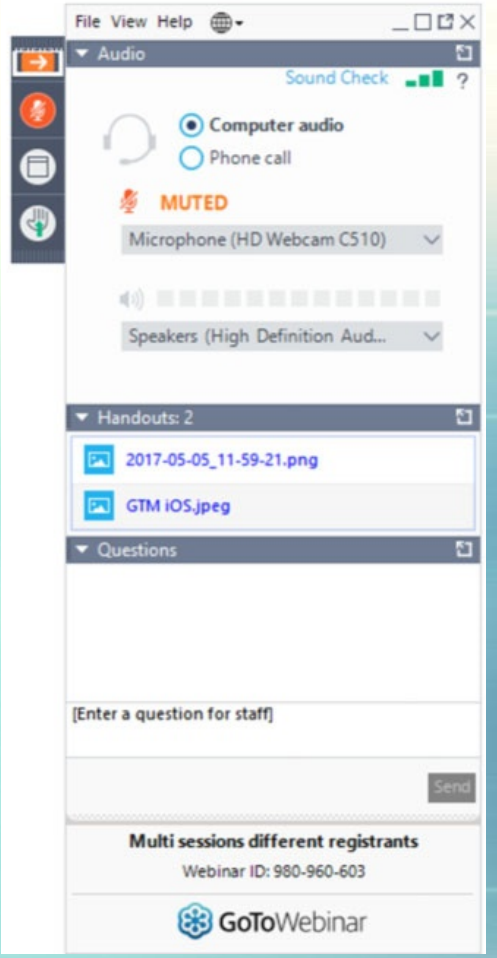
CALIFORNIA
AIR RESOURCES BOARD

Advanced Clean Cars (ACC) II Workshop

October 13, 2021

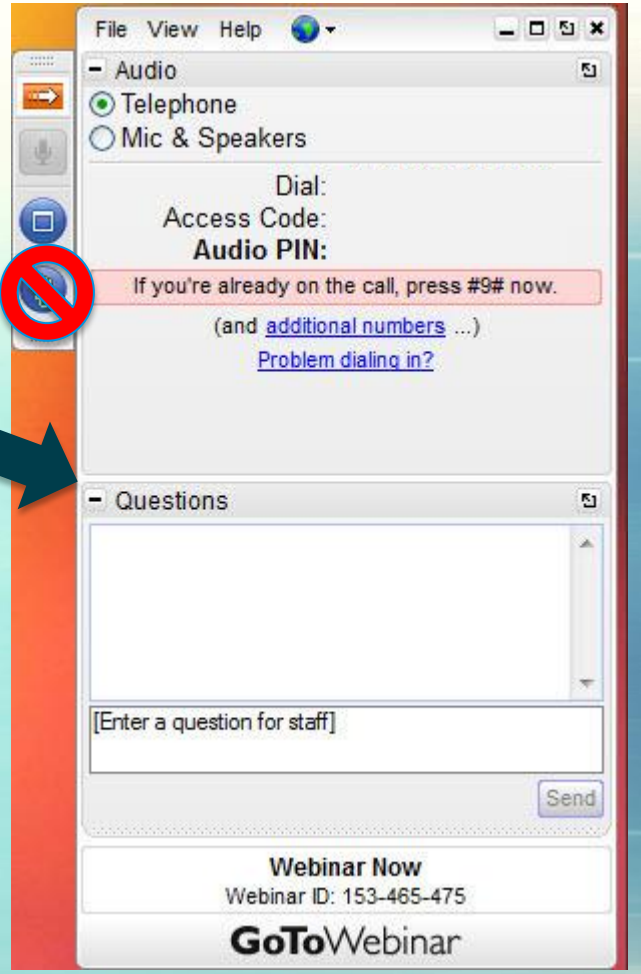
Today's Workshop Logistics

- Workshop is being recorded
- Slides are available in the handouts section of your GoToWebinar control pane
- Slides and recording will also be posted: https://ww2.arb.ca.gov/advanced-clean-cars-ii-meetings-workshops
  - Subscribe to the Clean Cars email list for updates on website postings



Workshop Questions

- Break for questions after each section
- All attendees will remain muted
- Questions can be sent via the GoToWebinar question box
  - Please include slide numbers
- Please raise you hand if you would like to ask a question we can take a few questions during breaks
- Additional questions may be submitted after today to: cleancars@arb.ca.gov



Workshop Comments

- Written comments may be submitted using the ACC II workshop by Oct 27th using the informal comment submittal form
- Comments submitted can be viewed on the ACC II workshop comments log webpage

Today's Workshop Agenda

1. LEV Regulation Proposal Status and Updates
2. ZEV Regulation Proposal Status and Updates
3. ZEV EJ Optional Credits Update

   --- BREAK ---

4. ACC II Proposal Updated Costs and Emission Impacts
5. Next Steps

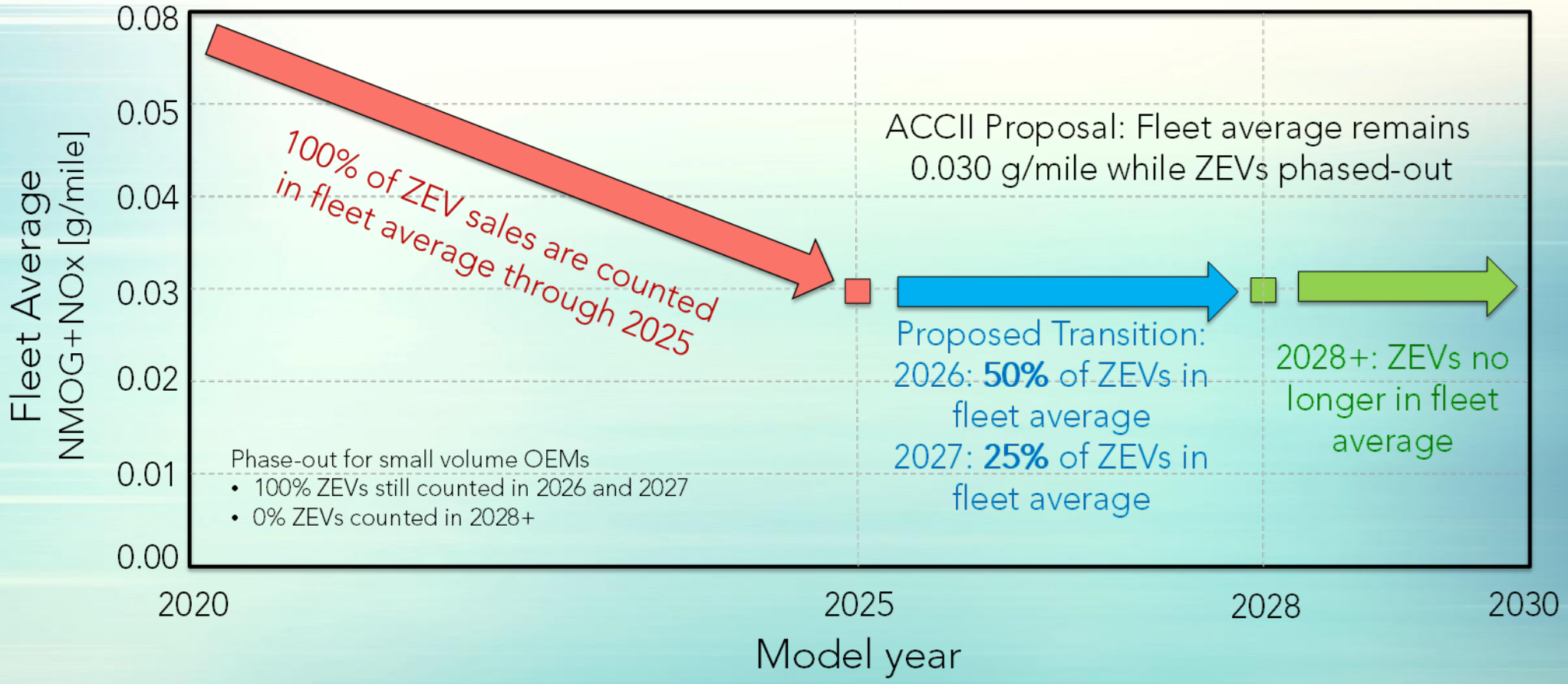
LEV Criteria Emission Proposals

Overview of Topics

1. NMOG+NOx fleet average
2. Aggressive driving emission standards
3. Particulate matter standards
4. Emission control for vehicle soaks
5. Control of quick drive-away emissions
6. PHEV high power cold-start emissions
7. Evaporative emission standards
8. Emission control for heavier vehicles

1. NMOG+NOx Fleet Average

Proposal: Remove ZEVs from Fleet Average



1. NMOG+NOx Fleet Average

Analysis of Reducing Fleet Average to 0.020 g/mile

- Analyzed emission benefit of reduced fleet average (0.030 to 0.020 g/mile)
- 2050 statewide emissions saved:
  - HC < 0.11 tons/day
  - NOx < 0.05 tons/day
- South Coast NOx carrying capacity for 2037 ozone attainment
  - Estimated 55-85 tons/day
- Results largely due to diminishing share of conventional vehicles

- **Proposal will not include further lowering of fleet average for light-duty vehicles**

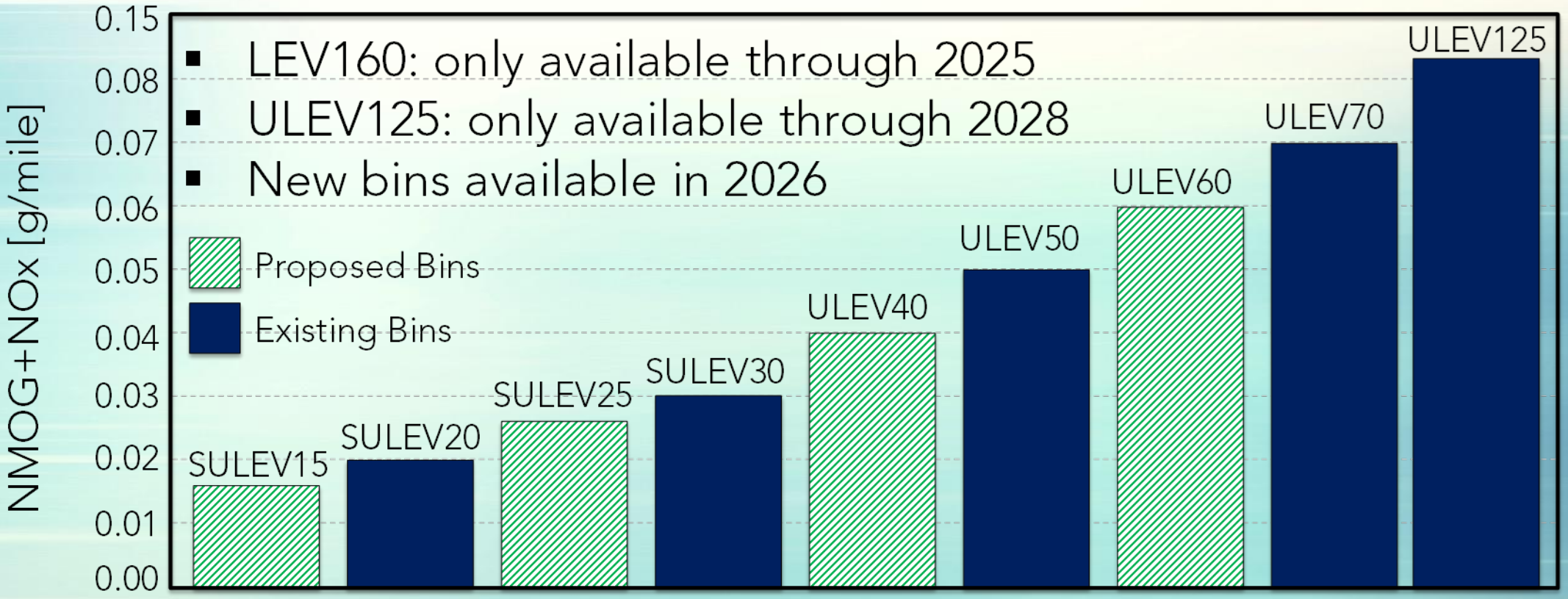
1. NMOG+NOx Fleet Average

Additional Changes

- Combined fleet average for PC, LDT, and MDPV
- Remove PZEV anti-backsliding requirements for 2026+
- Changes/phase-out of PHEV NMOG+NOx credits for electric driving
  - Only for PHEVs that earn credits in ZEV regulation
  - Max credit will change to reflect new bin structure
  - Credit eliminated for 2028+ with ZEV phase-out schedule

