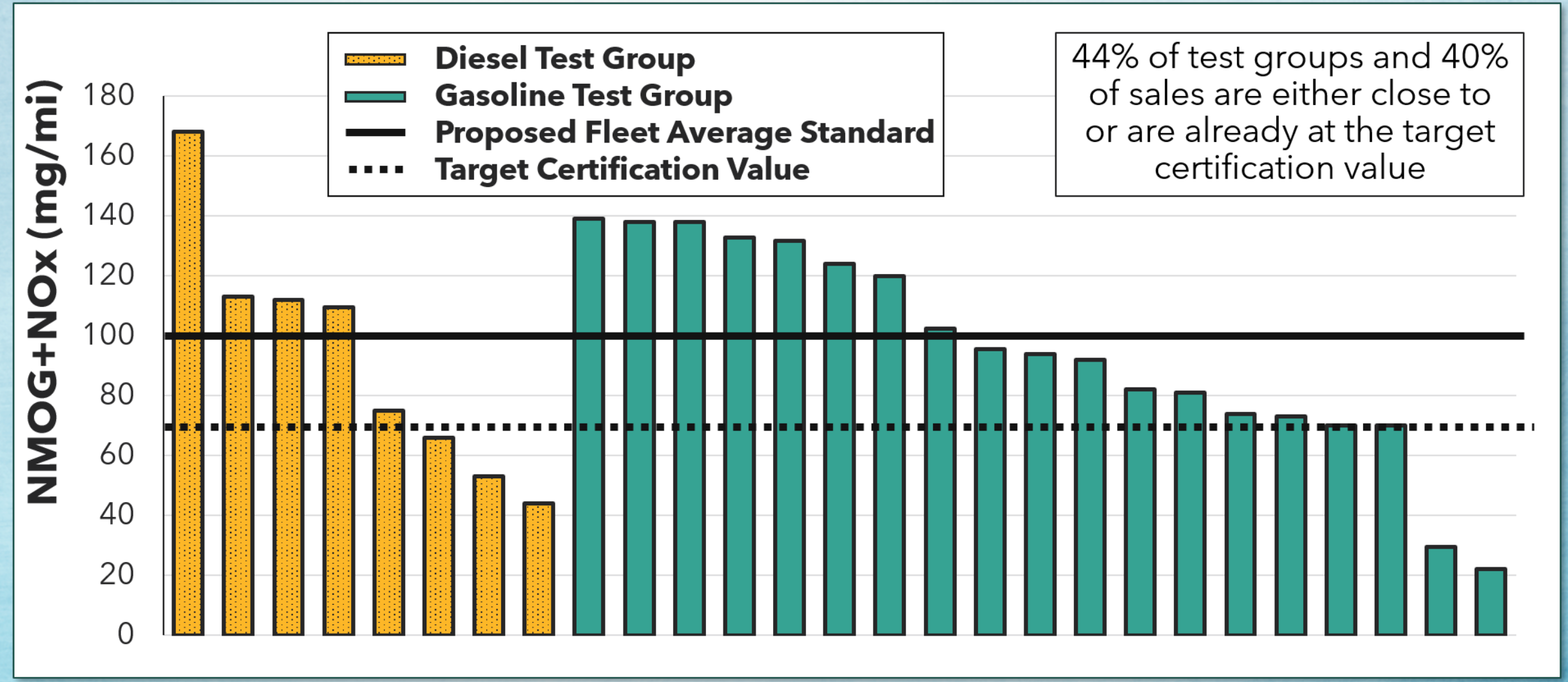
Prior Workshops

- Proposed MDV NMOG+NOx fleet average standards
  - 170 mg/mi in 2031 to 100 mg/mi by 2033
  - Including ZEVs in the fleet average
- Proposed new NMOG+NOx Bins
- Proposed SFTP standalone standards
- Proposed Moving Average Window (MAW) in-use standard

Today's Workshop

- Updated NMOG+NOx certification data for the MDV fleet

MDV NMOG+NOx emission levels consistent with Drive Forward are achievable



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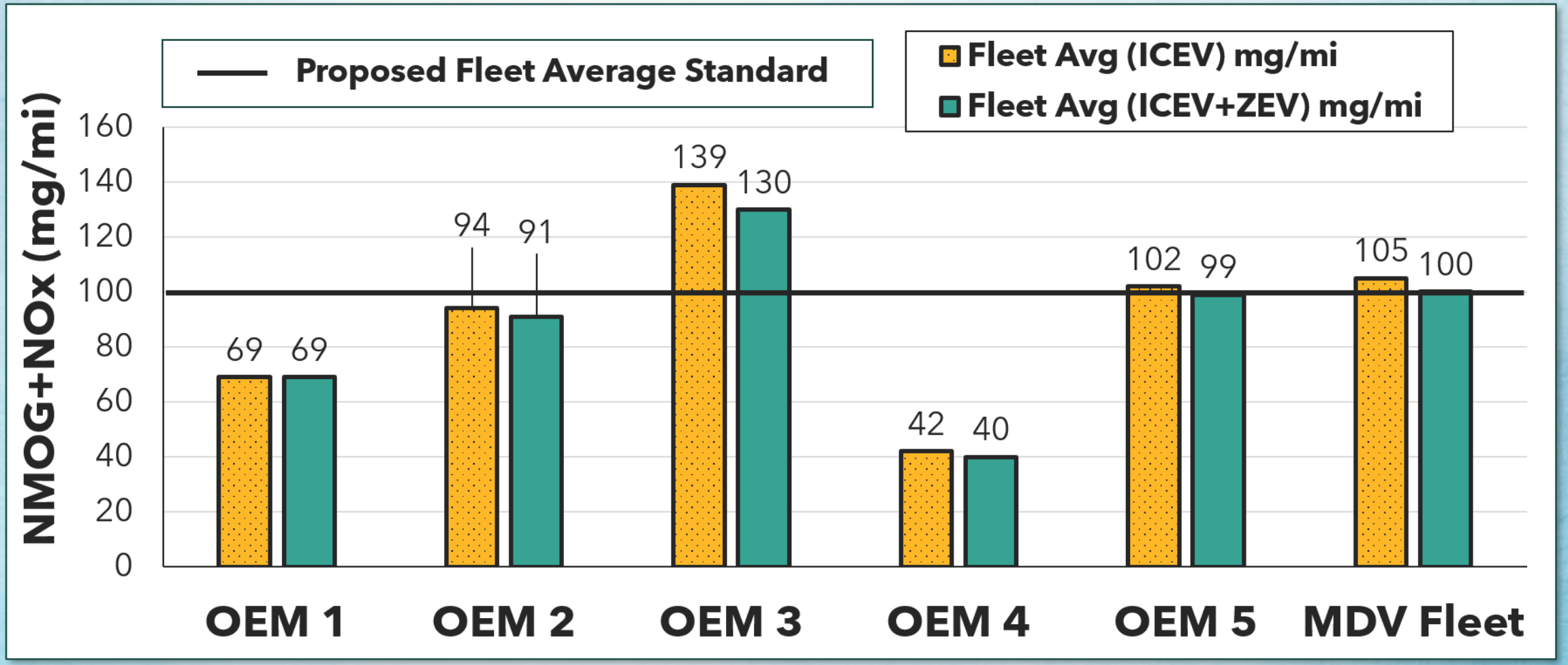
Proposed MDV Fleet Average Standards Can be Met With Minimal Technology Upgrades



*Calculated from MY2026 certification data and MY2025 sales data

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Proposed LDV and MDV PM Standards

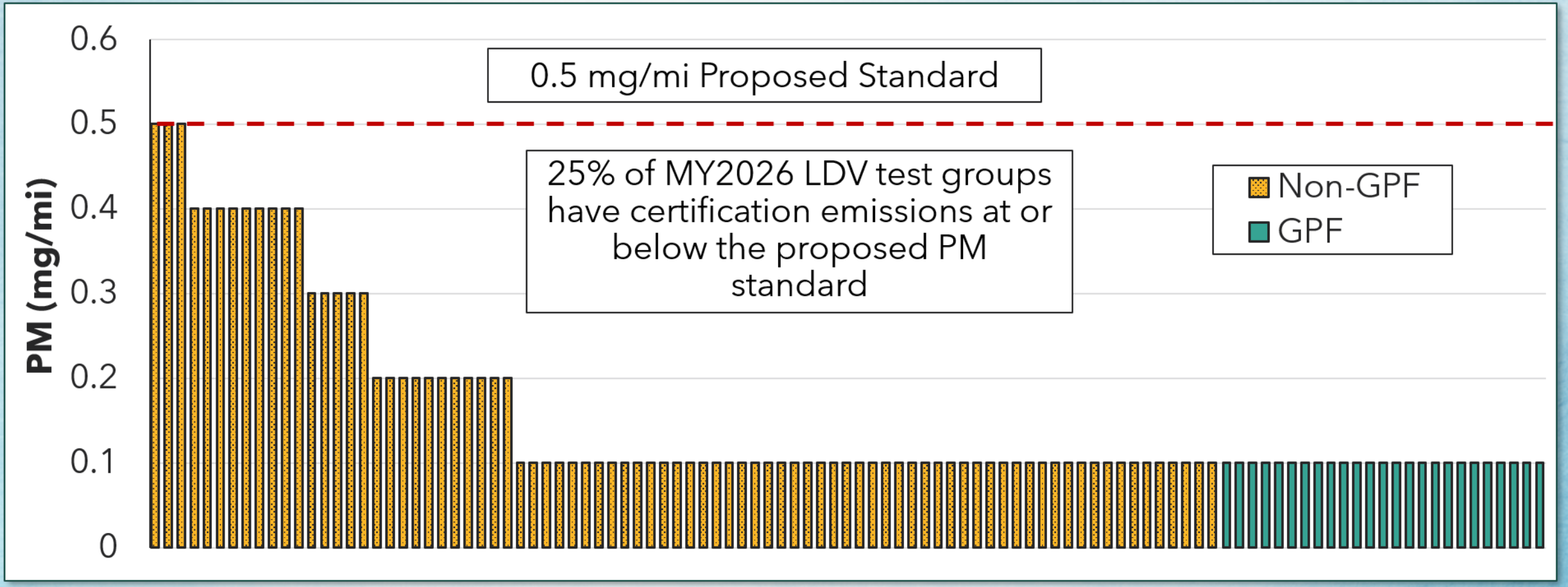
Prior Workshops

- Proposed 0.5 mg/mi PM standard for LDV and MDVs
  - FTP
  - Cold FTP
  - US06

Today's Workshop

- Updated PM certification data for the LDV fleet

Some vehicles designed to meet the 1 mg/mi standard emit below the proposed PM standard



CARB is seeking input on technical considerations for GPF adoption and test procedure modifications for measuring PM emissions at low levels.

Proposed Non-Exhaust Brake Wear PM Emission Standards for LDVs

Prior Workshops

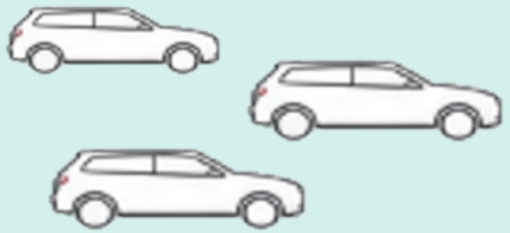
- Proposed Brake-Wear PM Standards
  - Non (or weak) regenerative braking: 11 mg/mile
  - Strong regenerative braking: 5 mg/mile
- Proposed a New Cycle Developed for California

Today's Workshop

- Provide additional details on the brake-wear PM emission testing requirements and procedures to meet the standards

Overview of Brake-Wear Testing Process

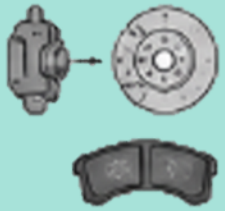
1 Vehicle Population



Vehicles with similar brake system characteristics

2 Brake Emissions Family

- Caliper
- Disc or Drum
- Friction Material
- Other Characteristics influencing emissions



Group vehicles into a brake emissions family

3 Select Worst-Performing Brake



One representative brake is selected to verify compliance.

4 Brake Dynamometer Test (Not Whole Vehicle Test)



PM_{10}(required)/ $PM_{2.5}$ (optional) Sampling

The brake assembly is tested on a brake dynamometer.

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Brake Emissions Family

- Vehicles with sufficiently similar brake-system characteristics can be grouped into a **brake emissions family.**
- Brake emissions families are defined in accordance with **United Nations Regulation No. 179 (UN R No.179)**.
- Family characteristics include, among other things:
  - Caliper
  - Disc or drum
  - Friction material
  - Other characteristics that may significantly influence brake emissions
- The **worst-performing representative** is selected for brake testing to demonstrate compliance.
- The brake emissions family can include vehicles with different levels of electrification, provided they meet the applicable family criteria.
- Testing is performed for each brake emissions family.

Accounting for Regenerative Braking

- Friction-braking share is used to account for regenerative braking.
  - Electrified vehicles may use **regenerative braking in addition to friction braking**.
  - The brake dynamometer test measures emissions from the friction brake.
  - A friction-braking share coefficient (C-factor) is used to translate the brake-dynamometer result to the vehicle's applicable brake-emission contribution.
- UN R No. 179 provides **default friction-braking share coefficients (C-factors)** for applicable vehicle categories.
- Alternatively, manufacturers may determine a vehicle-specific friction braking share coefficient using the **Annex 5 methodology of UN R No. 179.**

Seeking Input, Data, and Collaboration Opportunities

- Friction-brake sharing coefficient (C-factor) across different levels of hybridization
- Number of different brake emissions family
- Lead-time and cost considerations for test facility upgrades
- Developing certification requirements for the brake-wear PM emissions standard:
  - Compliance-demonstration approach
  - Enforcement framework
- Exploring alternative methods for brake-wear PM emissions testing
- Opportunities for industry collaboration through the newly formed SAE task force on brake-wear emissions

Proposed Evaporative Emissions Requirements

Prior Workshops

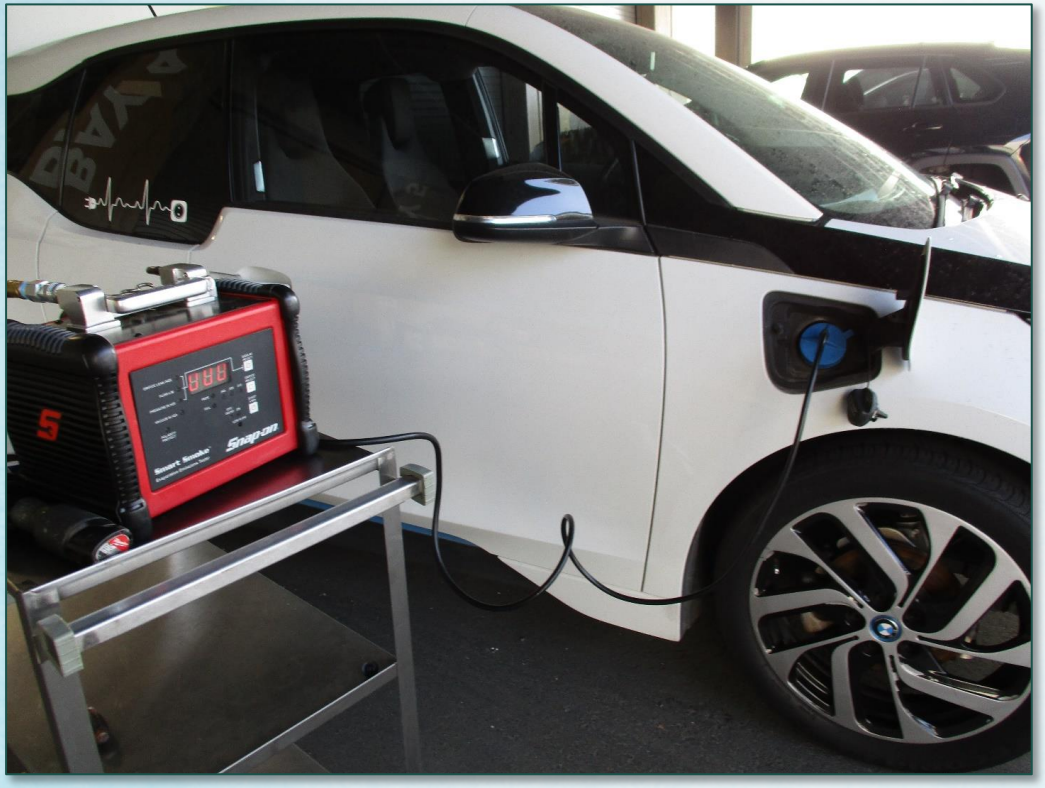
- Proposed 0.001 NIRCOS fuel system in-use leak standard
  - Off board equipment measurement (not OBD)
- E15 fuel attestation
- Additional evaporative emissions requirements (running loss, canister size, test procedures updates, etc.)

Today's Workshop

- Provide details on 2 options for meeting NIRCOS fuel system in-use leak standards

In-Use Leak Testing Option 1

Use leak-detection equipment that displays leak size directly





NIRCOS = Non-integrated refueling canister-only systems

In-Use Leak Testing Option 2

- Use leak check equipment of your choice, meeting Code of Federal Regulations (CFR)1066.985.
- Measure pressure and flow, then apply the existing CFR1066.985 equation to yield leak size.
- Allows the use of more widely available equipment.

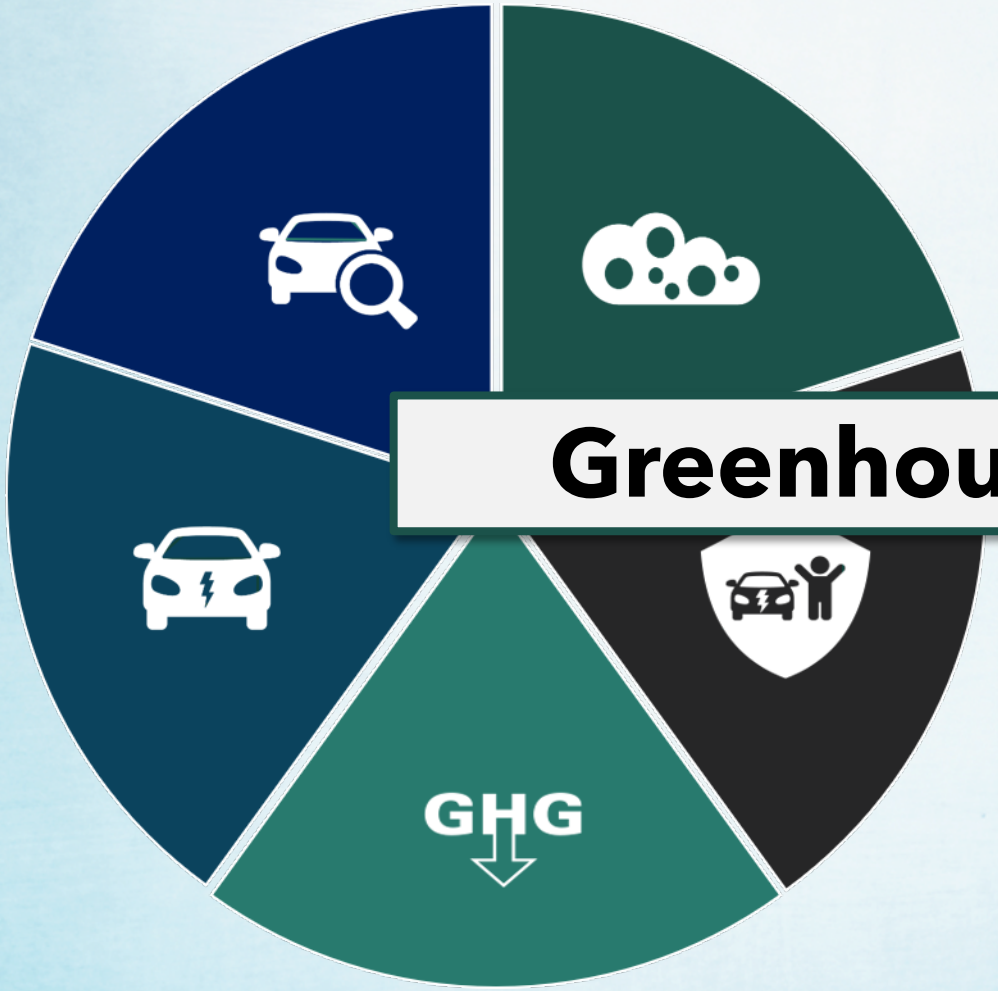


NIRCOS = Non-integrated refueling canister-only systems

Criteria air pollutant standards Q&A



Email questions to the **Clean Cars** email box



Greenhouse gas standards

Proposed Light-Duty GHG Fleet Average Standards

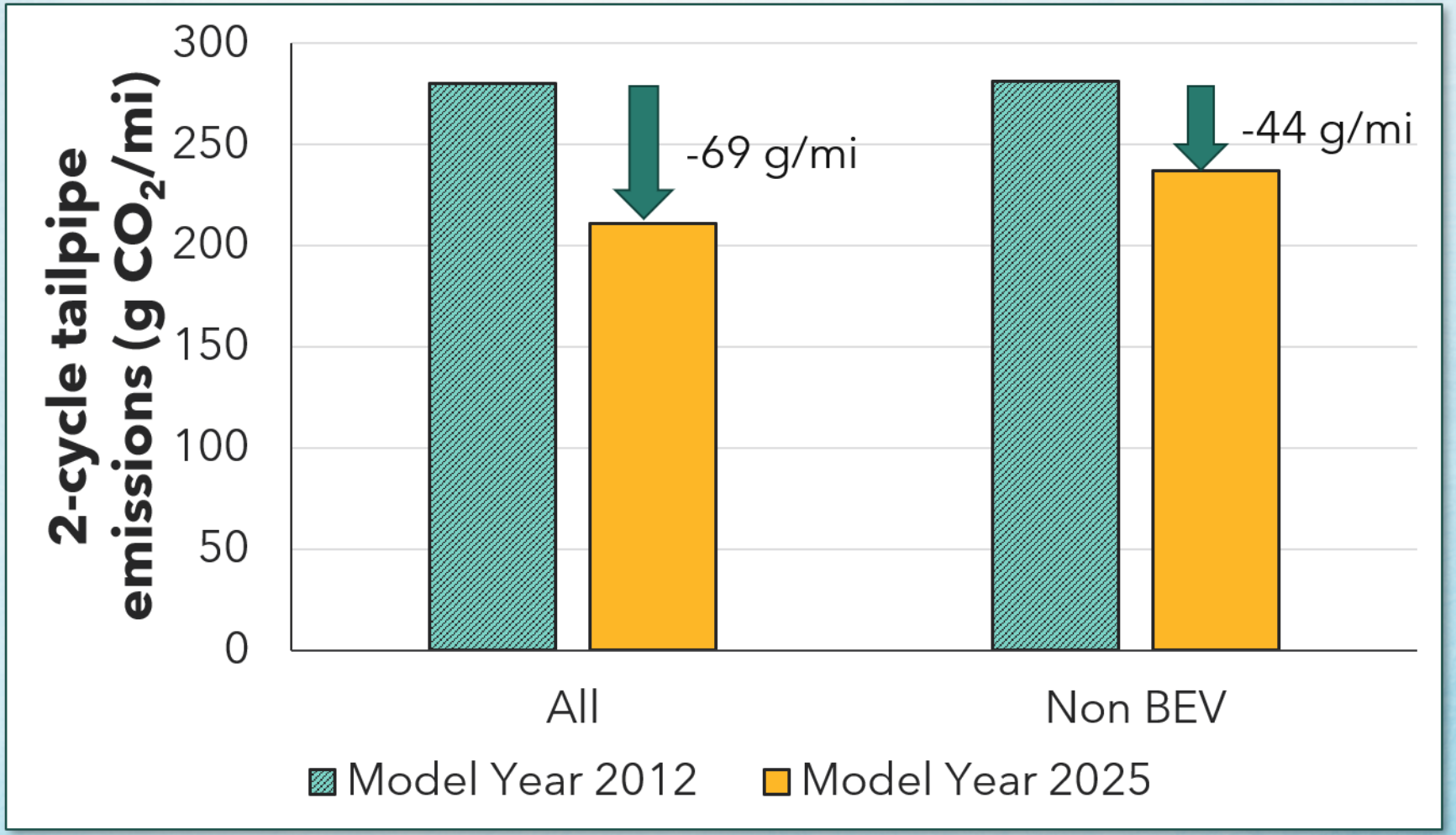
Prior Workshops

- Proposed fleet average GHG standards
  - Projected 80 g/mi in 2038 model year
  - Remove off-cycle credits, and ZEV A/C credits
  - Eliminate upstream emissions factors
- Sought input on proposed standards and plug-in hybrid (PHEV) treatment

Today's Workshop

- Analysis of compliance and market trends
  - Potential of hybrids and PHEVs
- GHG program design changes to maintain flexibility while securing durable emissions reductions
- PHEV treatment proposal

Industry has progressed in reducing greenhouse gas emissions

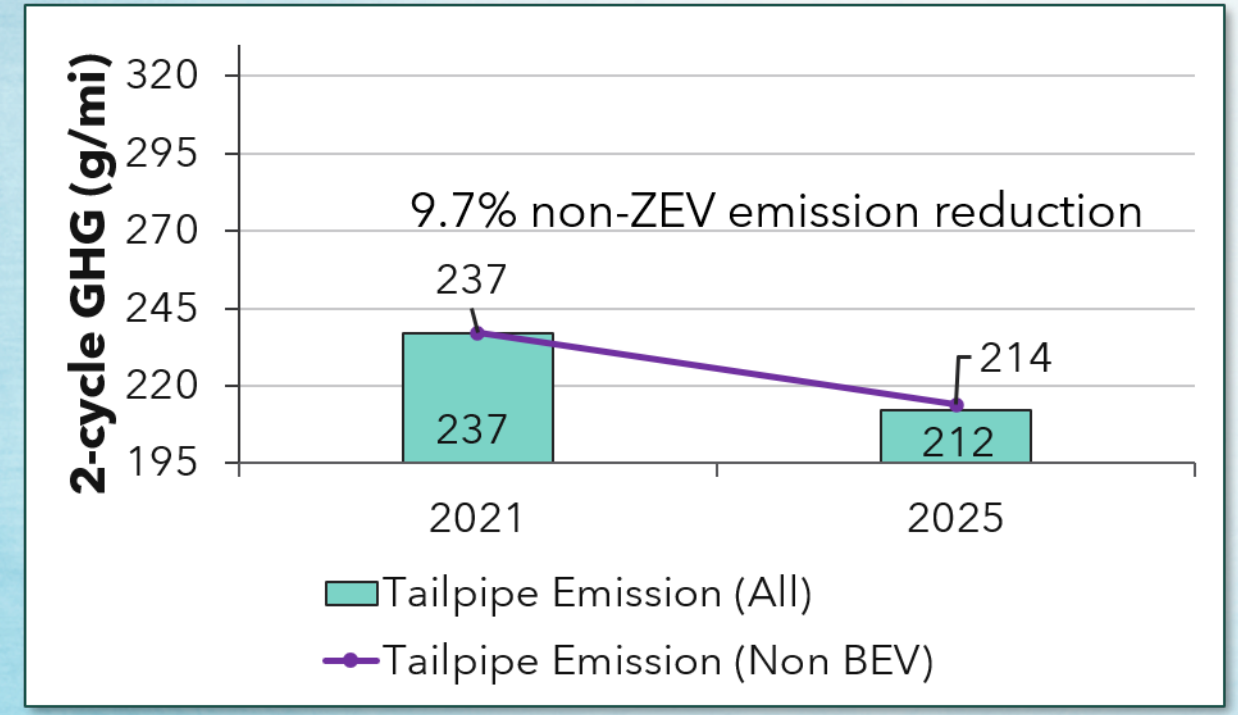


Automakers have used many technologies to reduce GHG emissions

Automaker A (10.5% overall reduction)

ZEV share

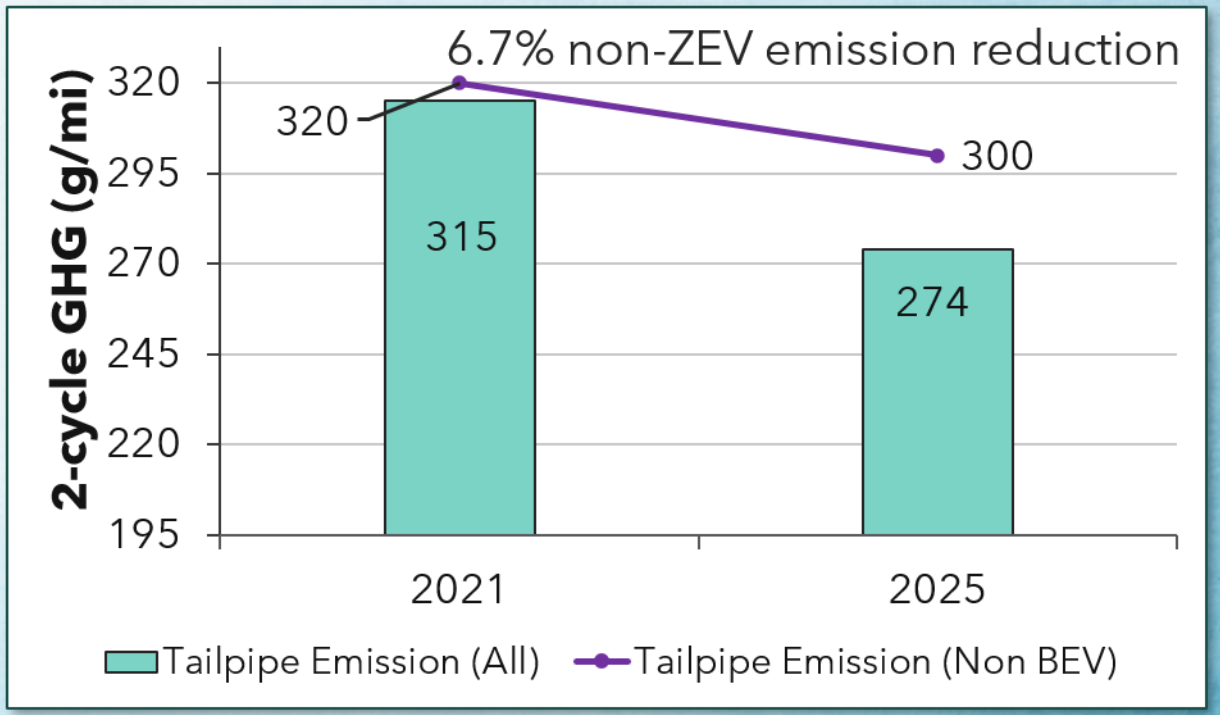
0% → 1%



Automaker B (13% overall reduction)

ZEV share

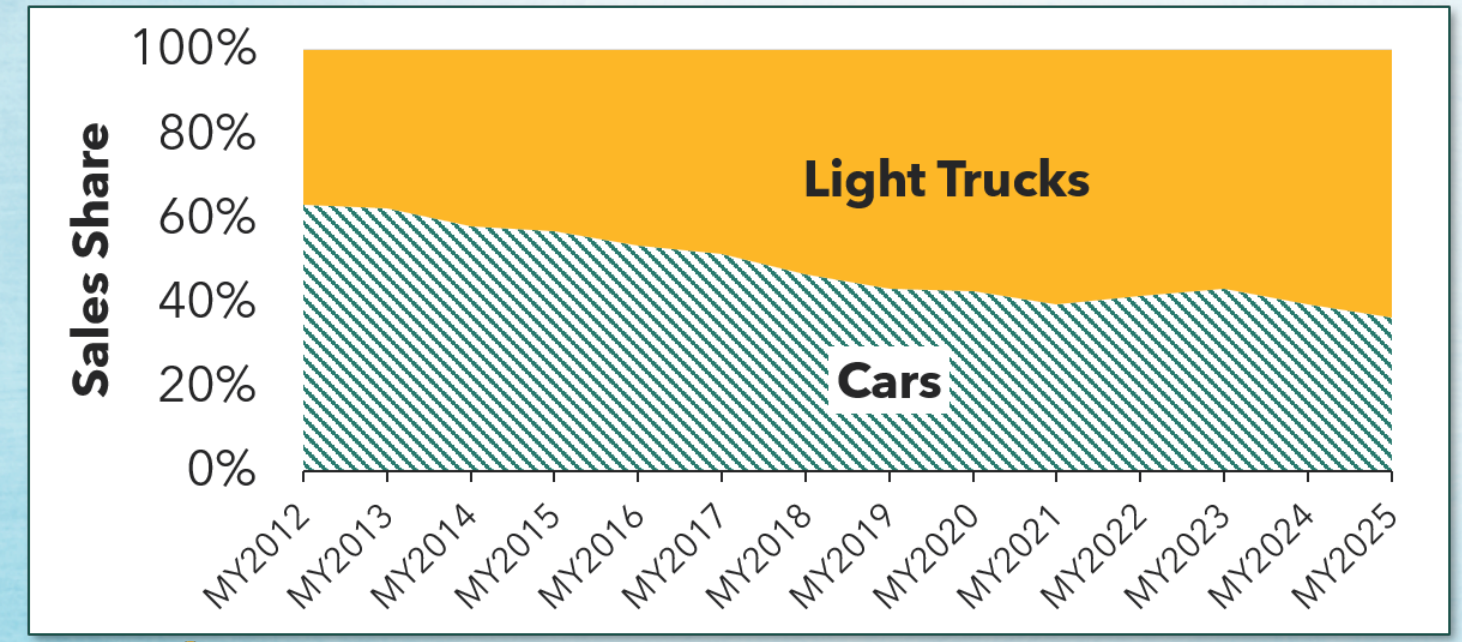
1.5% → 9%



Despite progress, GHG emissions are higher than expected

2025	Car Share	Car Emissions	Truck Emissions	Combined Emissions
Projected	63%	145 (45.6 ft²)	200 (52.5 ft²)	165 (48.2 ft²)
Actual	36%	132 (47.6 ft²)	218 (52.9 ft²)	188 (51.0 ft²)

+23 g/mi (+14%)



Factors leading to higher GHG emissions:

- Footprint growth
- Shift to trucks
- Extensive use of compliance credits
- Broad use of technology credits (addressed in previous workshop)