1. NMOG+NOx Fleet Average

Changes to Certification Bins



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2. Aggressive Driving Emission Standards

	Proposed US06 Stand-Alone Standards	
FTP Bin	NMOG+NOx [g/mile]	CO [g/mile]
ULEV125	0.125	9.6
ULEV70	0.070	9.6
ULEV60	0.060	9.6
ULEV50	0.050	9.6
ULEV40	0.040	9.6
SULEV30	0.030	9.6
SULEV25	0.030	9.6
SULEV20	0.030	9.6
SULEV15	0.030	9.6

Proposals

- Eliminate option to use composite standards for certification
- New US06 standard set equal to FTP standard down to 0.030 grams/mile
- Attestation for SC03 standards
- Phase-in schedule:

MY	2026	2027	2028
Phase-in	30%	60%	100%

3. Particulate Matter Standards

- September 2020 proposal: Reduce from 6 to 3 mg/mile PM on US06 cycle

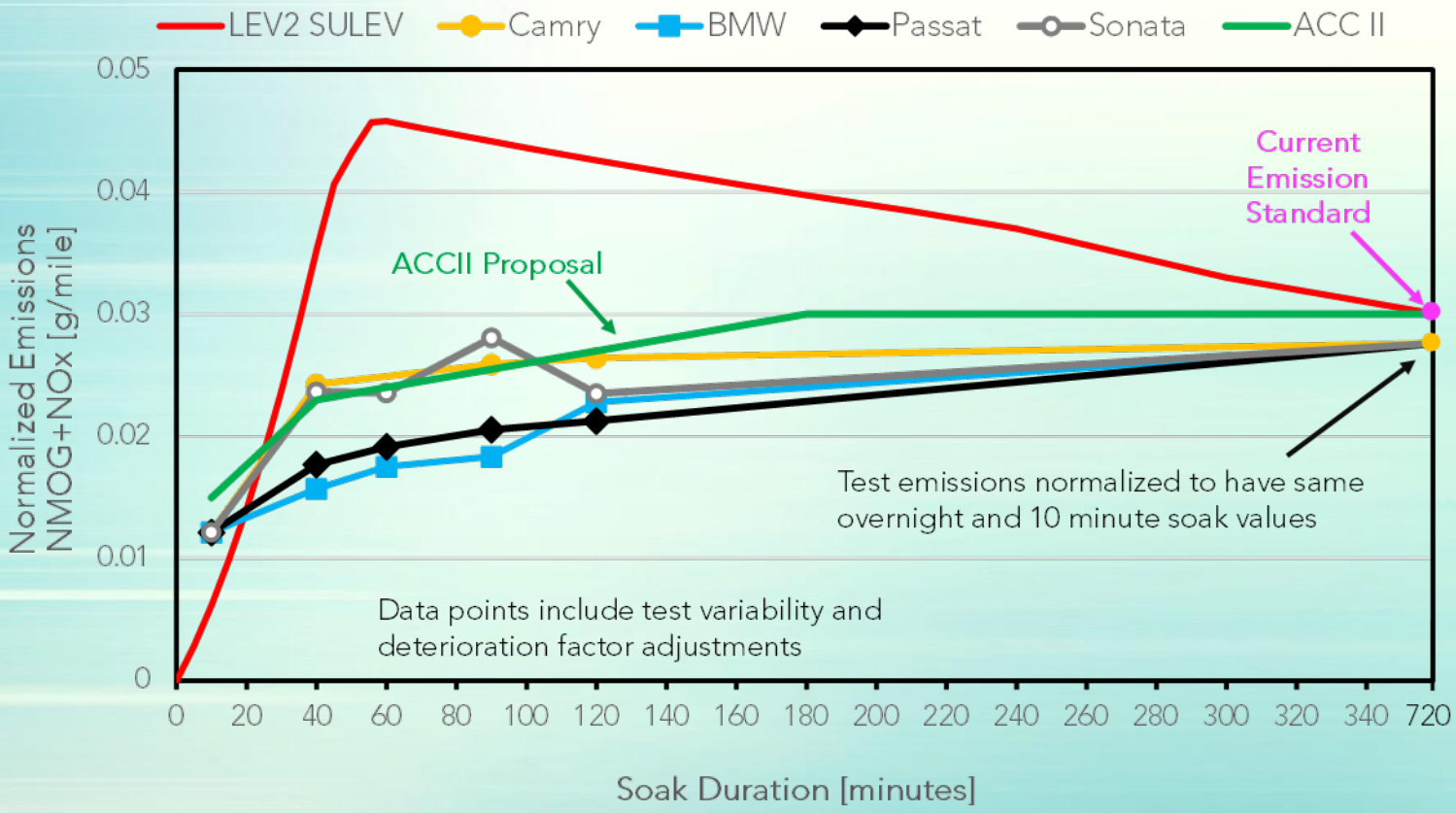
- Phase-in schedule:

MY	2027	2028	2029	2030
Phase-in*	25%	50%	75%	100%

*Pure ZEVs remain excluded from requirement/phase-in

4. Cold-Start Emissions

Emission Control for All Vehicle Soaks



ACC II Updated Proposal

- Emissions must be below the ACCII curve defined by:
  - 10 mins = 0.50 x FTP std
  - 40 mins = 0.767 x FTP std
  - 180+ mins = 1.00 x FTP std
- Attestation for 10 min to 12 hour soaks and certification for 12-36 hour soaks
- Emission benefit: 0.8-3.3 tons/day NMOG+NOx statewide in 2035-2040

MY	2026	2027	2028
Phase-in	30%	60%	100%

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5. Cold-Start Emissions

Control of Quick Drive-Away Emissions

ACC II Proposal

- Require emission certification for:
  - Existing FTP with 20 sec idle
  - FTP with 8 sec idle (new requirement)
- To reduce test burden, both FTP tests may share Phase 2 and Phase 3 (warmed-up driving) emission values
- Phase-in schedule:

MY	2026	2027	2028
Phase-in	30%	60%	100%

	Proposed Emission Standards for 8s FTP
FTP Bin	NMOG+NOx [g/mile]
ULEV125	0.125
ULEV70	0.082
ULEV60	0.072
ULEV50	0.062
ULEV40	0.052
SULEV30	0.042
SULEV25	0.037
SULEV20	0.031
SULEV15	0.025

6. Cold-Start Emissions

PHEV High Power Cold-Start Emissions

FTP Bin	SULEV15	SULEV20	SULEV25	SULEV30	ULEV40	ULEV50	ULEV60	ULEV70	ULEV125
Cold-Start US06 Proposal NMOG+NOx [g/mile]	0.050	0.067	0.083	0.100	0.125	0.150	0.175	0.200	0.250

- Proposal: New cold-start US06 certification test
- US06 capable PHEVs (as defined by ZEV reg) are exempt
- Phase-in schedule
  - 2 test groups or less: 50% in 2027, 100% in 2028
  - 3 test groups or more: 30% in 2026, 60% in 2027, 100% in 2028
  - Seeking feedback: sales volume or test group phase-in?

7. Evaporative Emission Standard

- Tighten Running Loss Standard: from 0.05 to 0.01 g/mile
  - Most vehicles meeting this now but some higher emitting
  - Eliminate dirtiest, ensure good designs remain the norm
  - Phase-in Schedule:

MY	2026	2027	2028
Phase in	30%	60%	100%

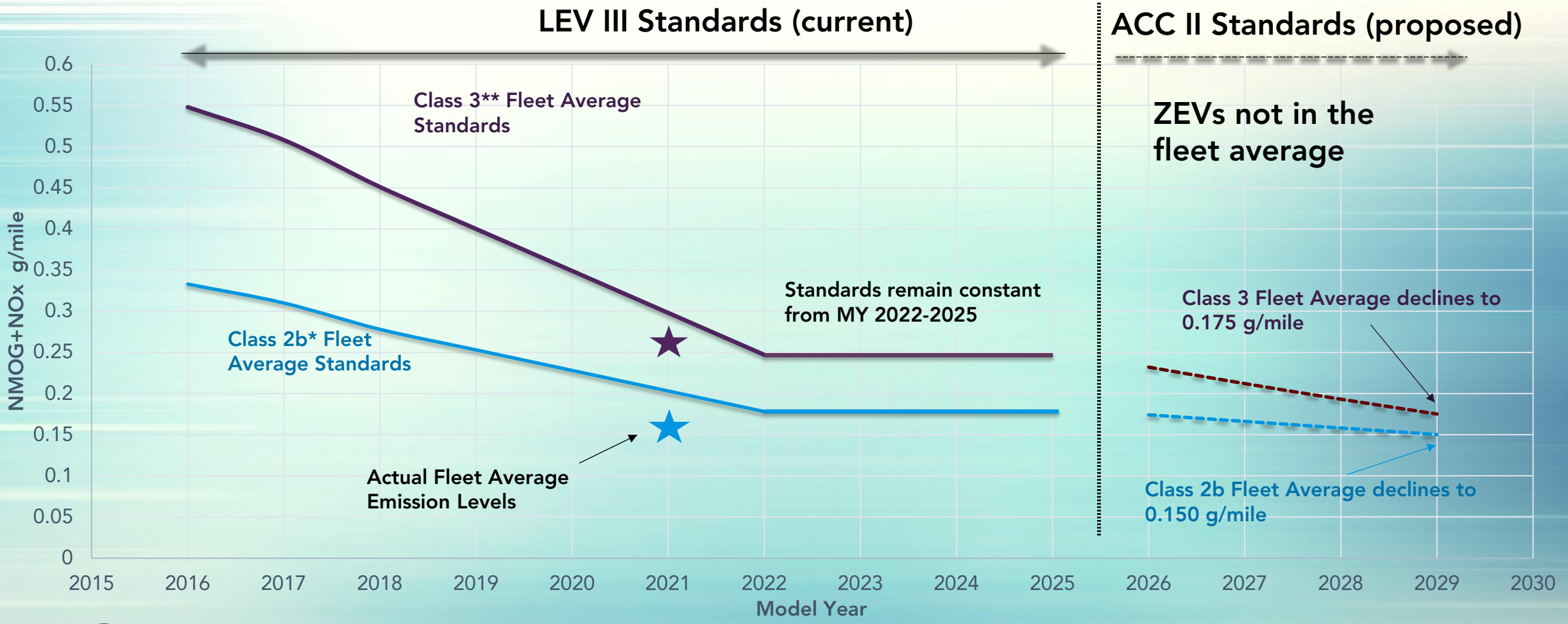
Evaporative Emissions: Puff Loss

- Puff Emissions Proposal
  - Unique to special sealed gasoline tanks
    - Common on PHEVs (and some HEVs)
  - Specify minimum canister size in regulation
  - Emission protection without adding test burden
- Begins MY 2028

8. Emission Control for Heavier Vehicles

Reduce Fleet Average and add lower bins	Standalone Standards for aggressive driving	PEMS standards for towing vehicles only
• New elements—not previously presented at workshops • Proposal based on certification data	• Concept presented at previous workshop • Proposed standards based on certification and test data	• Change based on data and stakeholder feedback • Meets intent of controlling beyond the FTP—on those vehicles that are used in that manner