Potential design elements to strengthen the GHG program

- Remove all off-cycle credits and ZEV A/C efficiency & leakage credits
  - Discussed in previous workshop

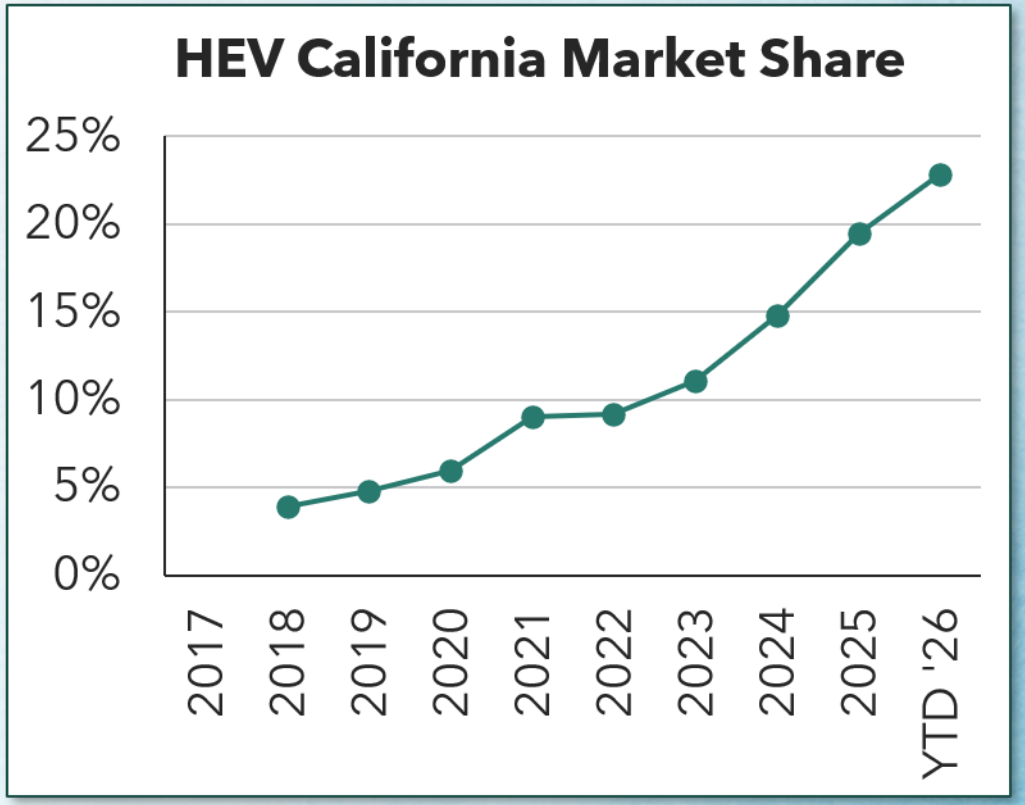
- Require credit deficit be fulfilled in three model years instead of five
  - Increases likelihood of improvements in tailpipe emissions

- Update light truck definition & maintain separate curves
- Adopt a single footprint curve for all light-duty vehicles
  - Removes the incentive to classify vehicles as trucks
  - Simplifies the regulation; aligns with criteria fleet average standards
  - Increases likelihood of lasting reductions in tailpipe GHG emissions

Strong hybrids (HEVs) are more popular than ever, and growing

- HEVs reached 23% market share so far in 2026
  - Highest level ever for HEVs

- HEV market poised for continued growth
  - Like plug-ins, HEVs help owners save on fuel, which is experiencing high and volatile pricing
  - Many models have gone "hybrid only," and automakers have announced several more; collectively nearly 30% of vehicles (33% of non-plugins)
  - Automakers also announcing new HEV models within 1-5 model years



Source: CNCDA California Auto Outlook, October 2026

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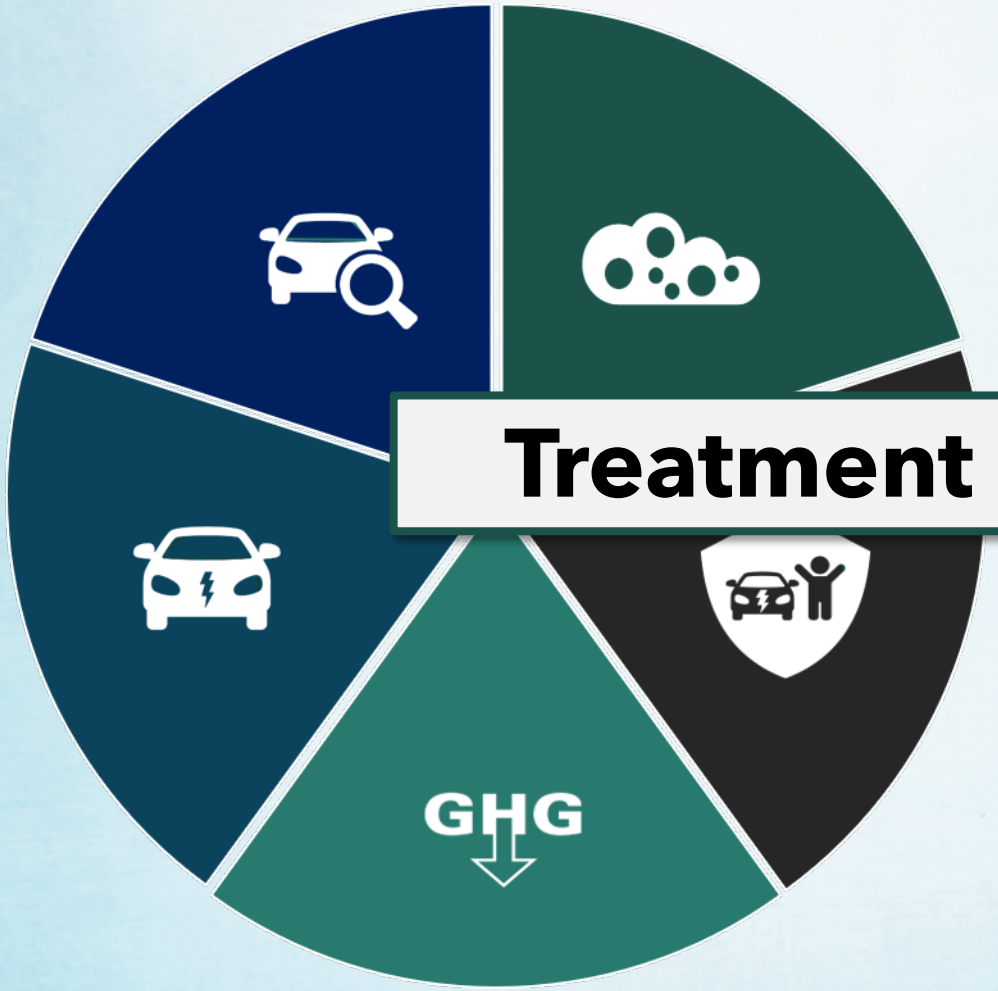
HEVs have major GHG benefits, and opportunities for more

- HEVs offer major GHG benefits today
  - HEVs reduce GHG by 25%-35% vs non-HEV counterparts
  - Many models are still not offered as hybrid, nor are standard as hybrid

- HEVs can further reduce GHG over next 10-12 years:
  - Lighter, more energy dense batteries
  - Improved and more powerful motors and inverters
  - Dedicated/Optimized HEV engine (overexpansion cycles, operation near peak efficiency)

Seeking Input

- Data sources of technologies that reduce GHG emissions of HEVs, non-hybrid vehicles, and PHEVs
  - Current and future costs of those technologies
- Combining all light-duty vehicles in a single footprint curve
- Modifying vehicle definitions
- Limiting deficit carryforward to 3 model years, or other changes to credit averaging, banking, and trading
- Other changes that strengthen the efficacy of the GHG program



Treatment of plug-in hybrids

PHEV market is ready for major changes

- PHEV market poised for significant change
  - Like ZEVs, PHEVs help owners save on fuel, *especially if owners plug in*
  - Automakers have announced 21 upcoming new PHEV models through 2028
    - Many expected to have longer all-electric range and greater electric capabilities than today's PHEVs

- PHEVs offer major GHG & criteria emissions benefits and opportunities
  - PHEVs that are routinely charged can reduce emissions by >50% vs non-HEV counterparts
  - Large PHEV batteries enable deeper emissions reduction opportunities from the same technological improvements available to non-plugin HEVs

- New treatment of PHEVs will encourage better electric capabilities and secure greater emissions reductions

PHEV emissions background

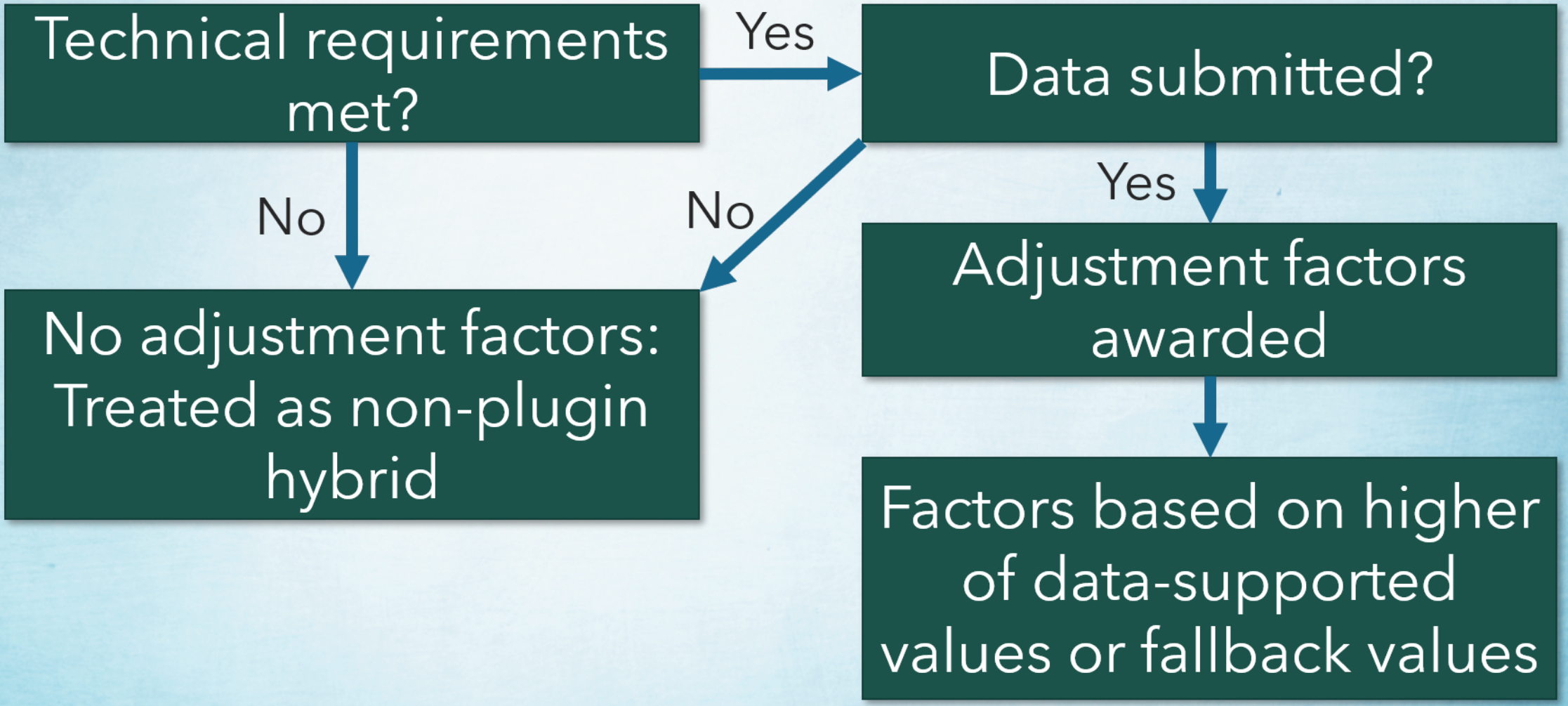
Emissions Profile

- GHG emissions are primarily from driving with the engine
- Tailpipe NMOG+NOx emissions come primarily from engine starts, and secondarily from engine-on miles
- Charge-depleting mode can contribute emissions from engine operation

Impact of Charging

- *Regular recharging is critical for minimizing real-world emissions*
- Reliance on consumer charging behavior creates inherent risk/uncertainty in emissions from PHEVs.
- CARB's responsibility is to protect public health and the climate
  → this inherent risk necessitates a conservative approach

Overview of Proposed PHEV adjustment factors



Other requirements for alternative treatment of PHEVs in fleet averages

To receive UF or CF, PHEV must meet the following requirements

Technical Specification	Requirement
Minimum All-Electric Range	None
Inlet Standardization	J3400, adapter if other, carryover allowed
Convenience Cord	Included with purchase
Battery Warranty	75% state-of-health (SOH), 8y/100k mi
Data Standardization	Yes, incl. SOH and Charging if DC capable
Battery Labeling	Yes, same as ZEV certification requirements
All-electric capable HVAC	Yes
SULEV30 maximum (CS mode)	Yes
Prohibit driver-selectable mode	Yes

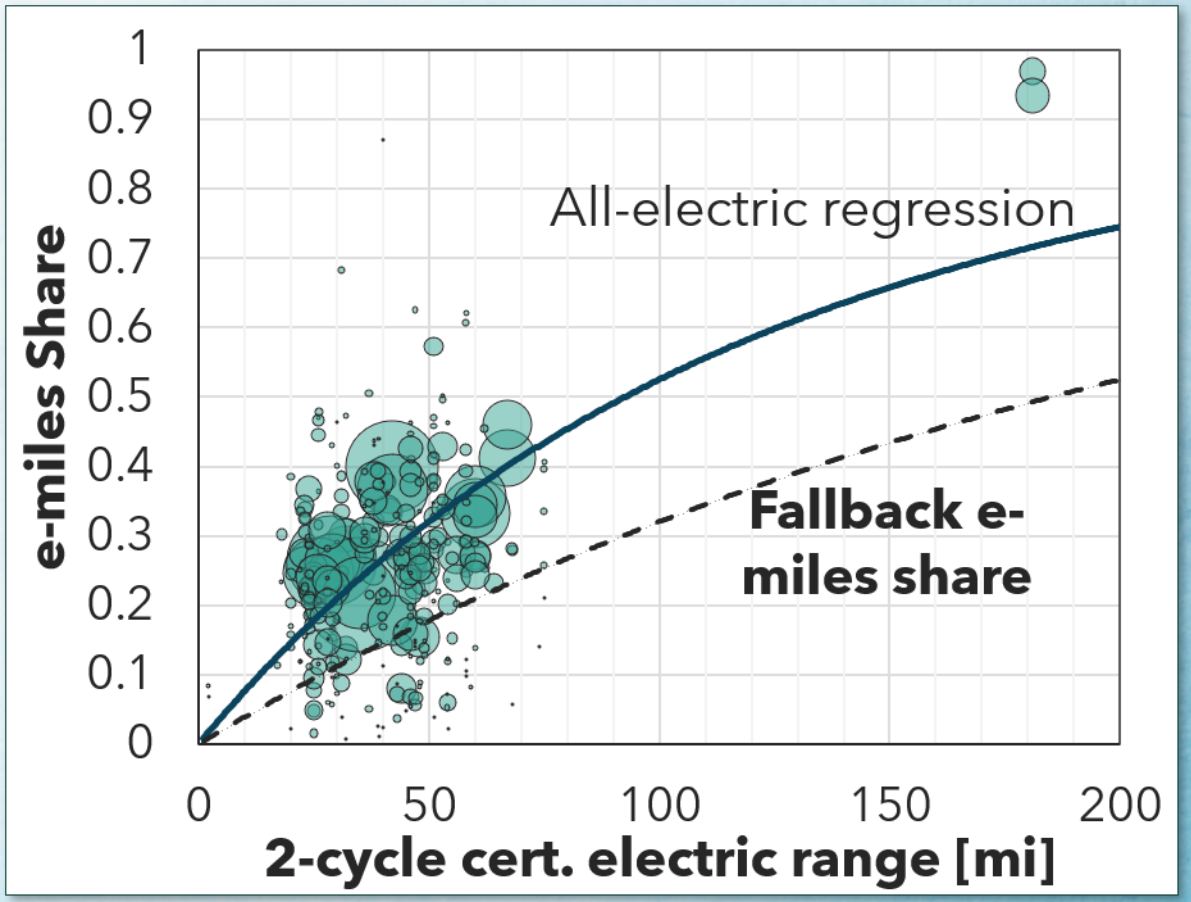
Proposal for PHEV GHG Adjustment Factor: Fleet Utility Factor (FUF)

Data-based FUF:
- Real-world e-miles share
- Electric miles ÷ total miles

Fallback FUF:
- Determined by curve (dashed line)
- Relies on 2-cycle electric range

FUF will be the higher of:
A. Data-based e-miles share
B. Fallback e-miles share

FUF will be based upon all-electric range and mileage



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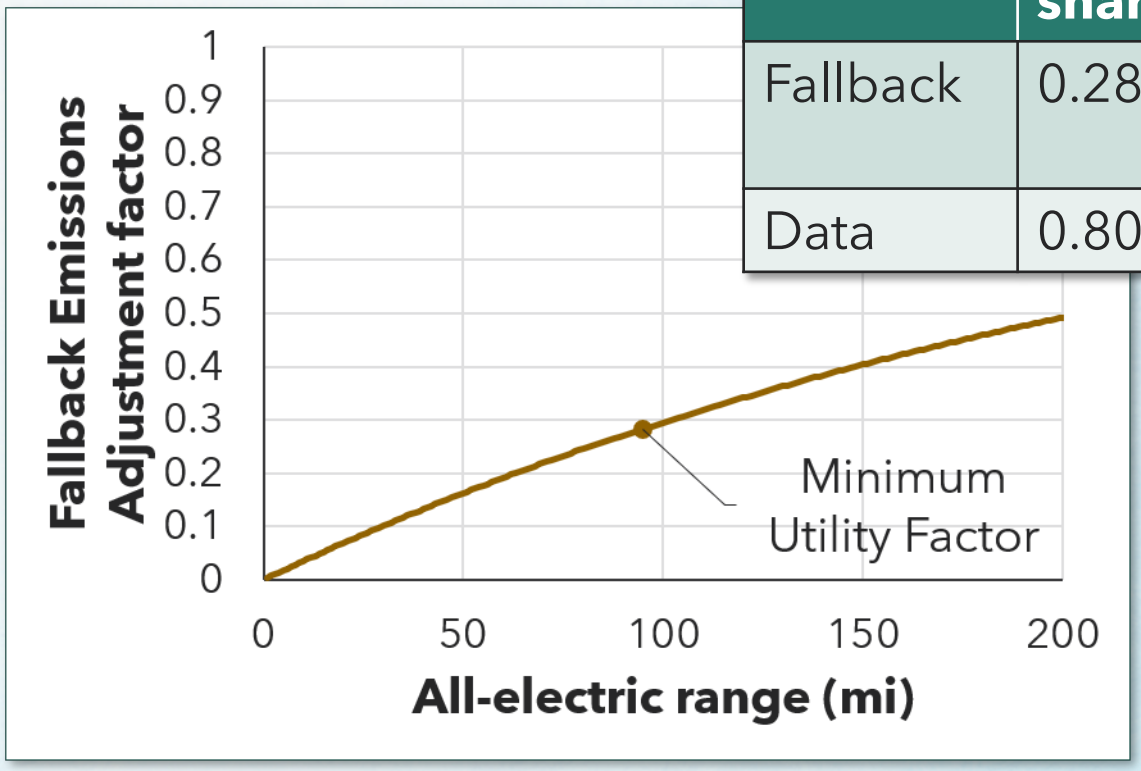
Example: Long-range PHEV → GHG

Cert. Range
95 miles, combined, electric only

Charge sustaining emissions
180 g CO_2/mi, 2-cycle



	E-miles share	Compliance Value
Fallback	0.283	129 g CO_2/mi
Data	0.800	36 g CO_2/mi

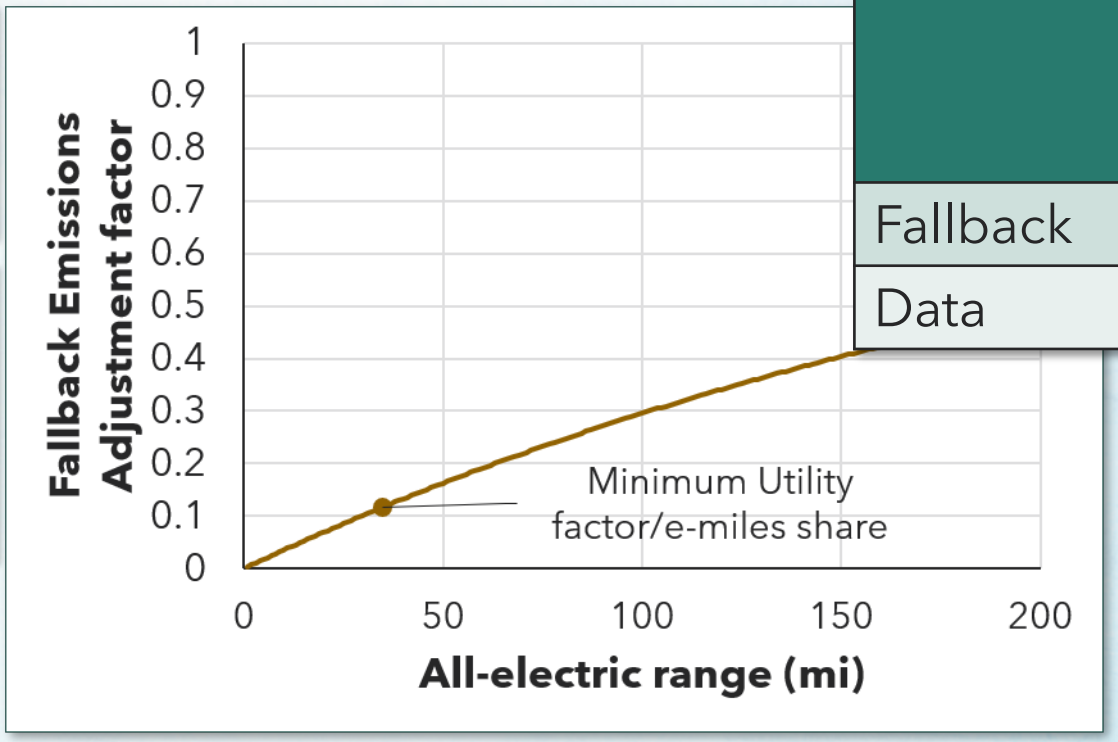
Adjustment factor	Compliance calculation
UF (defined by e-miles share)	GHG = CS emissions * (1-UF)

CARB

Example: Short-Range PHEV → GHG

Cert. Range
35 miles, combined, electric only

Charge sustaining emissions
180 g CO_2/mi, 2-cycle



	E-miles share	Compliance Value
Fallback	0.117	159 g CO_2/mi
Data	0.098	Fallback used

Adjustment factor	Compliance calculation
UF (defined by e-miles share)	GHG = CS emissions * (1-UF)

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Proposal for PHEV NMOG+NOx Adjustment Factor: Contribution Factor (CF)

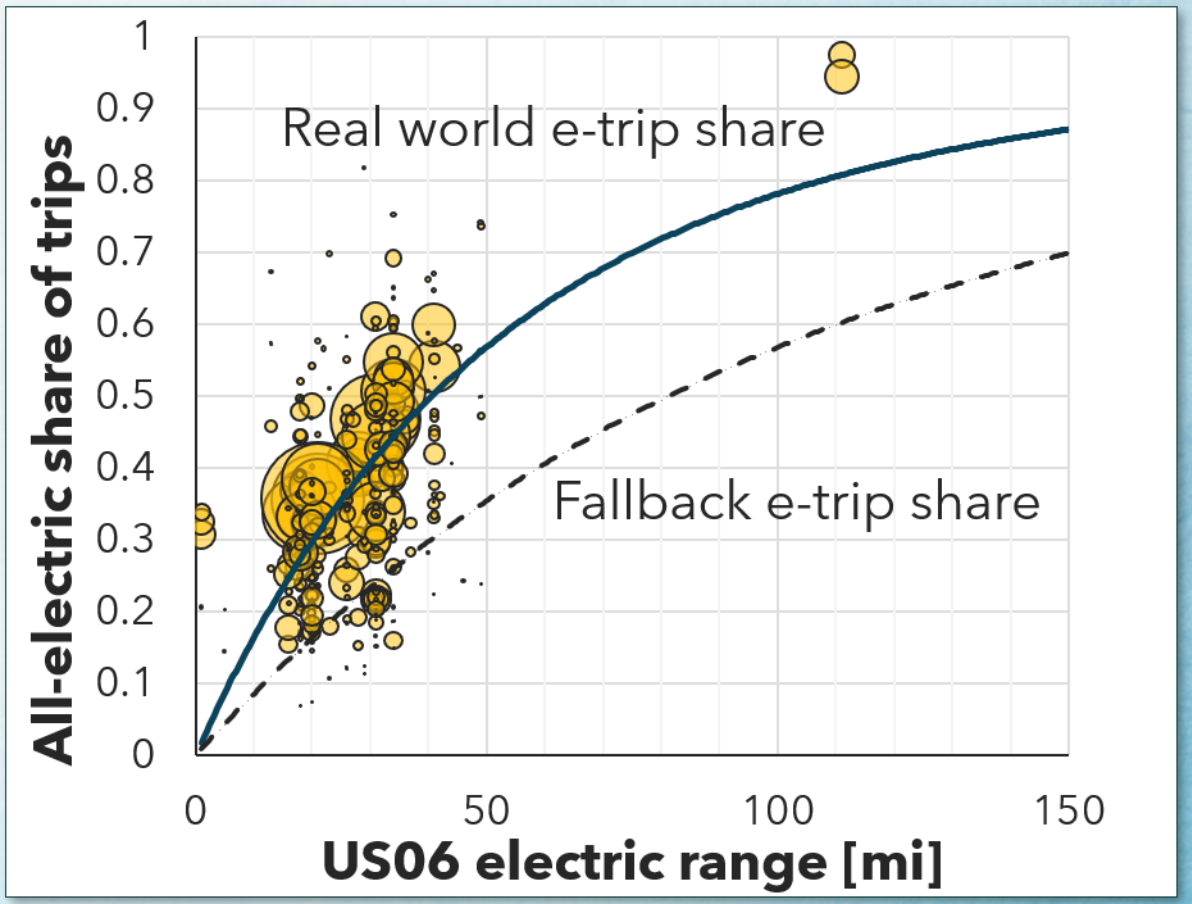
- Proposed CF comprised of two factors:
  - E-trip share: electric trips ÷ total trips
  - E-miles share (same as for GHG)
- Values are the larger of data-based, or fallback

Fallback Values:

- Determined by curve (dashed line)
- E-trips based on US06 electric range
- E-miles based on 2-cycle all-electric range

Fleet Contribution Factor:

$$20\% * e_miles\ share + 80\% * e_trip\ share$$



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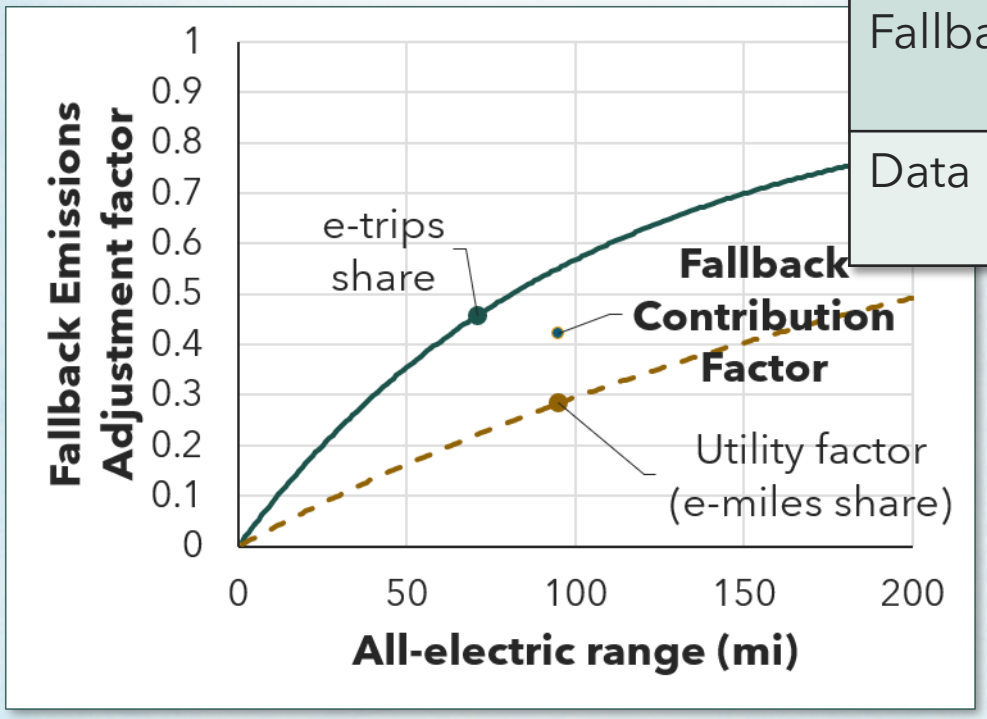
Example: Long-range PHEV → NMOG+NOx

Cert. Range
95 miles, combined, electric only
71 miles, US06, electric only

Cert. charge sustaining emissions
Bin 20



	Electric Share	Contribution factor	Compliance Value
Fallback	Trips: 0.457 Miles: 0.283	0.422	11.6 mg/mi
Data	Trips: 0.900 Miles: 0.800	0.880	2.4 mg/mi

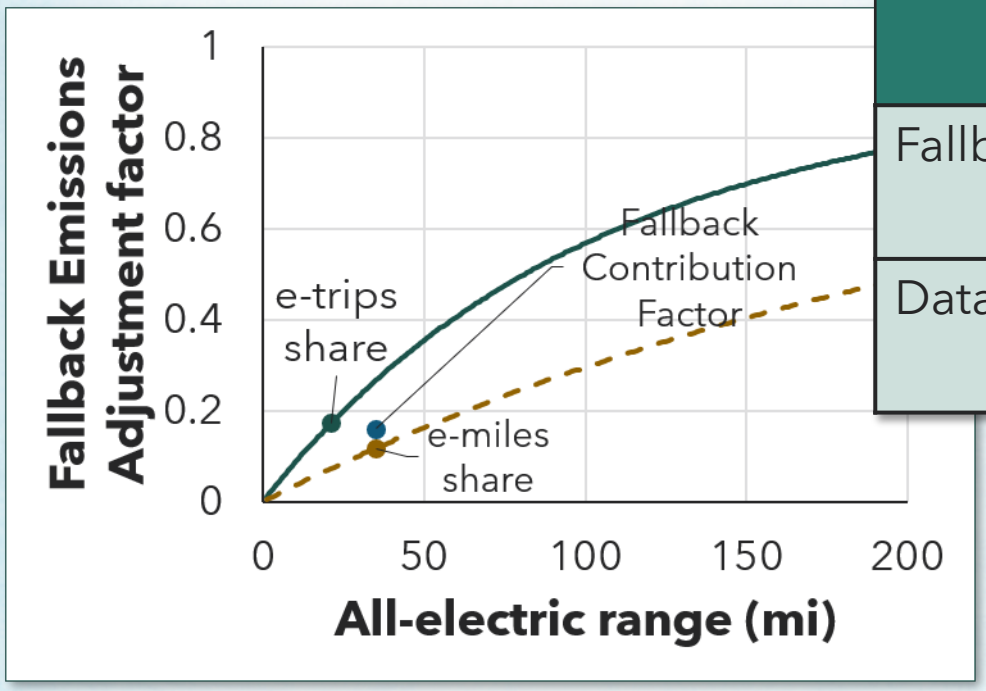
Adjustment factor	Compliance calculation
CF = e-miles * 20% + e-trips * 80%	NMOG+NOx = bin * (1-CF)

CARB

Example: Short-Range PHEV → NMOG+NOx

Cert. Range
35 miles, combined, electric only
21 miles, US06, electric only

Cert. charge sustaining emissions
Bin 20



	Electric Share
Fallback	Trips: 0.171
	Miles: 0.117
Data	Trips: 0.200
	Miles: 0.098

Contribution Factor
0.183

Adjustment factor	Compliance calculation
CF = e-miles * 20% + e-trips * 80%	NMOG+NOx = bin * (1-CF)

Compliance Value
16.3 mg/mi

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Data submission requirements

Data content (parameters listed in SAE J1979 Digital Annex)

- UF: lifetime all-electric miles, charge-depleting mode miles, total miles
- CF: same as above plus fueled engine operation ignition counter, propulsion system active counter

Data Sample

- Per-vehicle and summed across model/test group
- At least 85% of vehicles sold within model/test group
- No mileage minimum

Timing

- Final certification application part 2 for data submission
- Up to 7-year carryback/lookback allowed, provided cumulative data is submitted for each lookback year
  - If carryover, must include data accumulated each year

Example: MY34/35 PHEV

Calendar Year	2033	2034	2035	2036
MY 2034		MY34 vehicles	*	
MY 2035 (new)			MY35 vehicles	*

Calendar Year	2033	2034	2035	2036
MY2035 (carryover)	MY33 vehicles	MY34 vehicles	MY35 vehicles	*

Shaded Data collection period

* Data submission deadline (May 1)

CARB

Seeking Input

- Utility factor (data & calculation)
- Contribution factor (data & calculation)
  - E-miles share
  - E-trips share
- Data submission requirements & timing
- Ensuring durability of PHEV emissions reduction
- All other requirements