Reduce NMOG+NOx MDV Fleet Average and Remove ZEVs



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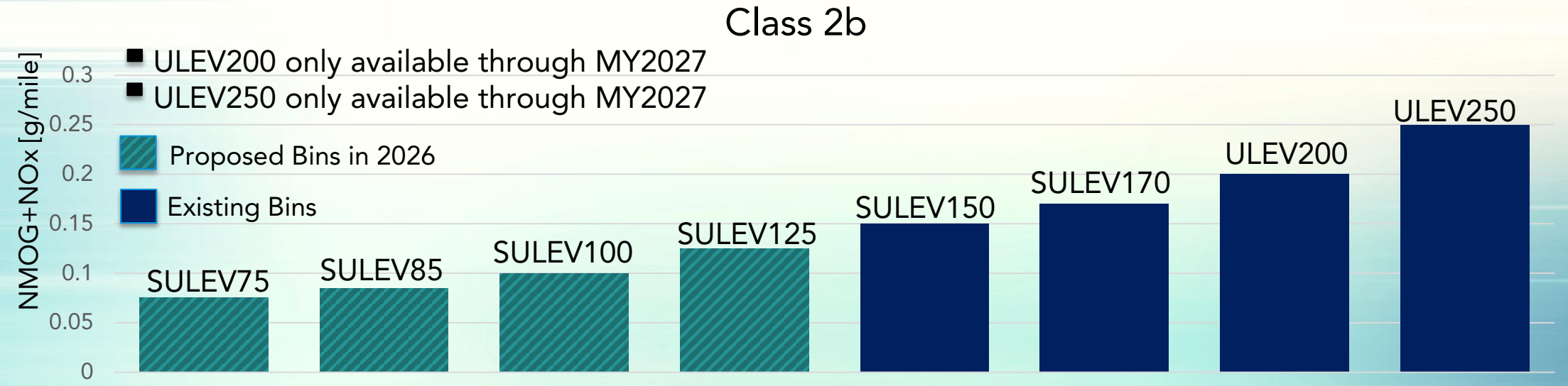
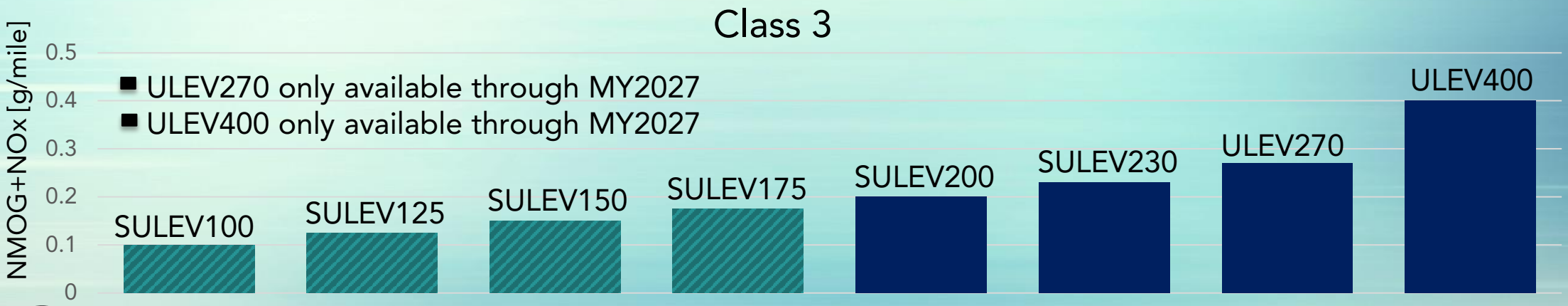
*Class 2b – (8,501-10,000 lbs. GVWR)
**Class 3 – (10,001-14,000 lbs. GVWR)

NMOG+NOx MDV Fleet Average

Changes to FTP Certification Bins





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Aggressive Driving Standards
Standalone SFTP

Class 2b Proposed Standard				
	NMOG+NOx [g/mile]		CO [g/mile]	
FTP bin	Full US06	(HP/GVWR ≤0.024) US06 Bag 2	Full US06	(HP/GVWR ≤0.024) US06 Bag 2
SULEV170	0.170	0.170	25	15
SULEV150	0.150	0.150	25	15
SULEV125	0.125	0.125	25	15
SULEV100	0.100	0.100	25	15
SULEV85	0.085	0.085	25	15
SULEV75	0.075	0.075	25	15

ACC II Proposal:

- Eliminate composite SFTP standards
- New lower standalone standards
- PM composite standalone standard still being evaluated

Class 3 Hot 1435UC Proposed Standard		
FTP bin	NMOG+NOx [g/mile]	CO [g/mile]
SULEV230	0.230	10
SULEV200	0.200	10
SULEV175	0.175	10
SULEV150	0.150	10
SULEV125	0.125	10
SULEV100	0.100	10

MY	2026	2027	2028
Phase-in	30%	60%	100%

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PEMS Standard for towing vehicles only

MDVs <14K lbs. GCWR

- Majority are vans where towing is less common
- Test data suggests majority of on-road operation covered by chassis test cycles
- Chassis certified MDVs <14K lbs. GCWR would continue with chassis dynamometer standards

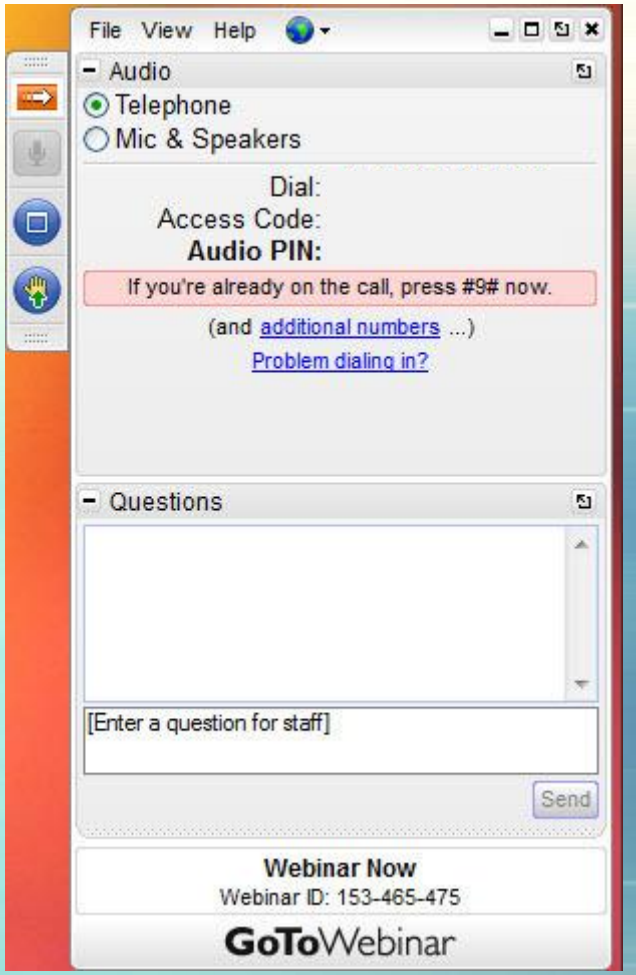
MDVs >14K lbs. GCWR

- Majority are trucks that have large towing capacity
- New requirements better ensure robust emission control even during towing
- PEMS MAW in-use test procedures and standards will apply to MY 2026 and phase-in more stringent standards similar to the HD Omnibus in-use program

Please use GoToWebinar pane to ask

QUESTIONS

(include a slide number in your question, if possible)

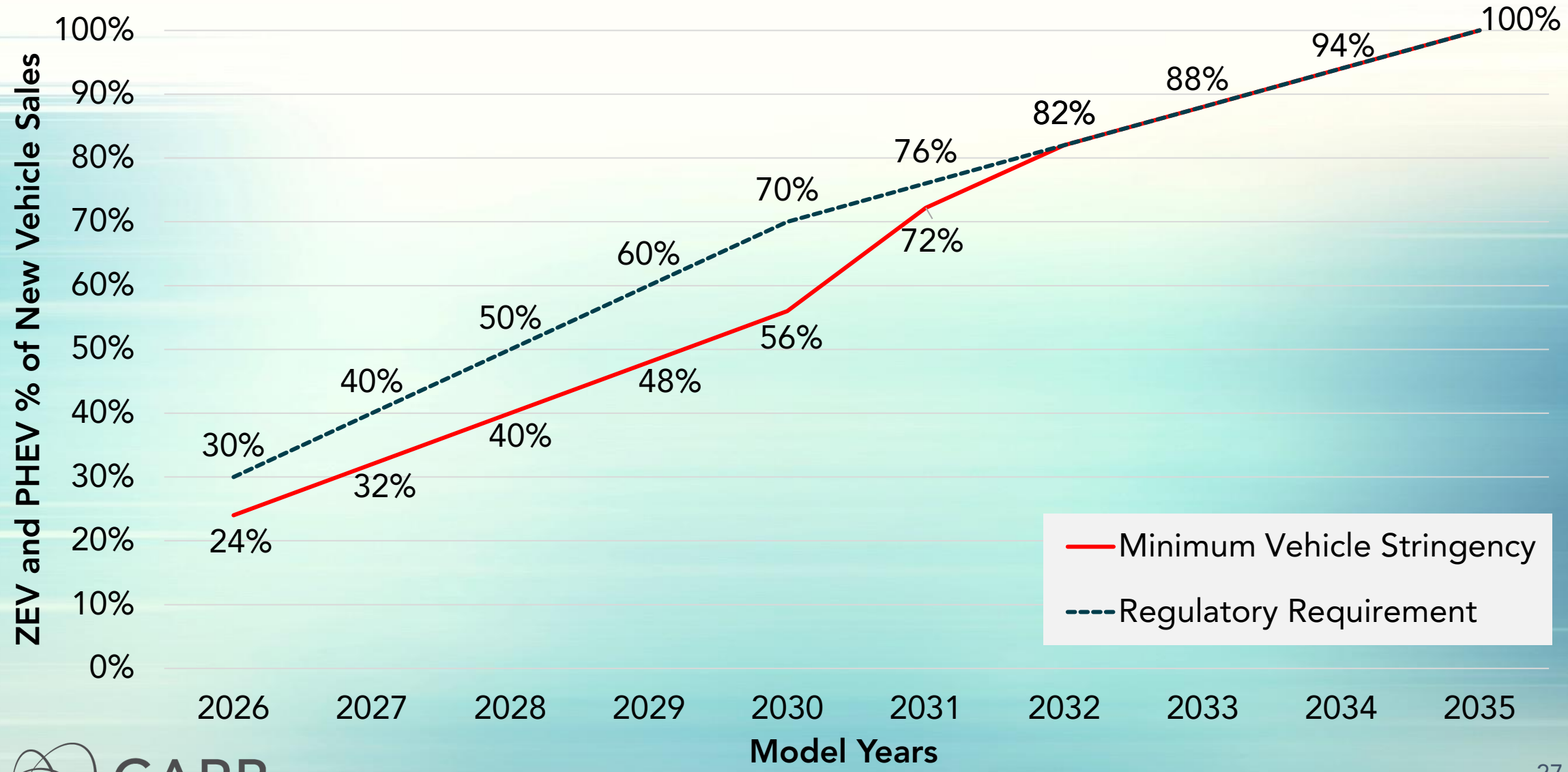


ZEV Proposal Status and Updates

ZEV Overview

- Recap of ZEV Stringency and Regulatory Structure
- Staff Updates to ZEV Assurance Measures
- 2026-2028 PHEV Partial Crediting
- Updates to Minimum Requirements
- Small Volume Manufacturer Treatment
- ZEV Requirement Calculations
- Updates to Environmental Justice (EJ) Credits
- Section 177 State Pooling Provision

Stringency Proposal



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How can the requirement be met?