Greenhouse gas standards & Treatment of plug-in hybrids Q&A

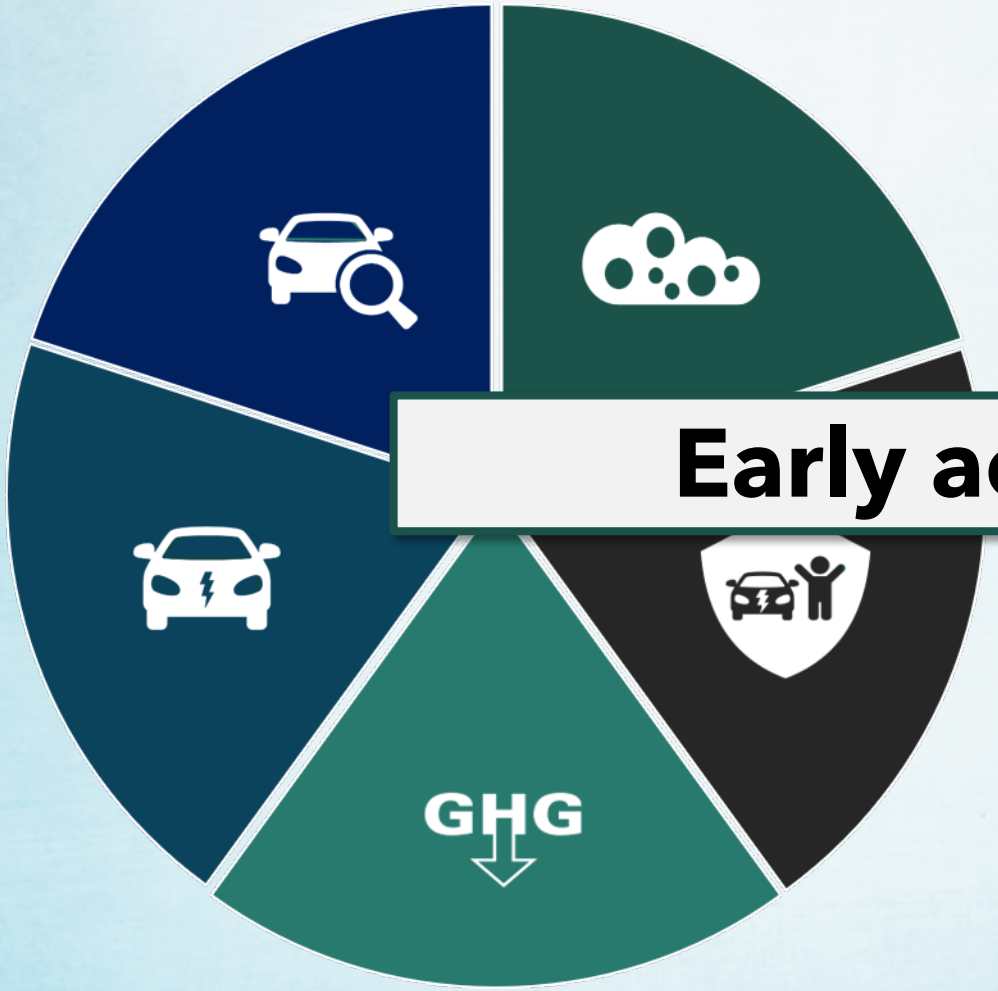


cleancars@arb.ca.gov

Email questions to the **Clean Cars** email box



Break: 10 minutes



Early action concepts

Voluntary Early Action Crediting Supports Multiple Goals



Encourage reductions prior to new standards



Incentivize early Drive Forward certification



Recognize voluntary ACC II activity

Manufacturers would be able to generate five types of voluntary early action credits

Drive Forward Early NMOG+NOx (LDV and MDV)

Drive Forward Early GHG

Drive Forward Early ZEV

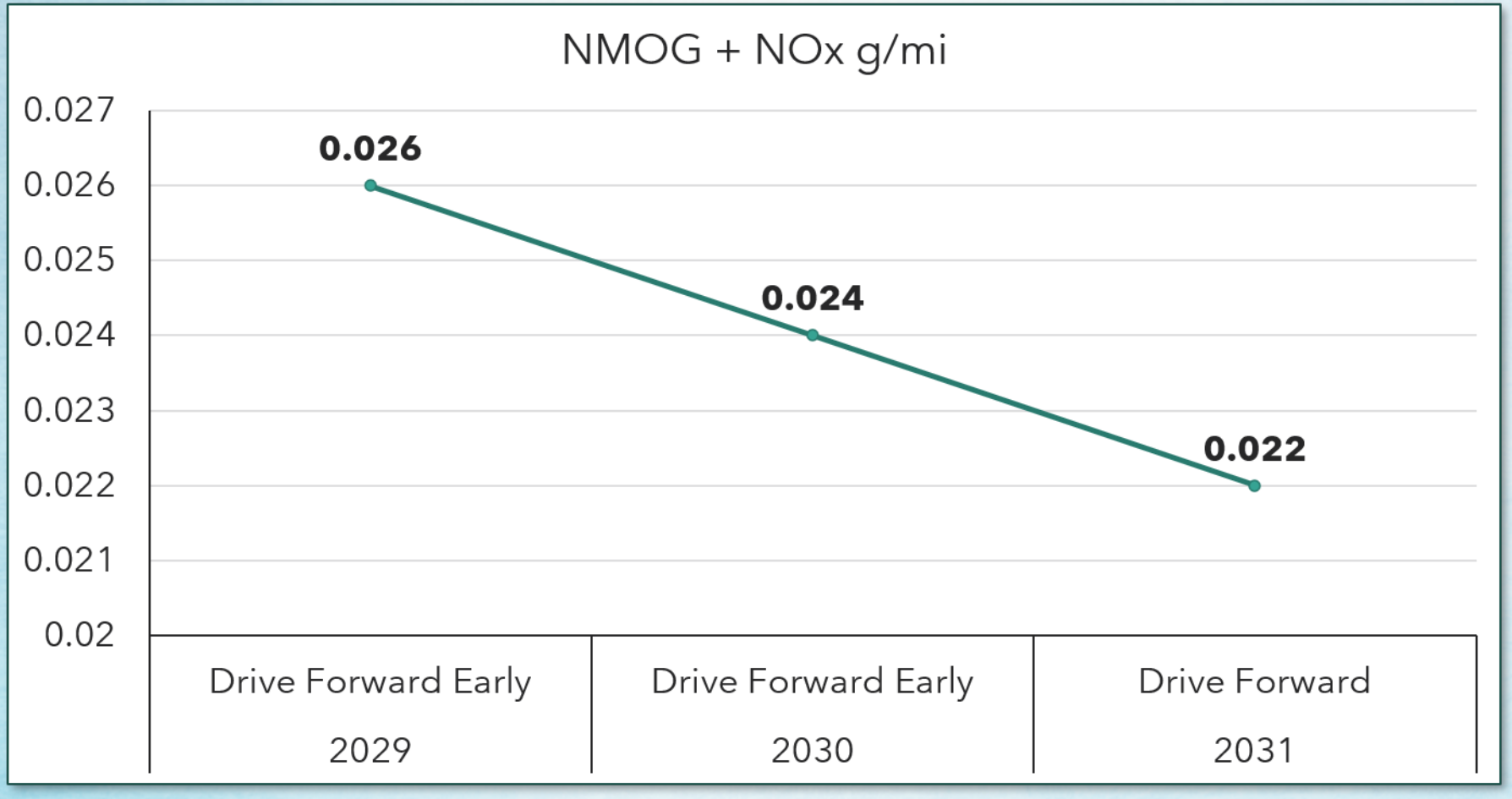
Based on voluntary early certification to Drive Forward standards beginning in 2029 MY

Voluntary ACC II ZEV Vehicle Values

Voluntary LEV IV Certification

Based on voluntary activities prior to 2029 MY

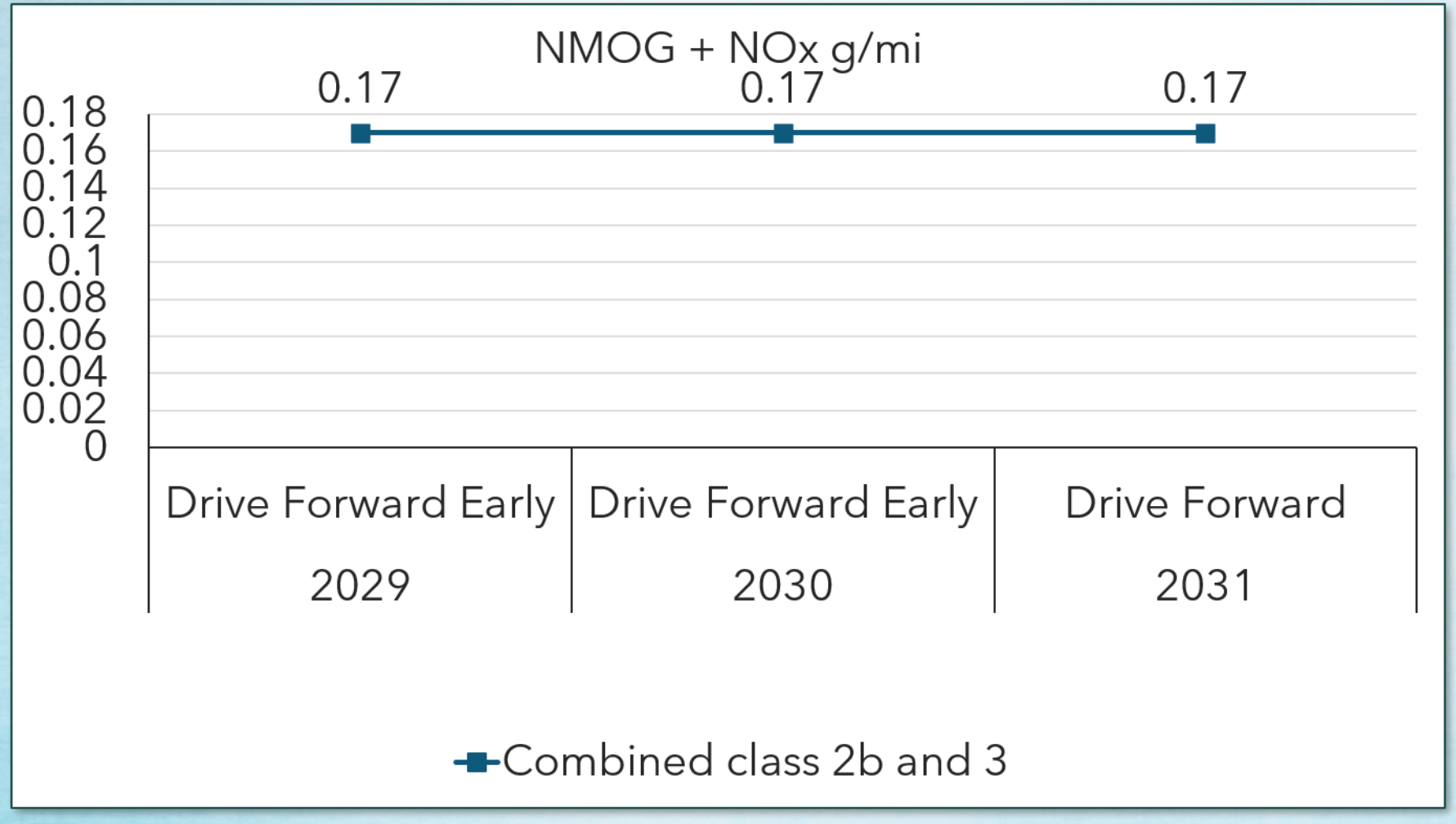
Drive Forward Early NMOG+NOx Preliminary Proposal



Overview

- Available to OEMs that voluntarily certify all test groups in the given early MY to Drive Forward
- Based on fleet average without use of banked or traded credits
- Usable for Drive Forward LDV NMOG+NOx compliance
- 5-year credit life

Drive Forward Early MDV NMOG+NOx Preliminary Proposal



Overview

- Available to OEMs that voluntarily certify all test groups in the given early MY to Drive Forward
- Based on fleet average without use of banked or traded credits
- Usable for Drive Forward MDV NMOG+NOx compliance
- 5-year credit life

Drive Forward Early GHG Preliminary Proposal

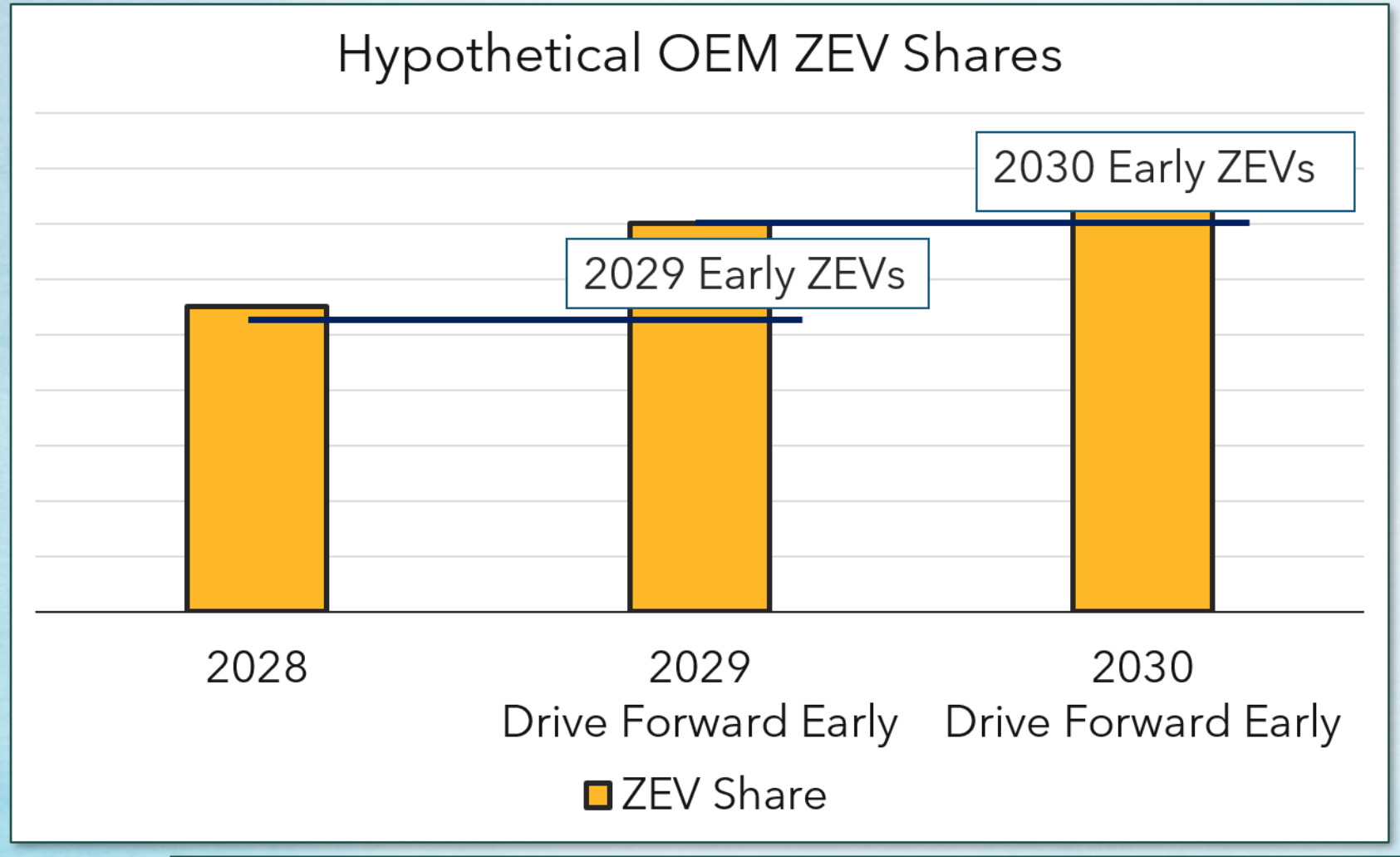
		Car		Truck	
Model Year	**Program**	**Slope**	**Intercept**	**Slope**	**Intercept**
2029	Drive Forward Early	.54	110.3	2.58	36.9
2030	Drive Forward Early	.54	101.3	2.58	26.9
2031	Drive Forward	.54	91.3	2.58	16.9

10 g/mi

10 g/mi

- Available to OEMs that voluntarily certify all test groups in the given early MY to Drive Forward
- Based on fleet average without use of banked or traded credits
- Usable for Drive Forward GHG compliance
- 5-year credit life

Drive Forward Early ZEV Preliminary Proposal



Overview

- Available only for legacy OEMs that voluntarily certify all test groups in the given early MY to Drive Forward
- Usable for compliance with ZEV minimum
- 1 compliance instrument per incremental ZEV
- 5-year credit life

Seeking input on:

- Potential inclusion of ZEV-only OEMs in Early ZEV if ZEV sales fall below certain levels