- Primarily, with actual ZEV sales
- Plus, partially with:
  - Actual PHEV sales
  - Pre-2026 MY ZEVs and PHEVs
  - Earned EJ allowances
  - Pooled new ZEVs and PHEVs from other states

Industry Feedback on Battery Life

- Initial Proposal
  - BEV Durability: 15 year/150,000 mile, 80% of certified all-electric UDDS range
  - Battery Warranty: 10 year/150,000 mile battery warranty, linked to state of health (SOH)
- Feedback
  - Battery technology rapidly evolving
  - Range degradation is dependent on behavior
  - Higher uncertainty due to time rather than mileage
  - Lower MSRP offerings could result in reduced durability

Staff Assessment of Comments

- **Mileage vs. Years:** Agree that there is less data on the effect of time on durability
- In the absence of standards, industry has coalesced around 8 year/100,000 mile warranty (70% capacity)
- Further improvements in durability remain reasonable given continued technology advancement
- Difficult to understand future consumer tolerances

Updated Durability Requirement

- 2026 and subsequent model year
  - BEV and FCEV test groups must be designed to maintain 80% of certified **2 cycle range** for full useful life defined as **10 years**/150,000 miles
- In-Use Compliance and Recall Regulations
  - Manufacturer data collection/reporting requirements
    - @ ~3 years (36k – 50k mi): BEV manufacturers report SOH data from 30 in-use vehicles per test group
    - @ ~6 years (60k – 90k mi): BEV manufacturers report SOH data from 30 vehicles per test group
    - No pass/fail compliance decision or trigger for more manufacturer action based on submitted data
  - Collecting information on appropriate FCEV data for in use compliance reporting

In-use Compliance Testing Proposal

- CARB authority to conduct testing
  - Only for test groups that are within full useful life
  - Procure and test 10 or more representative in-use vehicles
    - Determine two-cycle range per SAE J1634 testing
  - Test group noncompliant if **30%** or more representative vehicles fail test
    - Like conventional vehicle, can require up to and including recall to remedy violation
- Representative Vehicle
  - Does not have 'excessive' amount of V2x operation
  - Does not have 'excessive' amount of fast charge events
  - *Same as conventional vehicle:*
    - *CA certified/registered;*
    - *within full useful life;*
    - *no indication of abuse, major repair after collision; or issue that can jeopardize safety of test*

Updated Minimum Warranty Requirements

- Require warranty period of **8 years/100,000 miles** for batteries
  - Warranty failure when battery less than 80% SOH
- Emulate warranty reporting requirement for BEVs and FCEVs through warranty period
  - For "powertrain" components only
  - Verified warranty claims >4% (or 25 vehicles) on a component triggers corrective action plan

Other ZEV Assurance Proposal Updates

- Test Group Definition for ZEVs
  - Group by expected powertrain deterioration, battery configuration, motor configuration, and vehicle class
  - Disclose two cycle range for each variant in test group
- Battery Warranty Repair/Corrective Action
  - At time of certification, manufacturer will submit battery degradation curve that shows projected compliance with full useful life standard
    - Held as confidential business information
    - Can also be used when approving manufacturer plans to repair battery under corrective action

Proposed Changes to PHEV Minimum Requirements

Attribute	Current ZEV Regulation (2018-2025)	Transitional <1 Credit PHEVs (2026-2028)	1 Credit Earning PHEVs (2026+)
Range	>10 miles FTP cycle	>30 miles 'label'	>50 miles 'label'
Able to run US06 (high speed/accel) cycle 'all-electric'	Optional (added credit if > 10 miles US06 cycle)	Same (optional)	Mandatory (>40 miles electric range)
Criteria emissions	SULEV30	Same	
Emission part warranty	15yr/150,000 mi	Same	
Battery warranty	10yr/150,000 mi	8 yr/100,000 mi, 80% SOH	
OBC size and J1772 Level 2	3.3 kW, J1772 Req	5.76 kW OBC, Same J1772 Req	
Convenience cord	No requirement	Required	

2026-2028 PHEV Phase in

- 50 miles range and US06 capability ≈ 1 Vehicle Value
- Derived equation for 2026-2028 PHEVs:

$$\frac{\text{All Electric Range*}}{100} + \boxed{0.35 \text{ (US06)} \quad \text{or} \quad 0.2 \text{ (Non-US06)}} = \text{Partial Vehicle Value**}$$

*Range must be ≥ 30 miles
**Maximum value of 1.0

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Convenience Cord Proposal

- Applies to PHEVs and ZEVs with off-vehicle charge capability
- At least 20 ft in length
- Meets UL2594 for Safety Electric Vehicle Supply Equipment
- Require minimum dual amperage (Level 1/Level 2) capability
  - L1 amperage = 12 amp
  - L2 amperage $\geq$ 24 amp
- Require amperage to be down-selectable by user
  - Selection can be 'on cord' or in vehicle
- Will not specify NEMA plug type

How should we treat small volume manufacturers?

- What are they:
  - <4,500 in CA annual sales
  - Typically certify as few as 1-4 test groups/models
- Historically, exempted from ZEV production requirements and subjected to softened/delayed criteria and GHG standards

Manufacturer	3-year Average (2017-2019)
ASTON MARTIN	356
FERRARI	661
KOENIGSEGG	12
LANDI RENZO	169
LOTUS	34
MASERATI	2,793
MCLAREN	432
PAGANI	19
ROUSH	67
Total	4,436

Proposed ZEV Small Volume Treatment

- Able to produce and deliver for sale ZEVs and PHEVs, and participate in ZEV market pre-2035
- Required compliance beginning with 2035 model year
- No later than December 31, 2032, small volume manufacturers must submit 2035 compliance plan
  - Technology, expected volumes

Compliance Calculation Proposal

- Mimic GHG and criteria pollutant programs:
  - Determine model year requirement
  - Assess compliance based on actual sales for that model year
    - If shortfall, then other allowances can be used to satisfy remaining requirement
    - If surplus, then excess can be banked

Update on Environmental Justice (EJ) Credits for the ZEV Regulation

Proposed EJ Credits

- EJ credits for manufacturers who take action to help increase affordable access to ZEVs for our priority communities
- EJ Credits can be used in model years 2026 through 2031
- Credits expire after model year 2031
- 5% cap on the number of EJ credits allowed to fulfill a manufacturer's obligation in any year

Community Program

Used ZEV

Updated Community Program EJ Credit Category

- Original Proposal: A new ZEV or PHEV provided at discount for use in a community-based clean mobility program may earn extra credit
- Update: ZEVs and PHEVs eligible for community program EJ credits must be offered at a minimum 25% discount based on the vehicle MSRP

Updated EJ Credit for Used ZEVs

Updated Proposal: A CA ZEV or PHEV leased from new may receive extra credit at the termination of its lease if it is:

- subsequently registered for continued CA operation (either purchased or leased) in a qualifying low-income household

Type of Vehicle	EJ Credit
Used ZEV	0.25
Used PHEV	0.20

Updated EJ Credits Summary

EJ Credit Category	EJ Credit per PHEV	EJ Credit per ZEV
Community Program	0.40*	0.50
Used ZEV	0.20	0.25

*PHEVs are only eligible for vehicle models with 6-seat capacity or more

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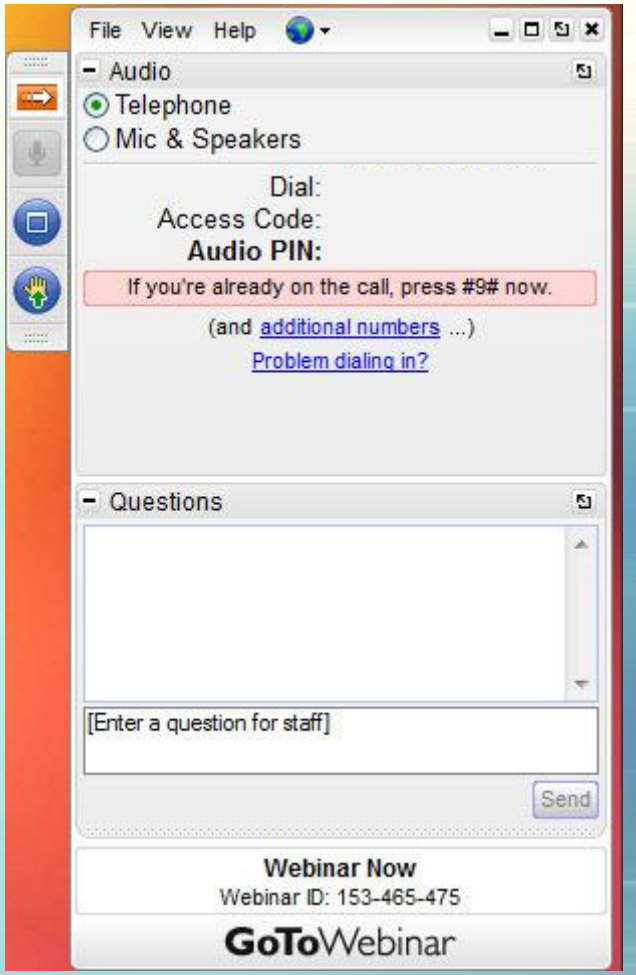

ACC II: Section 177 States

ZEV States (CA + Section 177 ZEV States)

State	ZEV Program – Applicable Model Year	Share of New U.S. Light-Duty Vehicle Sales
California	1990	11.0%
New York	1993	6.1%
Massachusetts	1995	2.1%
Vermont	2000	0.3%
Maine	2001	0.4%
Connecticut	2008	1.0%
Rhode Island	2008	0.3%
Oregon	2009	1.0%
New Jersey	2009	3.5%
Maryland	2011	1.9%
Colorado	2023	1.5%
Minnesota	2025	1.5%
		All ZEV States = 30.6%

Sources: California Section 177 States. California Air Resources Board. Available at https://ww2.arb.ca.gov/resources/documents/states-have-adopted-californias-vehicle-standards-under-section-177-federal; NADA Data 2020. National Automobile Dealers Association. Available at https://www.nada.org/WorkArea/DownloadAsset.aspx?id=21474861098

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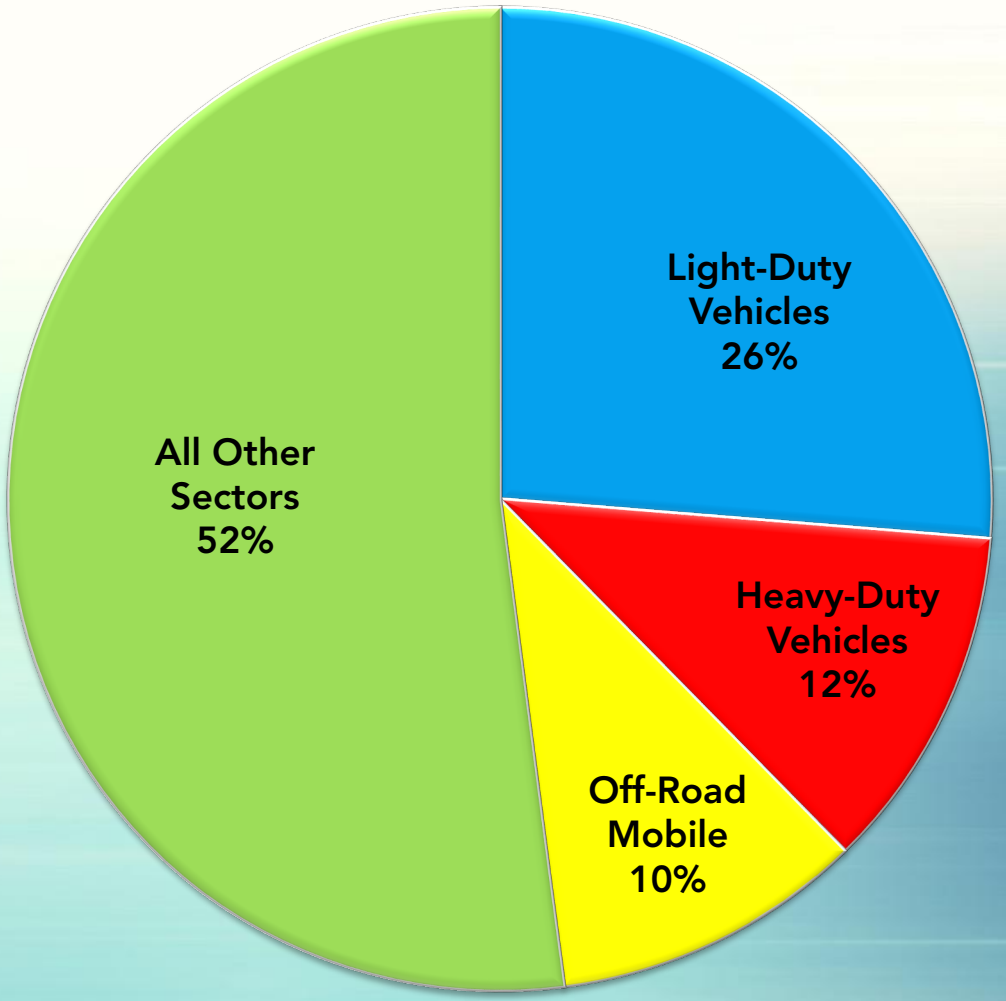
The Role of ZEVs in Achieving 177 State Climate Commitments

- Section 177 states are committed to reducing GHGs by 75-100% by 2050 and 40-50% by 2030
- Transportation is the largest source of GHG emissions in the Section 177 ZEV states, with light-duty vehicles accounting for the biggest share of transportation emissions
- ZEVs are a critical strategy in state climate action plans to mitigate worst impacts of climate change

2017 GHG Emissions in the Section 177 ZEV States
Total = 669.7 MMTCO2e



Sources: State Inventory and Projection Tool (2021). U.S. Environmental Protection Agency. Available at https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool ; Energy-Related CO2 Emission Data Tables. U.S Energy Information Administration. Available at https://www.eia.gov/environment/emissions/state/

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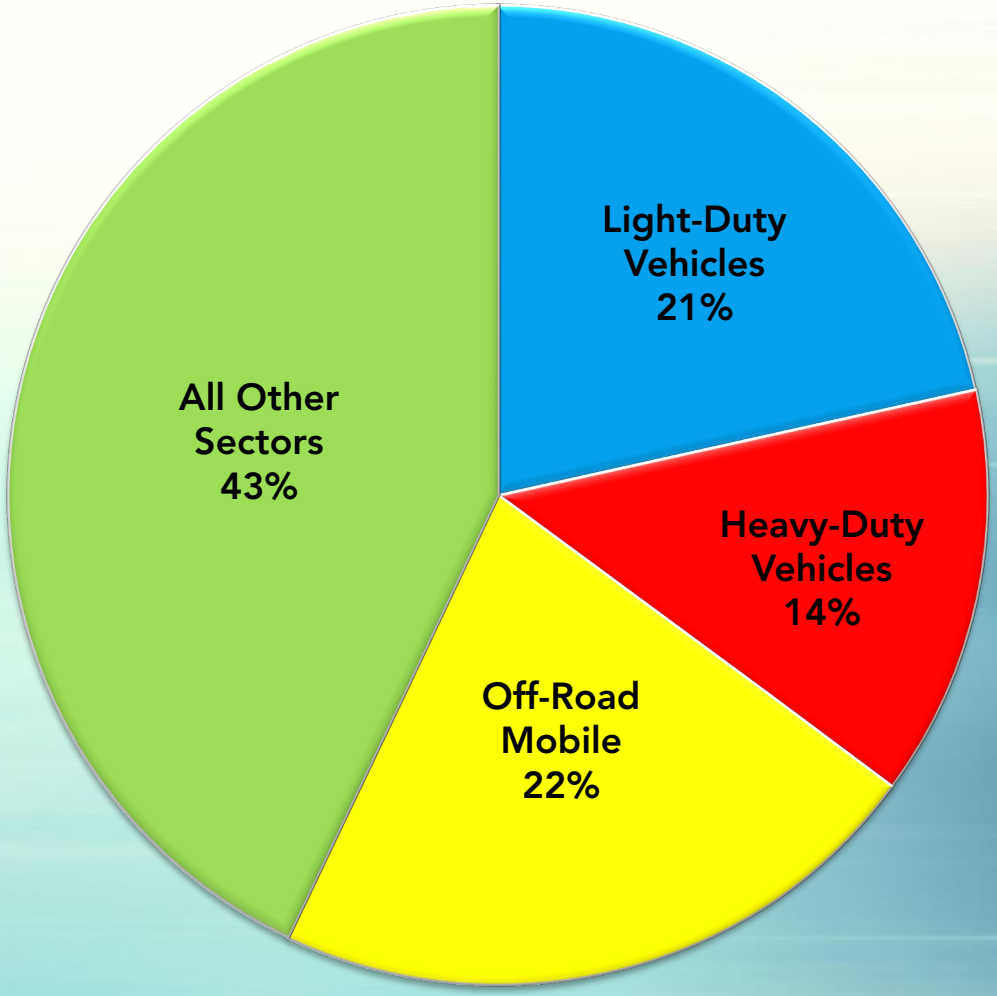
The Role of ZEVs in Meeting 177 State Air Quality Commitments

- Achieving and maintaining National Ambient Air Quality Standards for ozone, a major component of smog, continues to be a challenge in Section 177 states
- On-road vehicles, and in particular light-duty cars and trucks, are a major source of harmful smog-forming pollutants
- ZEVs help to address this challenge and provide improved public health benefits

2017 NOx Emissions in the Section 177 ZEV States
Total = 3,745 tons per day



Source: 2017 National Emissions Inventory (NEI). U.S. Environmental Protection Agency. Available at https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data#datas

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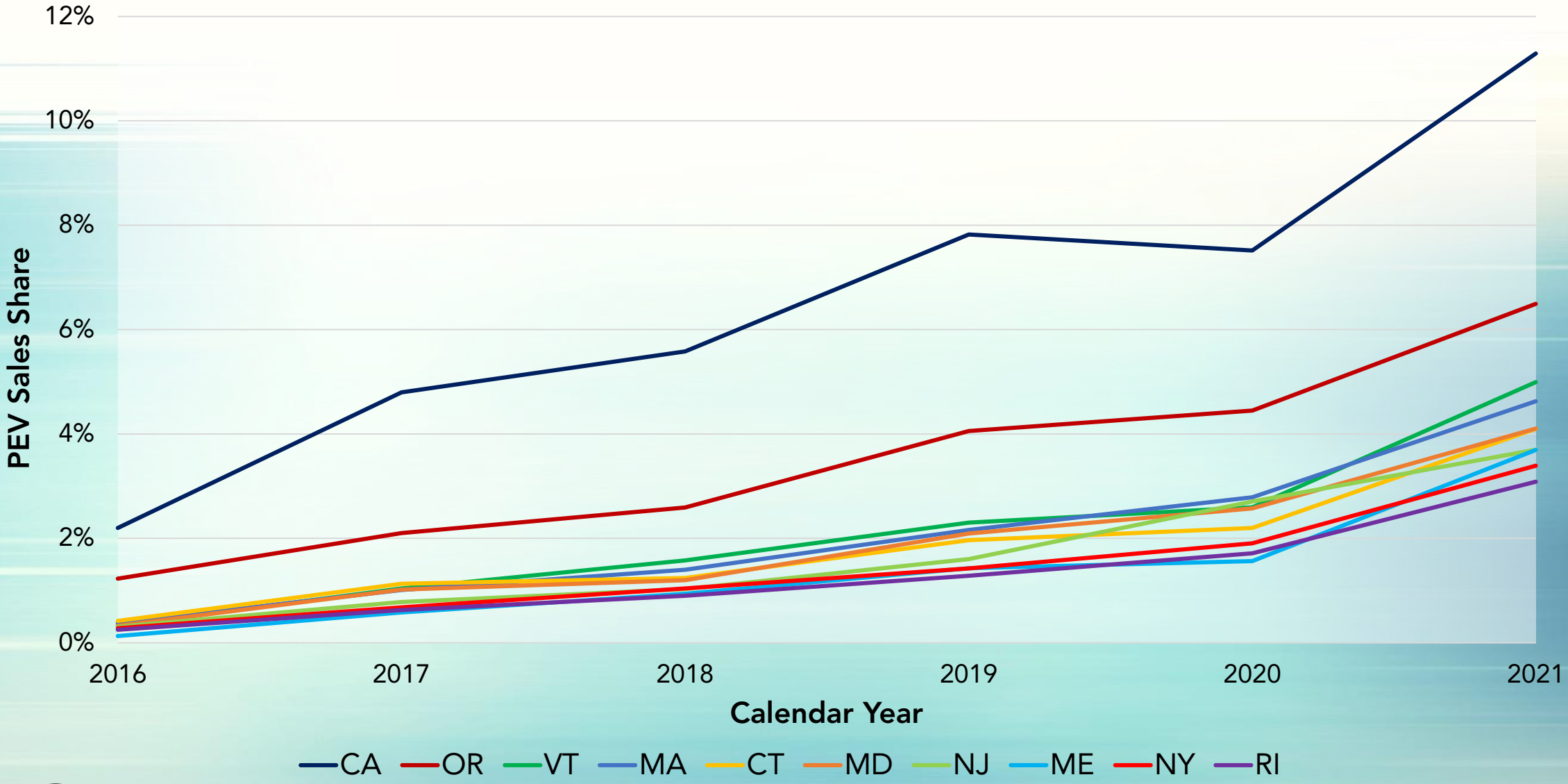
Plug-In Electric Vehicle (BEV+PHEV) Share of Light-Duty Vehicle Sales, January 2016-June 2021



Source: IHS Markit / Polk

ACC II: ZEV Pooling Proposal

- **Rationale:** Pooling provides flexibility to address varying needs and circumstances of 177 states, California, and OEMs by giving automakers flexibility in the early years, while ensuring sales ramp up to levels needed to achieve the states' climate and air quality goals
- **Concept:** For MYs 2026-2030, OEMs may transfer 2026 and later MY credits within a single pool (CA + 177 States) to meet up to 15% of its total obligation in each state in MY 2026, declining to 10% of its total obligation in each state in MY 2030
- **Limitations on pooling:**
  - *Fresh credits* – OEMs may only transfer MY 2026 and later credits; historical and EJ credits are ineligible
  - *Declining cap* – Pooling is capped at 15% in MY 2026, declining to 10% in MY 2030