2029 Incremental ZEVs = (2029 MY ZEV Share – 2028 MY ZEV Share) * 2029 MY Total Sales

ACC II ZEV Vehicle Values Background

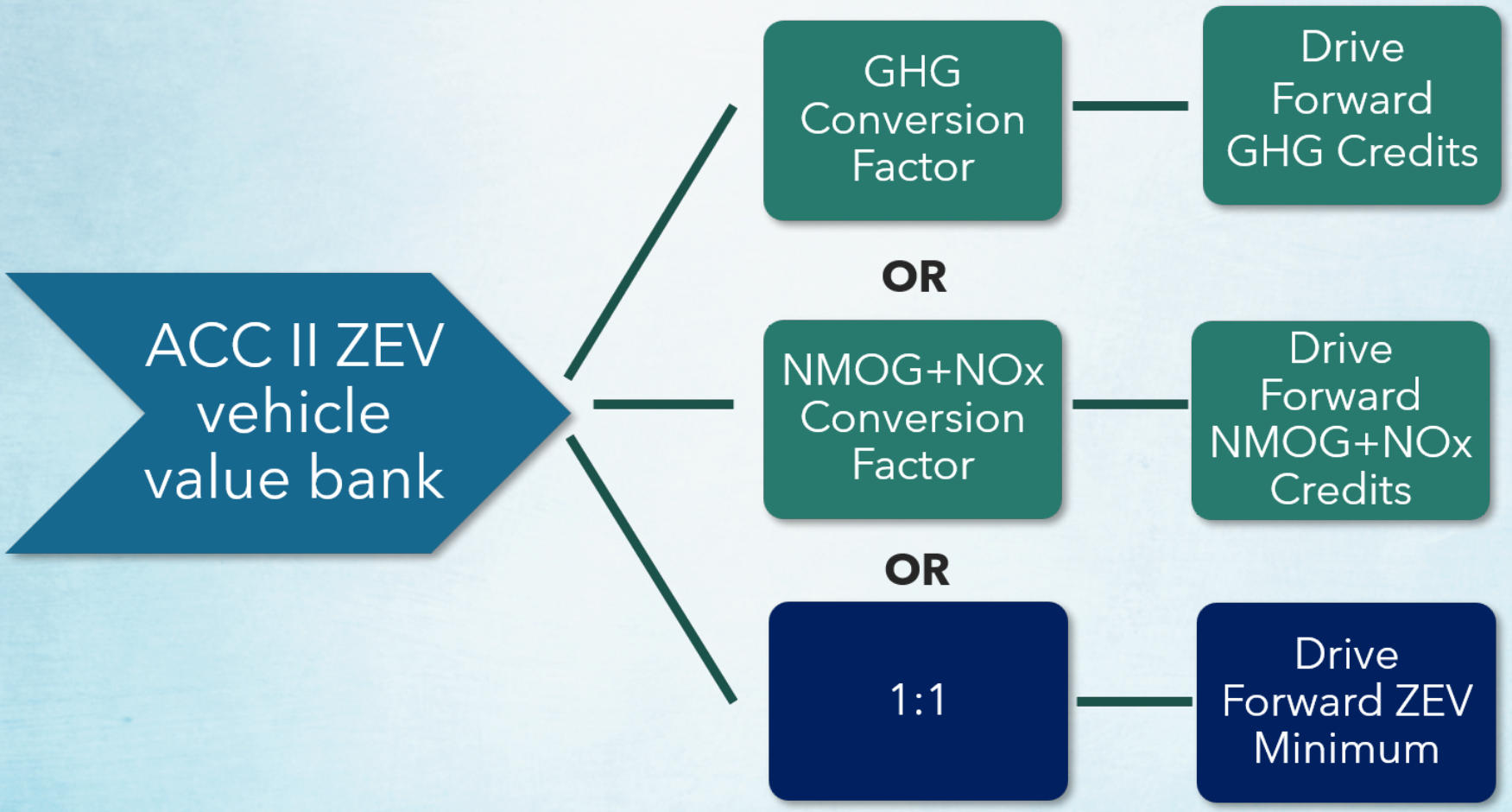
Manufacturers voluntary certifying ZEVs and PHEVs to ACC II are earning ACC II vehicle values



Higher ZEV volumes = Larger Banks

*Banks also include awarded voluntary ACC II ZEV early compliance and environmental justice vehicle values for 2024 and 2025 model years

ACC II ZEV Vehicle Values → Drive Forward Early Credits Preliminary Proposal



Legacy OEMs only

Overview

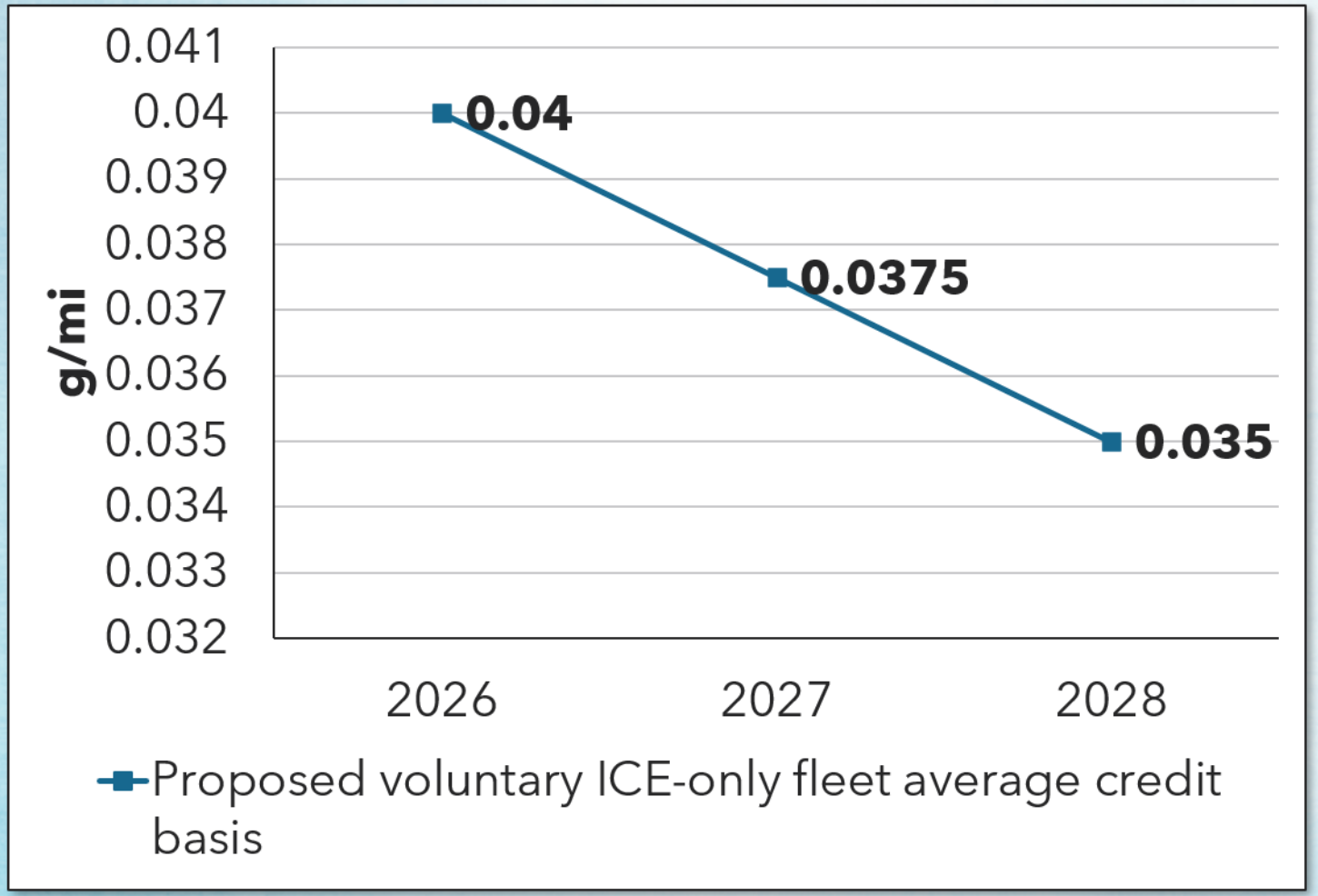
- All ZEV values can be converted into Drive Forward instruments
- Each ZEV value can follow only one path
- Extend credit life where needed

Seeking input on

- Conversion factors
- Caps if large vehicle value banks
- Potential use of ZEV-only values towards ZEV minimum if ZEV sales fall below certain levels

CARB

Optional LEV IV Certification Preliminary Proposal



Background

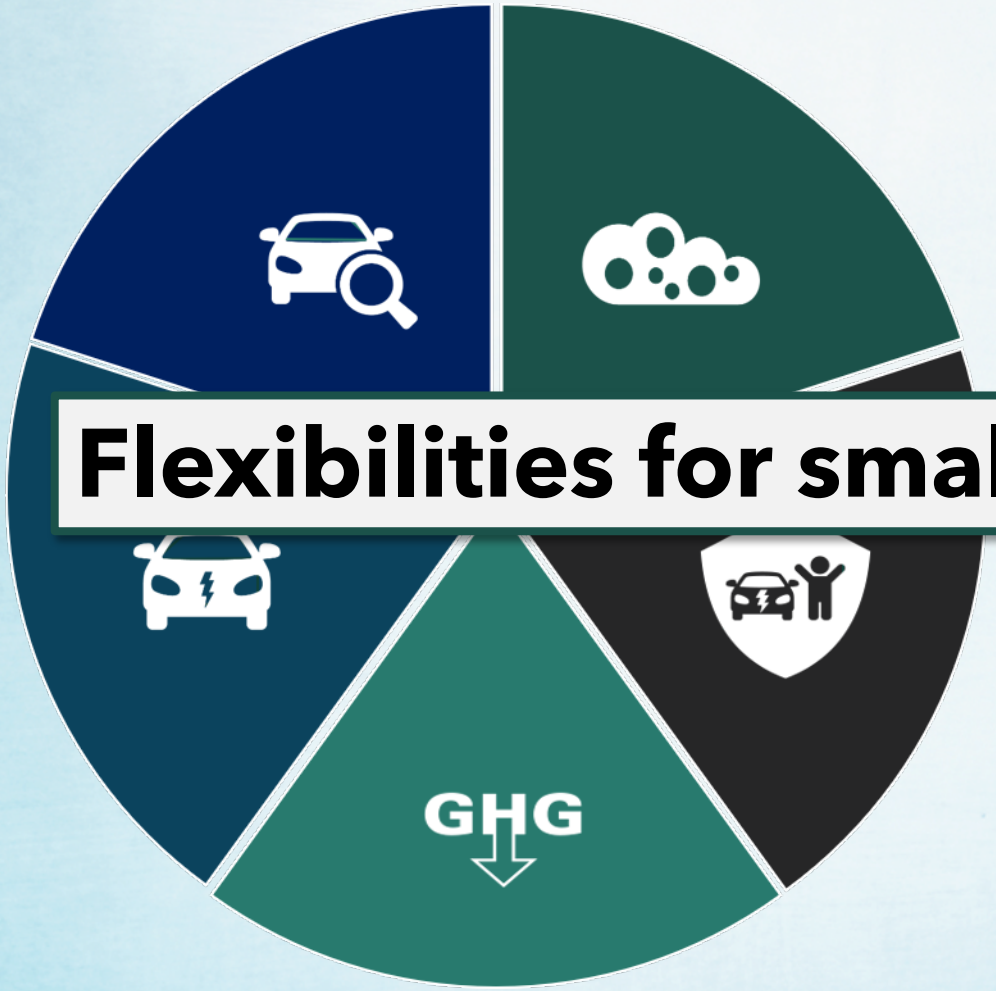
- Some manufacturers are voluntarily certifying test groups to LEV IV

Overview

- Award Drive Forward NMOG+NOx credits to LEV IV-certified ICE fleet relative to optional specified emissions levels
- 5-year credit life

Seeking input on

- Eligibility threshold based on share of California ICE sales certified to LEV IV
- Inclusion of PHEVs

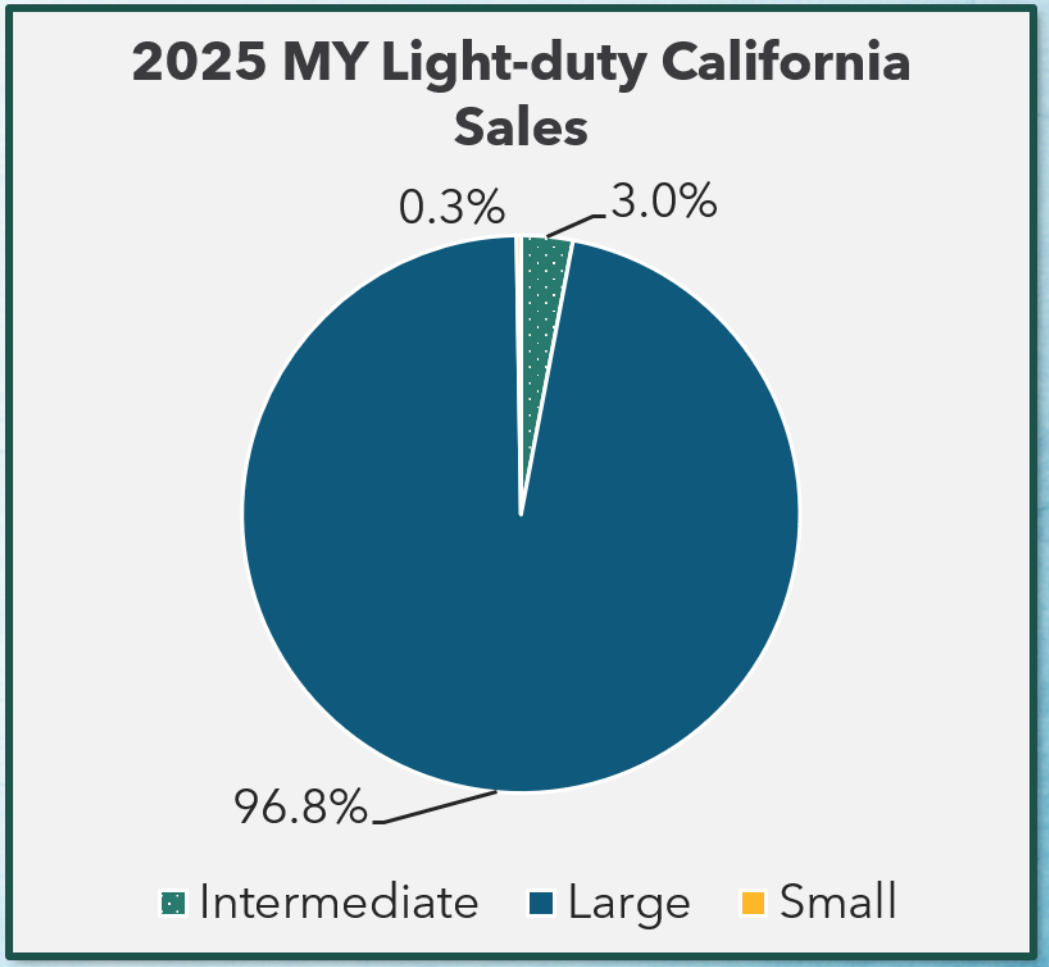


Flexibilities for small volume manufacturers

Overview of Manufacturer Size Definitions in California Regulations

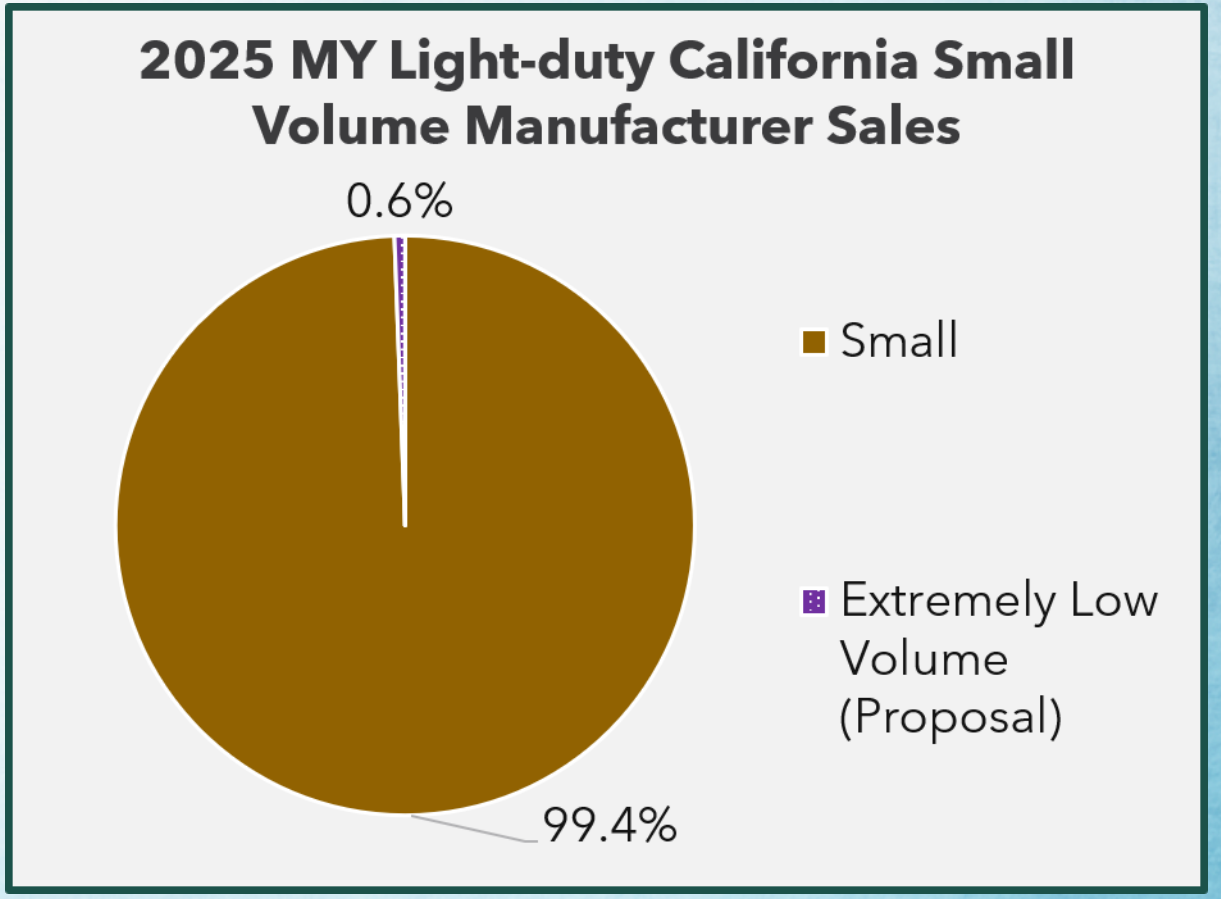
Volume Category	Average Annual California Sales
Large	>=20,000
Intermediate	Between 4,500 and 20,000
Small	<4,500