MY	2026	2027	2028	2029	2030	2031
Cap	15%	14%	12%	11%	10%	0%

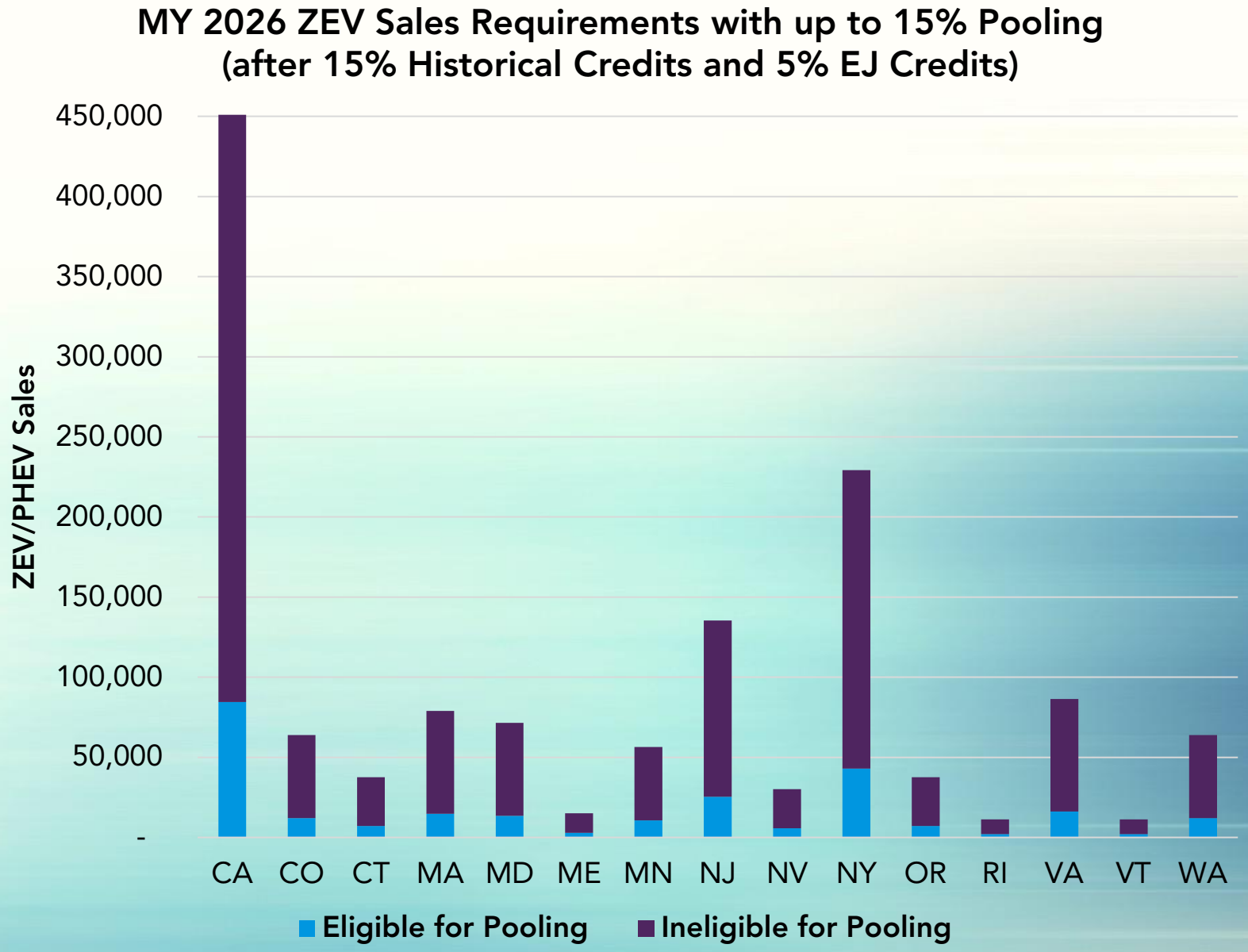
  - *Sunset* – Pooling ends after MY 2030

Pooling ZEV Credits

OEMs must deliver substantial volumes of vehicles in each ZEV state to comply

Only credits from excess sales may be transferred to other states

Requiring "fresh" credits for pooling maintains overall vehicle volumes and GHG reductions



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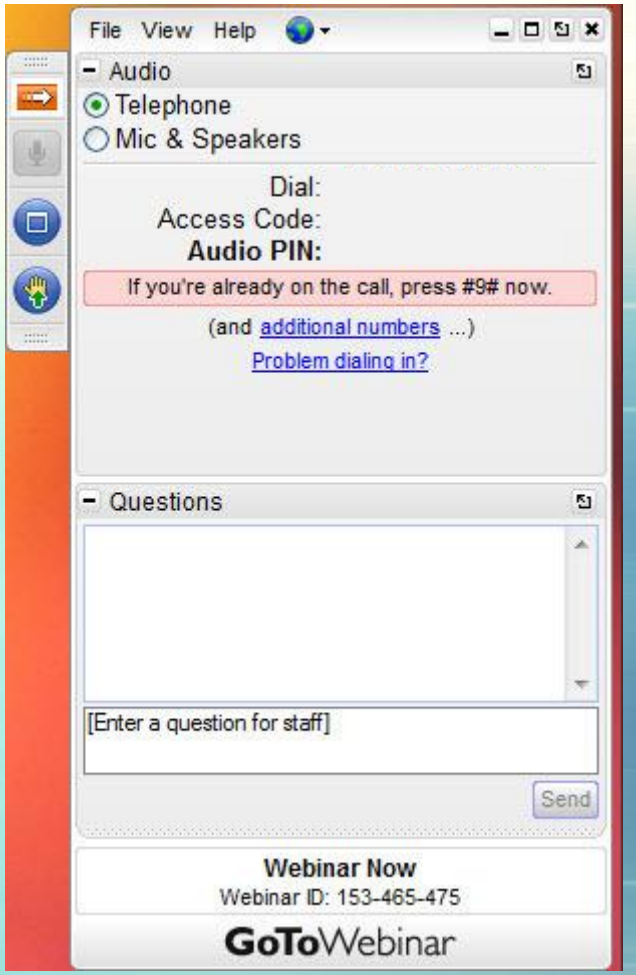


Updated Costs and Emission Impacts

Updated Costs

- In May, incremental vehicle costs were presented for individual technology packages (BEV, PHEV, FCEV)
  - Workbook posted on website

- These costs are now rolled up into fleetwide compliance costs for the proposal

ZEV and PHEV
Summary of Cost Updates from early Feedback

Directionally reduced costs:

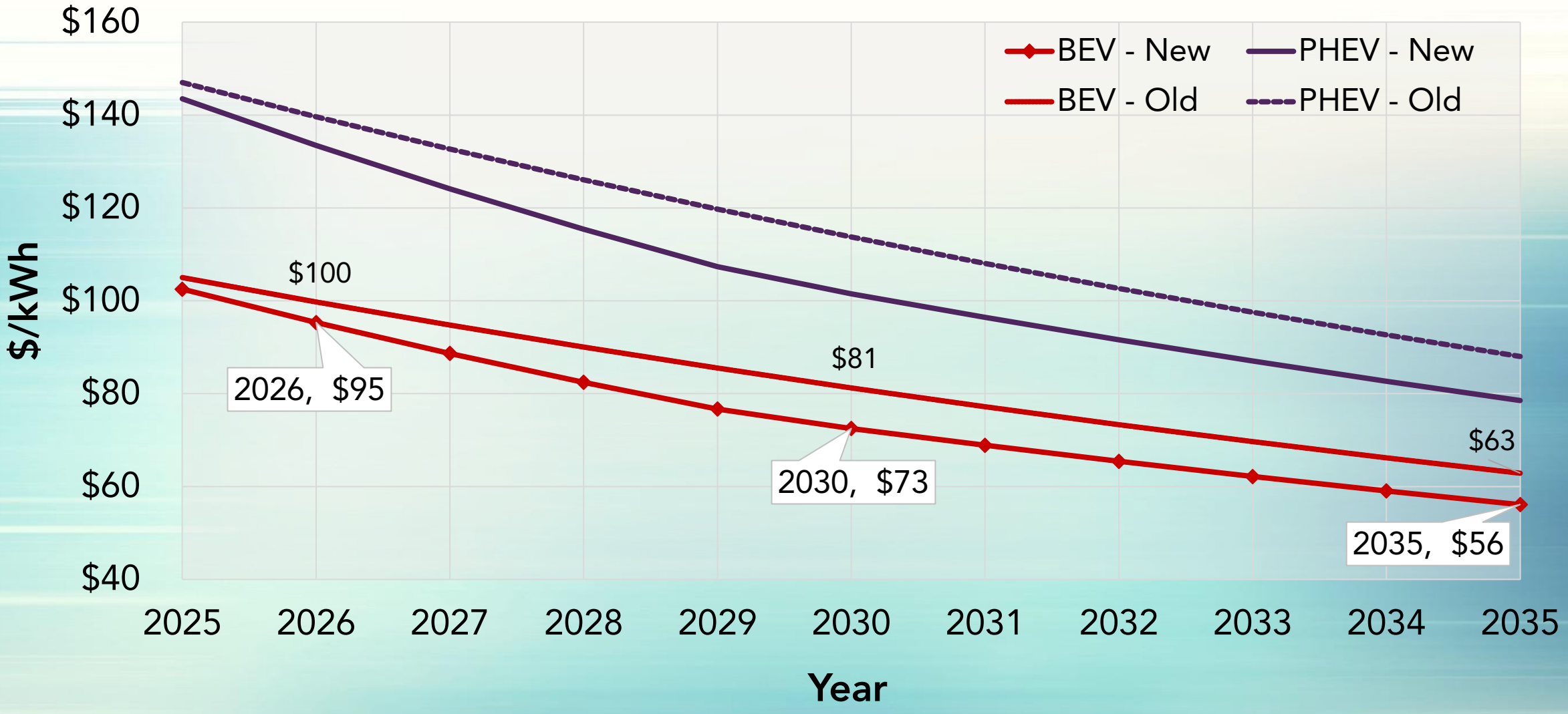
- Lowered battery pack per kWh costs
- Adjusted Small Car BEV efficiency upwards
- Downsized BEV e-motor power to be closer to conventional vehicles
- Raised % of Total Battery Energy assumed to be usable for PHEVs
- Added 2025MY GHG compliance cost placeholder ($965) for conventional vehicles

Directionally increased costs:

- Added in onboard charger fixed costs (~$730 by 2035)
- Simplified to single FCEV package per vehicle class with e-motor power closer to conventional vehicles
- Moved to lower production rate FCEV component cost curves
- Lowered % of Total Battery Energy assumed to be usable for BEVs

Further refinement planned, including on delete costs & motor sizing

Updated Battery Pack Costs



Staff projections are within a range of other studies reviewed

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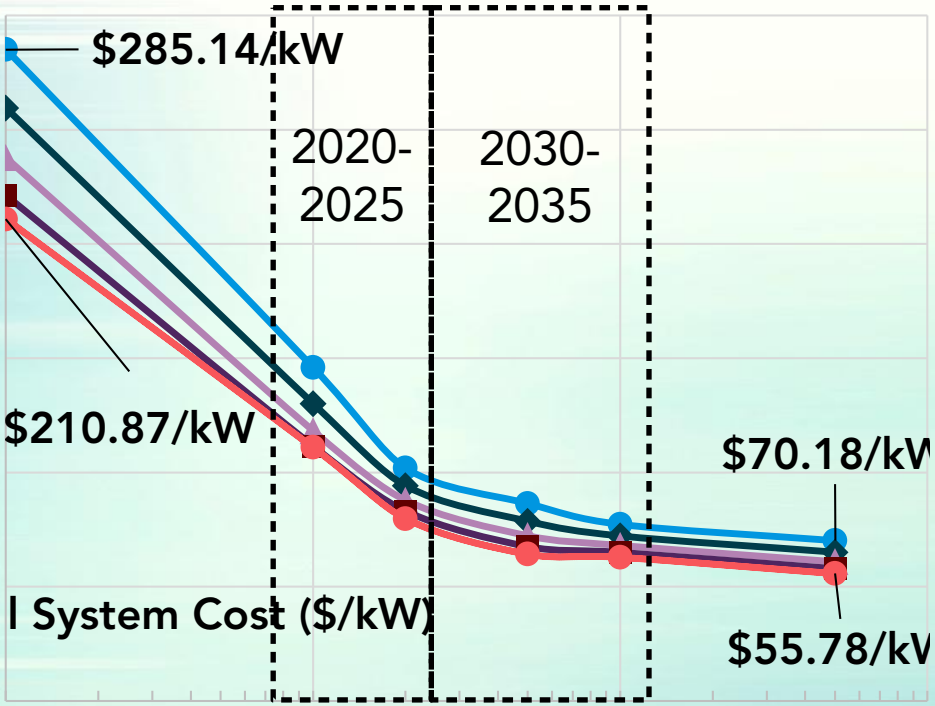
Updated Fuel Cell and Hydrogen Storage Costs