Small volume manufacturers make up a small share of sales and emission inventory



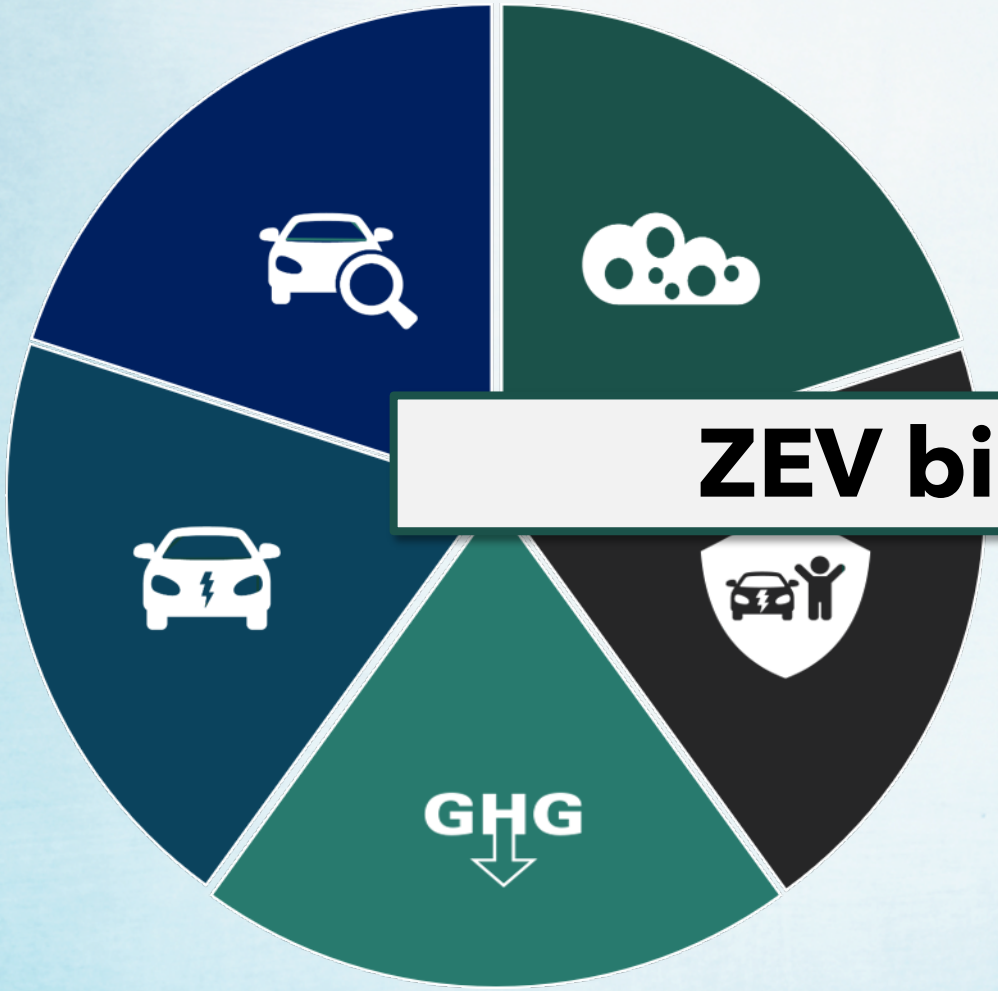
Preliminary Proposal: New Definition for Extremely Low Volume Manufacturers

- Certain small volume manufacturers comprise an even smaller share of sales and emissions
- Preliminary proposal for new Extremely Low Volume Manufacturer definition:
  - <30 annual average California sales



Preliminary Proposal: Flexibilities for Small-Volume Manufacturers

Program	Small Volume Manufacturers	Extremely Low Volume Manufacturers
Light-duty NMOG+NOx fleet average	Maintain ULEV125 certification bin Achieve 30 mg/mi fleet average by 2038 model year	Maintain ULEV125 certification bin No fleet average requirement
Greenhouse gas fleet average	Continue alternative standards through 2033 model year; then transition to primary program Achieve primary standards with additional two model years of lead time	Exempt
ZEV minimum	No requirement until 2038 model year Can opt-in but no trading	Exempt



ZEV bin certification

Proposed ZEV Certification Requirements

Prior Workshops:

Introduced ZEV bin concept and minimum requirements

Minimum Range	**Durability and Warranty**
Data Standardization	**Battery Label and Window Sticker**
Service Information	**Charging and HLC**

Today's Workshop

- MDV ZEV certification
- Alternative ZEV certification pathways
  - Fleet autonomous vehicles
  - Ultra low volume ZEV certification
- ZEV certification fee reassessment

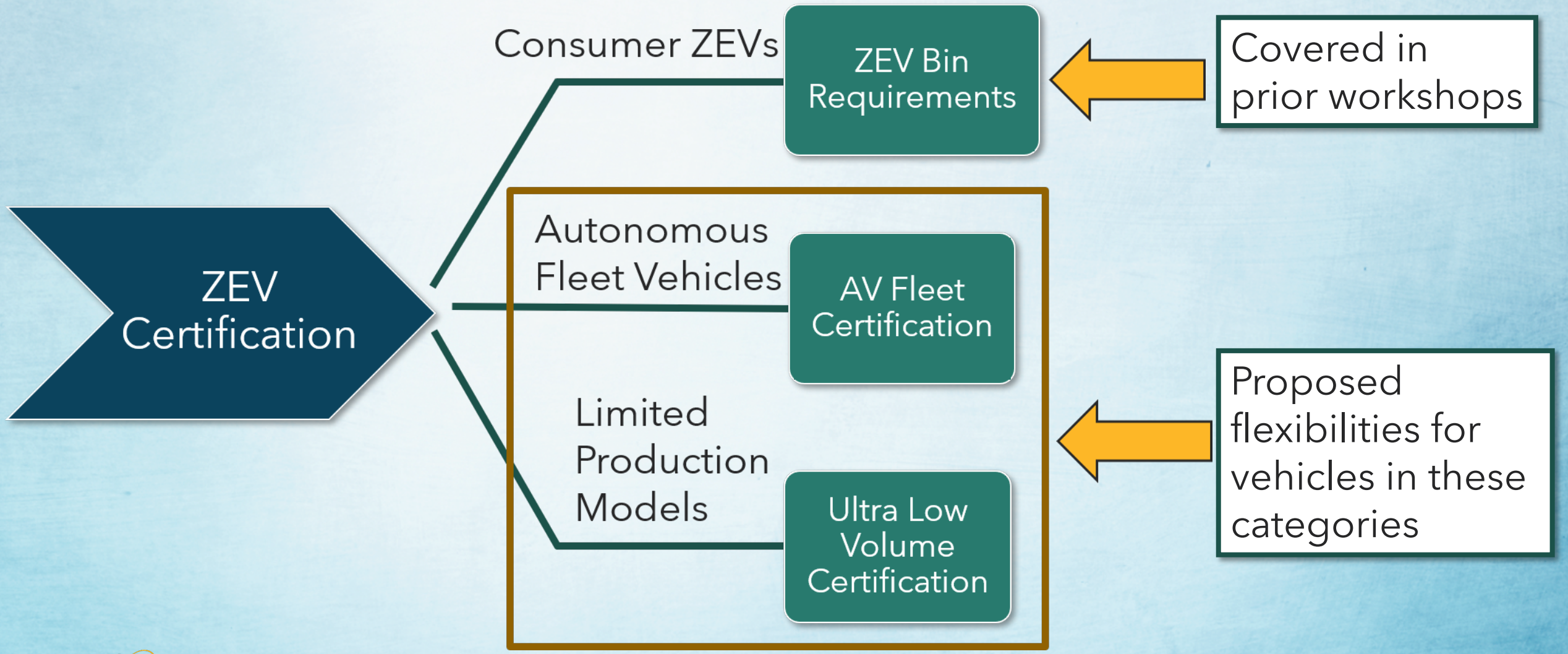
CARB

Proposed Requirements for MD ZEV Bin Certification for NMOG+NOx Fleet Average Compliance

- CARB is proposing chassis-certified MD ZEVs (8,501-14,000 lbs GVWR) meet the same LD ZEV Bin requirements

- CARB is seeking input on how certain requirements may need to be modified for particular fleet applications

Alternative ZEV Certification



Need for certification pathway for Zero-emission Fleet Autonomous Vehicles

- Autonomous Vehicles (AV) are increasing each year - 6 million commercial autonomous taxis globally by 2035*
- Unique vehicle design
- Unique use-case compared to consumer vehicles:
  - High up time and depot charging
  - Range can vary based on operational needs
  - Commercial fleet business model



Image courtesy of "Zoox, Inc."



* Goldman Sachs Research, April 2026

Zero-Emission Autonomous Vehicle Alternative Certification: Applicability

- Applicability is on a test group basis
- Qualifying Test Groups shall comply with the following:
  - Have zero tailpipe emissions
  - Comply with a subset of ZEV Bin Certification Requirements
  - Attestation that all vehicles will only be used exclusively in fleets
  - Obtained a California Department of Motor Vehicle AV permit to operate in California

Preliminary Proposal: Certification Requirements for Zero Emission Autonomous Vehicles

Provision	Requirement
Minimum range	No minimum range. Submit range test data only.
Durability / In-use	Same as ZEV Bin requirement (i.e., 80% of certified 2-cycle range for 10-yrs/150k-mi full useful life)
Battery label	Same as ZEV Bin requirement (i.e., label the battery pack, battery module, and vehicle with battery specifications)
Data standardization	Same as ZEV Bin requirement, except: • Fault codes and SOH/charge rate displays not required • Diagnostic port can be in any location • Diagnostic port not required if data can be provided for in-use via other means
Charging requirements	Manufacturer to supply description of charging system at time of certification
Warranty	No requirement
Service Info	No requirement

Ultra Low Volume Vehicles Background

- In 2025 model year, 21 test groups with a final sales volume of 20 vehicles or less, representing 0.01% of California's new vehicle market

- Typically, these test groups included:
  - High-performance vehicles that are driven very little per year
  - Vehicles with very low range, but made for a niche customer base

- Future test groups may be ZEVs and given the expected small market share, CARB is developing an alternative certification pathway

Ultra Low Volume ZEV Certification: Applicability

- Applicable to all OEM with ZEV test groups with expected sales less than 20 in any given model year
- Certification pathway will be limited to 20 vehicles:
  - Applied to certifying manufacturer and across related manufacturers
  - 20-vehicle limit can be spread across multiple test groups
- Assigned separate test groups from the ZEV bin test groups

Ultra Low Volume ZEV Test Groups: 20-vehicle limit per OEM

Example #1: 20-vehicle limit reached across three test groups

Test Group #1
6 vehicles

Test Group #2
4 vehicles

Test Group #3
10 vehicles

Example #2: 20-vehicle limit reached from one test group

Test Group
20 vehicles

Preliminary Proposal: Certification Requirements for Ultra-low Volume ZEV Test Groups

Provision	Requirement
Minimum range	No minimum range. Submit range test data only.
Durability / In-use	No requirement
Battery label	Same as ZEV Bin requirement (i.e., Label the battery pack, battery module, and vehicle with battery specifications)
Service Info	Same as ZEV Bin requirement (i.e., Require information access and disclosure for all propulsion-related components)
Data standardization	Diagnostic port, SOH, and charge rates only
Warranty	No requirement
Charging requirements	Either AC or DC J3400 inlet; and same power output requirements in ZEV Bin requirement

Preliminary Proposal: Fleet Averages for GHG and Criteria

ZEV Application	Include in Fleet Average?
Zero-emission Autonomous Vehicles for fleet applications	No
Ultra Low Volume Zero-emission Vehicles	Yes

ZEV Certification Fee Reassessment

- ZEV certification applications currently receive 75% discount
- Discount was originally based on minimal ZEV application volume and ZEV requirements
- Proposed ZEV bin requirements need additional agency resources to process applications

Reassessing to ensure the fee structure remains fair, cost-reflective, and sustainable.

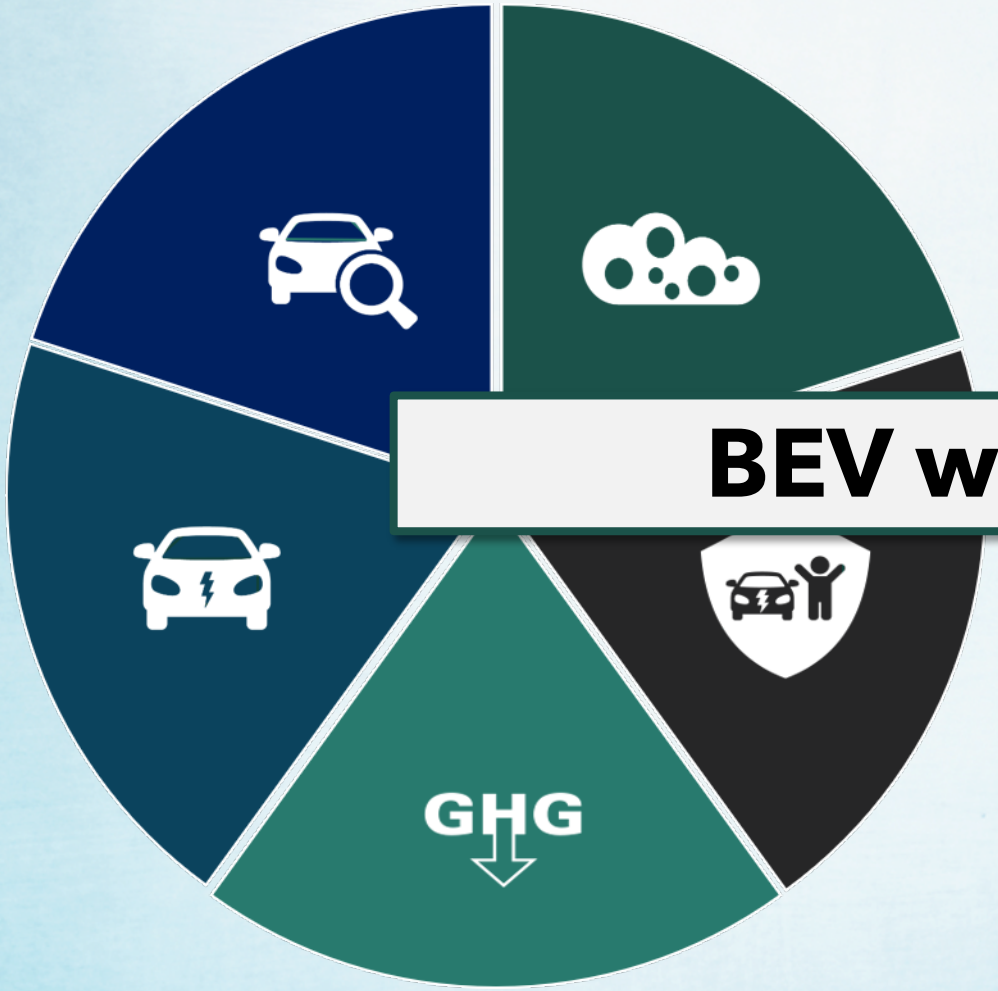
What Is CARB Evaluating?