Changes Since May Workshop

- Single FCEV package used for both "Base" and "Premium" vehicles in all classes
  - Better matched FCEV vehicle power to conventional vehicles
- Reduced pace of future growth in production volume
- Combined, fuel cell and hydrogen storage system costs increase $240-$3,000

OEM Cost and Emission Benefit Calculations Overview

For each model year (2026-2035):

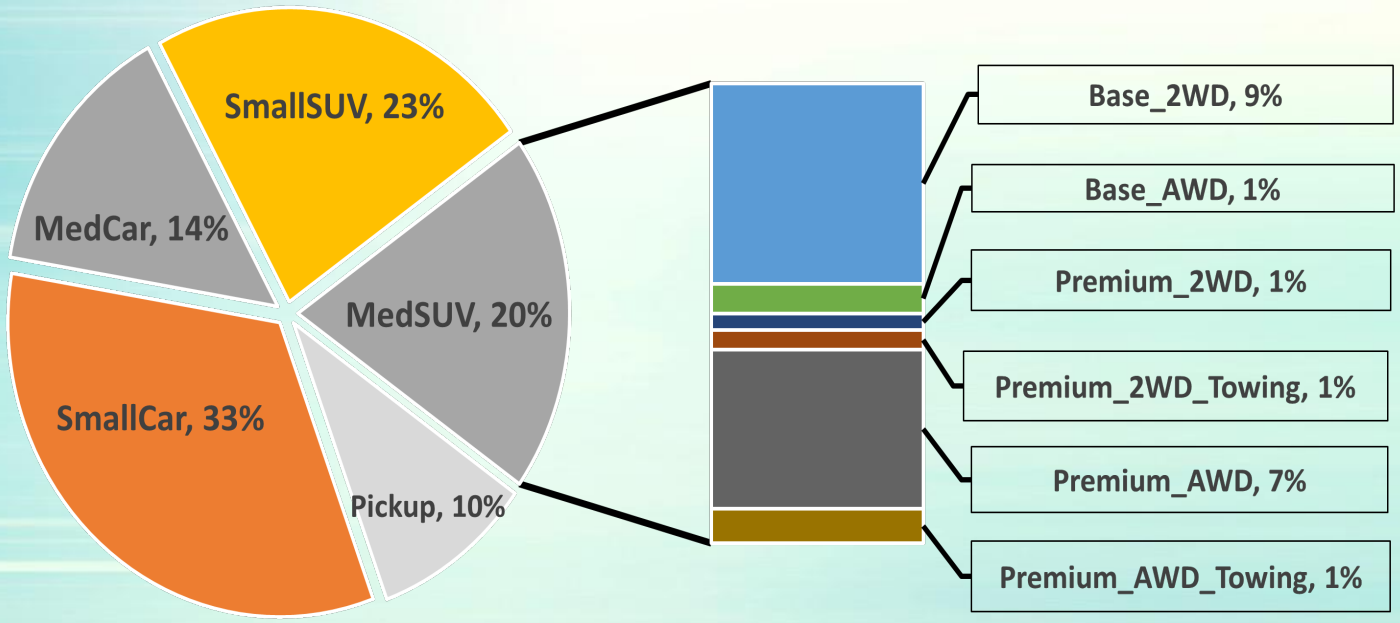
1. Identify the vehicle class or classes with the lowest incremental cost for BEV, FCEV or PHEV application.

2. Industry-wide, each model year, convert non-ZEVs to ZEVs such that lowest total cost is achieved while meeting target stringency.

3. Use final technology splits among different vehicle classes as MY inputs to the EMFAC2021 model to calculate emission reductions.

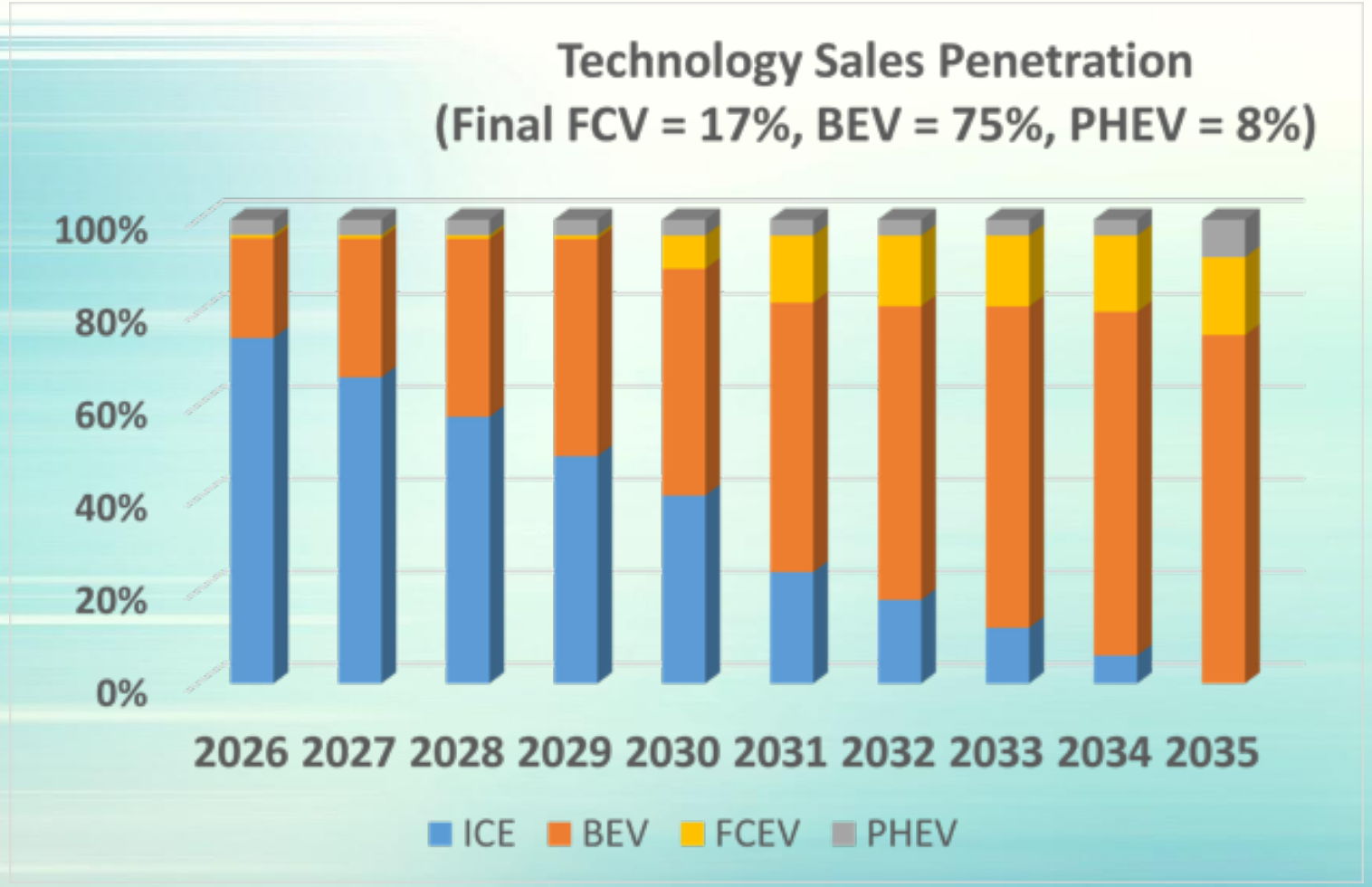
Calculating Compliance Costs

Fleet Characterization



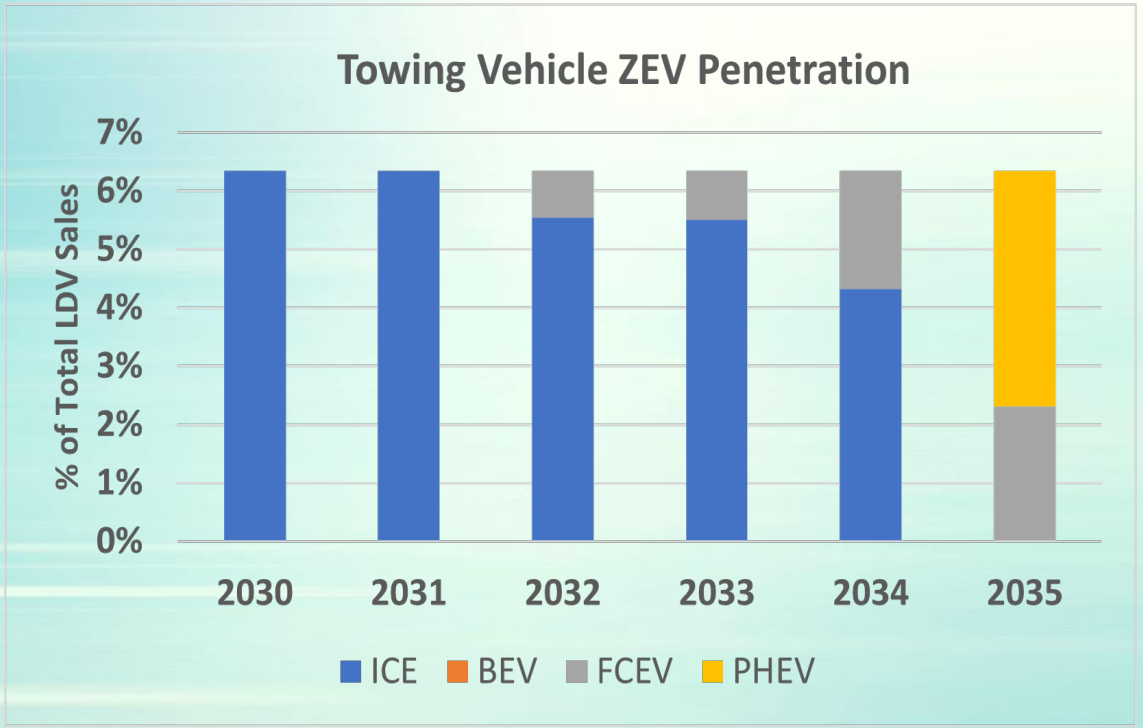
1. Vehicle class assignments based on historical sales data
2. Additional assignments reflecting vehicle characteristics (AWD, Towing, etc.)
3. Scale sales of each class proportionally to match emission model projections of total LDV sales in regulation timeframe

Technology Penetration for the Proposal



- BEV sales provide the lowest cost compliance option for OEMs
- FCEVs become prominent for small cars and heavy towing trucks in 2030 and beyond
- PHEVs become prominent for heavy towing trucks in 2035

Towing Packages in the Fleet



- Towing vehicles represent ~6% of the LDV fleet
  - Defined as vehicles in the Pick-up and Med/Large SUV classes with an 8-cylinder or larger engine
- Only PHEV and FCEV packages used
  - Represent some of the last vehicles to become ZEVs in 2032-2035

Results for the Proposal

- Costs:
  - Represents initial purchase price increase only
  - Sum of total costs divided by total sales
- Tailpipe Emission Benefits:
  - Statewide projected benefits (reductions) relative to light-duty vehicle baseline

CY	Ave. Incremental Retail Price Increase Per Vehicle ($)
2030	$ 1,417
2035	$ 1,939

	NOx		ROG		CO2		PM	
CY	(tpd)	% Reduction	(tpd)	% Reduction	(MMT/yr)	% Reduction	(tpd)	% Reduction
2030	3.8	5%	2.3	2%	13	11%	0.03	3%
2040	25.0	47%	19.2	21%	65	62%	0.17	17%
2045	34.4	71%	30.2	37%	81	79%	0.22	22%
2045	34.4	71%	30.2	37%	81	79%	0.22	22%
2050	40.5	86%	43.1	55%	89	87%	0.24	24%