Total cost of certification with additional requirements for ZEVs:

- Direct Labor
- Operating Costs
- Facility Costs
- Agency Overhead



Workload and Costs Projections

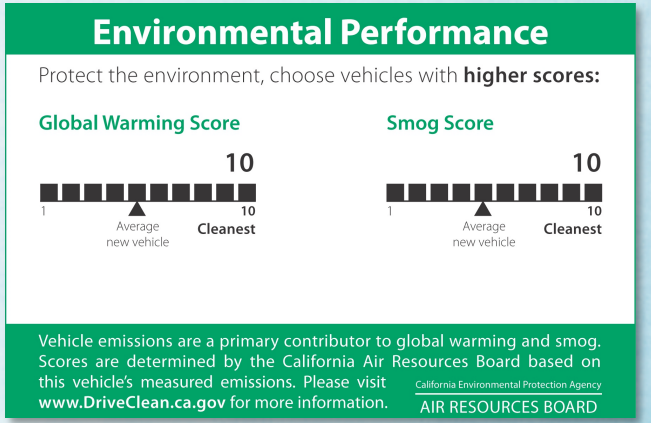


BEV window sticker

Consumer-facing Vehicle Window Sticker Background

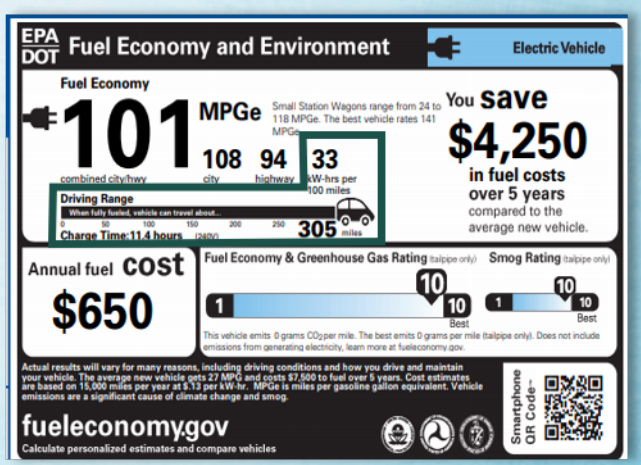
CA Environmental Performance Label

- Authority through HSC 43200
- Incorporated into the U.S. EPA/DOT Fuel Economy Label



U.S. EPA/DOT Fuel Economy Label

- Current information not informative for ZEVs



Develop new CA vehicle window sticker

- Provide improved metrics for BEVs

Proposed BEV Window Sticker Requirements

Prior Workshops

- Draft window sticker
- Proposed methods for driving range and charging speed metrics

Today's Workshop

- Updates on driving range (highway and cold weather) adjustment factor
- Test data used to revise charging speed calculations
- Revised window sticker
- Request for input on window sticker design and metric calculations

Updated Highway (70 mph) Range Adjustment Factor

- Currently, the highway range does not account for real-world effects such as road surface, wind variation, grade, and cargo load

- **Proposed action:** Require a 0.92 factor to be applied to the highway raw range result to account for above effects

- For EPA label range, 0.92 is used in the 5-cycle range calculations to account for the same real-world effects

Updated Cold Weather Adjustment Factor Based on Real-World Cold Temperature Ranges

Vehicle	Unadjusted EPA Range (miles)	Real-world Cold Range (20°F) *	Adjustment Factor
Ford Mustang Mach-E AWD Extended	394	193	0.48
Hyundai Ioniq 5 Long Range AWD	366	189	0.51
Tesla Model Y Long Range AWD	428	192	0.44
Volkswagen ID.4 Pro S	343	173	0.50

Cold range source:
- Consumer Reports, January 2024

* Interpolated from 16°F ranges

Cold Avg Factor: **0.48**

CARB

Charge Speed Metric Analysis: CARB Results (350 to 400 kW chargers)

Vehicle	Max DCFC Supported by Vehicle	Starting State of Charge (SOC)	Charge Speed (Window: First 10 Mins)	Charge Speed Average (Window: 10-80% SOC)
BEV #1	150 to 200 kW	7%	68 miles / 10 min	58 miles / 10 min
BEV #2	125 to 175 kW	13%	33 miles / 10 min	27 miles / 10 min **(14-80%)**
BEV #3	75 to 125 kW	8%	51 miles / 10 min	47 miles / 10 min
BEV #4	275 to 350 kW	8%	86 miles / 10 min	48 miles / 10 min

Results show that the charging speed can vary based on the measurement window (e.g., first 10-mins, 10-80% SOC) used for calculations.

Data and studies support 10-80% SOC as a good measurement window

- SAE 12906 *only* analyzes first 10 minutes of charge speed

<u>Example using Vehicle #4: 30 minutes of charging using CARB results</u>

  - Extrapolating from first 10-minute window: 258 miles recharged
  - Using actual 10-80% SOC window: 144 miles recharged
- Average DCFC session is 30-45 minutes among consumers

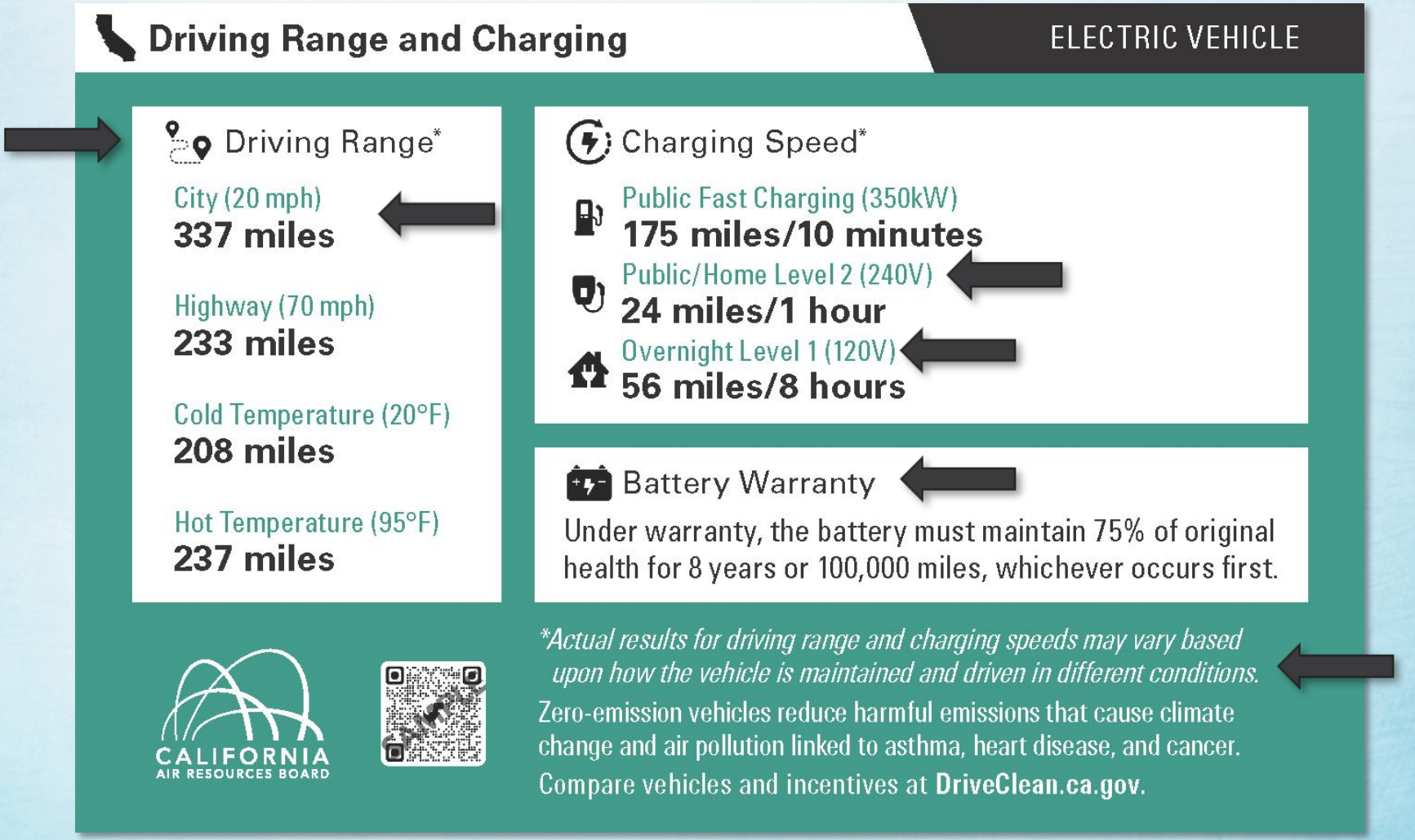
Proposed 10-minute charging rate is derived from entire 10-80% SOC window

CARB

Summary of Proposed Range and Charge Speed Calculations

Metrics	Initial Proposal	Updates
Highway (70mph) Range	Range is raw value from 70 mph SAE J1634 formula	Same calculation as original proposal and apply 0.92 factor to raw range value
Cold Range	0.6 factor applied to unadjusted 2-cycle range	Revise factor to 0.48
DC Charging Speed (miles per 10 minutes)	Charge speed testing based on first 10 minutes	Based on average within 10-80% SOC window

Updated Proposed BEV Window Sticker

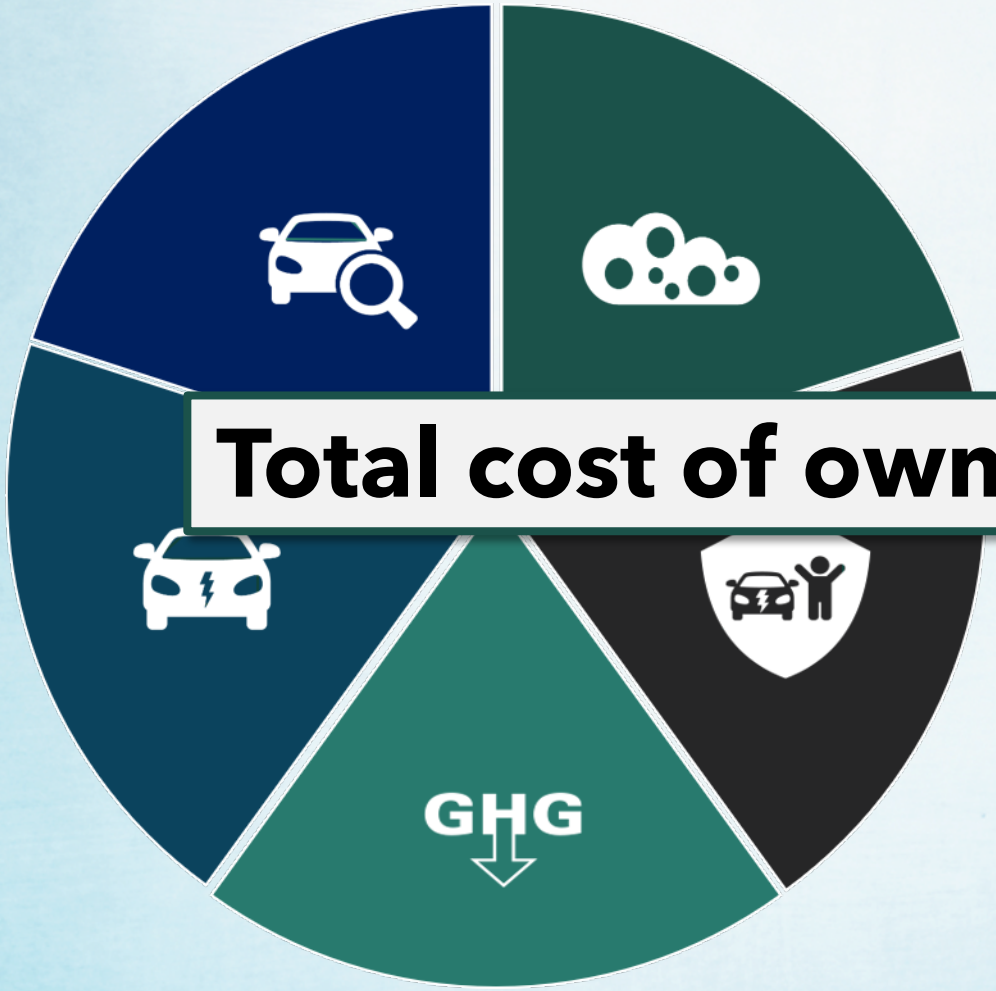


Proposed BEV Window Sticker Applicability

- Beginning in 2030 model year
  - Allows new range and charging metrics to be available early
- Applicable to manufacturers that produce and deliver for sale BEVs for the following vehicle classes:
  - Passenger cars
  - Light-duty trucks
  - Medium-duty passenger vehicles

Seeking Additional Input

- Default adjustment factors for cold and hot ranges
- Required amperages and power for charging metrics
- Information behind the QR code
- Window sticker design
  - Survey to be released later today



Total cost of ownership analysis inputs

Overview of regulatory impact analysis



CARB will make inputs and results publicly available

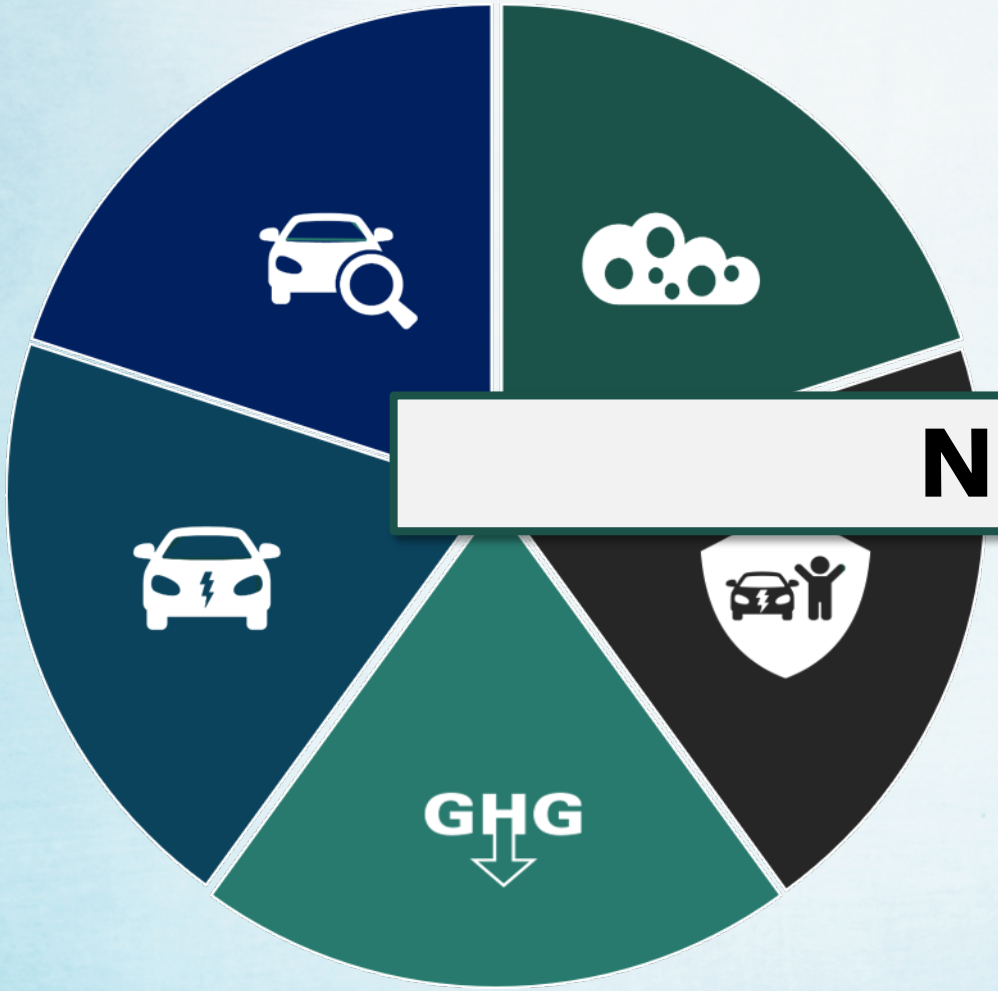
Seeking input on factors used for regulatory impact analysis

Vehicle costs and benefits

- Battery costs for plug-ins and hybrids
- Electric powertrain costs (e.g. motor, inverter, DC-DC converter, on-board charger, thermal management & HVAC, wiring harnesses)
- Combustion vehicle powertrain costs
- Non-powertrain costs for ZEVs and non-ZEVs
- Future costs of above technologies & improvements (e.g. software defined/zonal architecture, "X-in-1" component integrations, dedicated hybrid engines or range-extenders)
- Emissions reductions from combustion vehicle technology and road load improvements

Operational and Societal costs and benefits

- Fuel and electricity price projections
- Maintenance, repair, and insurance costs for different powertrain and body types
- Charging infrastructure capex & charging behavior/type (e.g. share of charging at fast chargers)
- Vehicle-to-grid impacts
- Annual vehicle miles traveled schedules
- Social cost of GHG emissions, health costs of criteria emissions



Next steps

Drive Forward Light-duty Regulatory Engagement with Communities

- CARB's Community Engagement Model as the foundation
- Receive input through open dialogue to shape programs and policies
- Engage on community's terms, repair trust, build partnerships



2027 Regulatory Engagement Plan

1. **Provide** clear information on the upcoming rulemaking, including scope, timeline, anticipated benefits, and potential costs.
2. **Understand** community priorities and concerns and integrate them into the regulation's design wherever feasible.
3. **Expand** outreach to historically marginalized communities to ensure representation beyond established CARB partners.
4. **Gather** targeted feedback on key regulatory provisions where community input can help shape requirements.

Community Regulatory Engagement for Q2 2027



Two additional community meetings planned

- April–May 2027

Partnering with community-based organizations

- Participate in existing events

Focused community feedback

- Historically under-resourced communities
- Areas with potential EV adoption

Building on 2026 engagement

- Identify gaps, resource needs, and potential OEM support

Seeking partnership

- We want to hear from you

Stakeholder Feedback

Submit written public comment through December 18 at 11:59 PM to **the comment docket**

Reach out to us at **Clean Cars** (cleancars@arb.ca.gov)

Subscribe to our **listserv** for updates

ZEV cert, BEV sticker, TCO inputs, & Next steps Q&A



cleancars@arb.ca.gov

Email questions to the **Clean Cars** email box