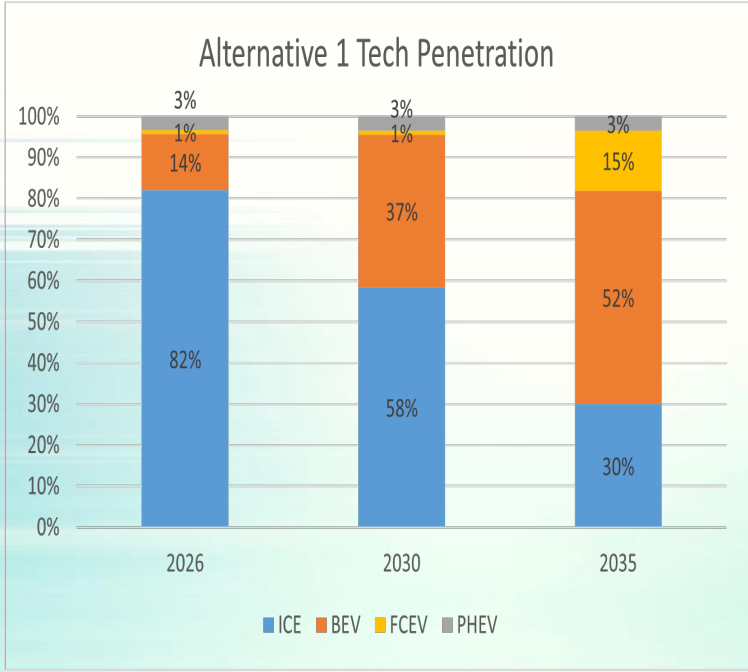
Alternatives Considered

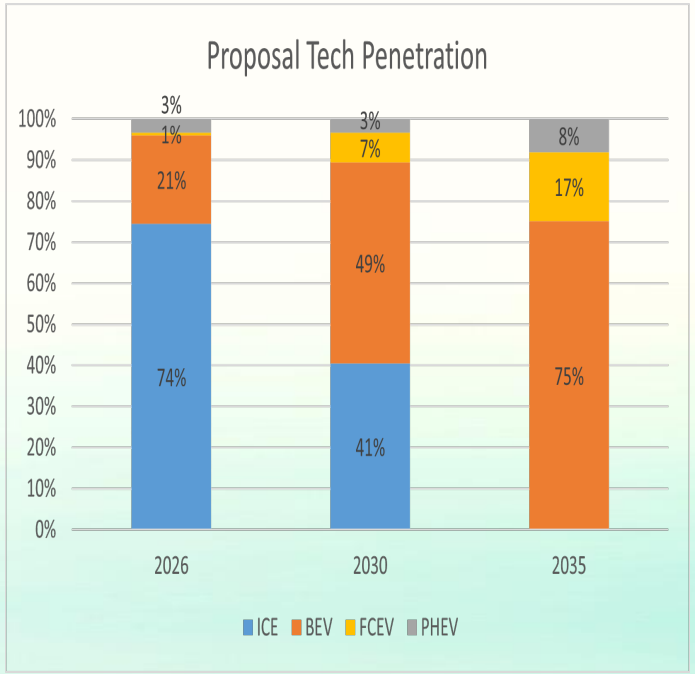
Alternative 1

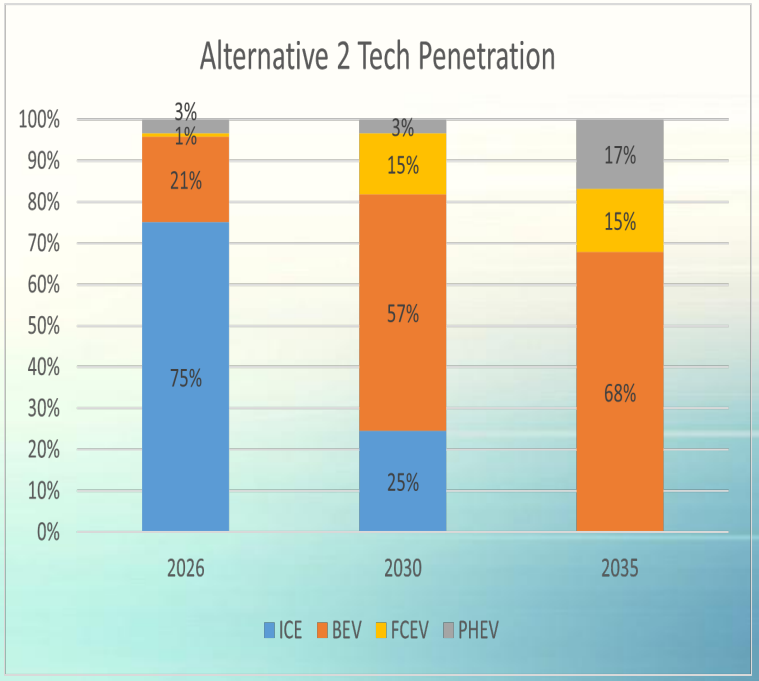
- 70% ZEVs by 2035 based on past surveys showing hesitancy to purchase

Alternative 2

- 100% ZEVs by 2032 accelerated roll-out influenced by aggressive industry announcements







Technology Penetration for Alternative Scenarios

- BEVs remain the technology of choice for cost minimization.
- FCEV usage is similar at the end of all three scenarios but gets to that end point earlier for the most stringent Alternative 2.
- Also in Alternative 2, PHEVs play a bigger role with an earlier switch to ZEVs for large trucks and SUVs by 2032.

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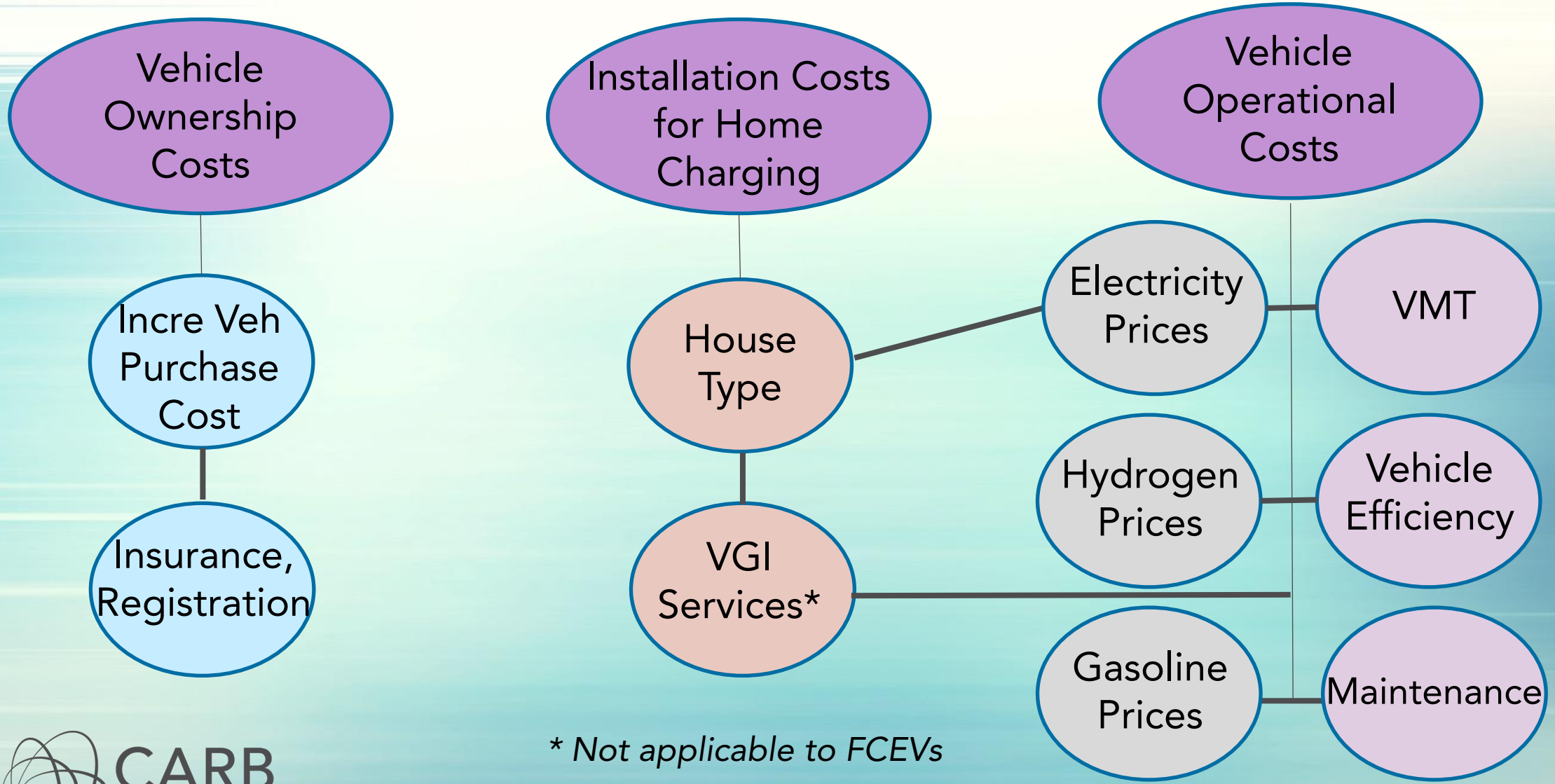
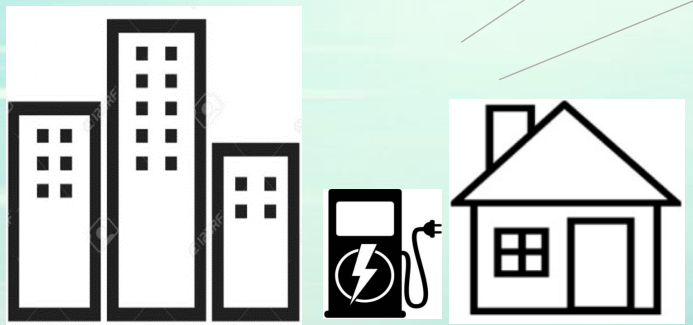
Total Cost of Ownership



** Not applicable to FCEVs*

Home Type and Ability to Charge at Home Affect Electricity Costs

Multi-Unit Dwelling (MUD)



Single Family Home (SFH)

SFH or MUD <u>without</u> home charging

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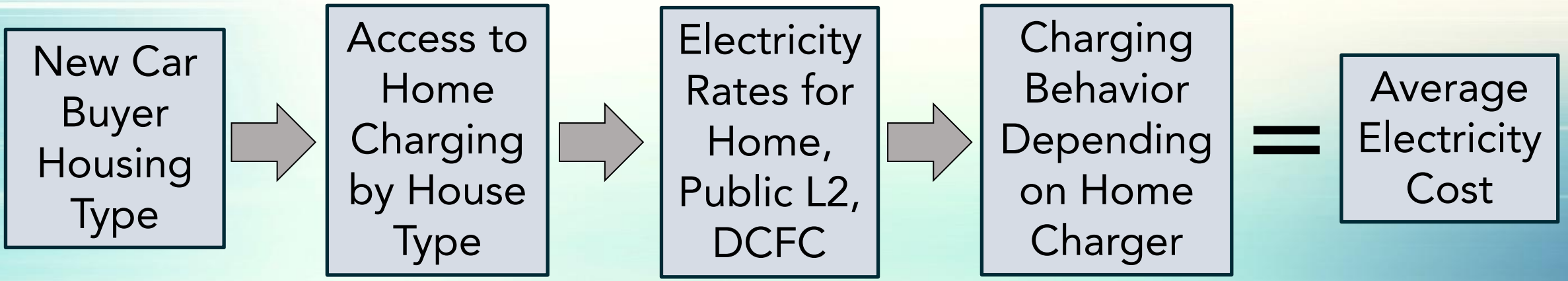
Electricity Cost Estimation Process

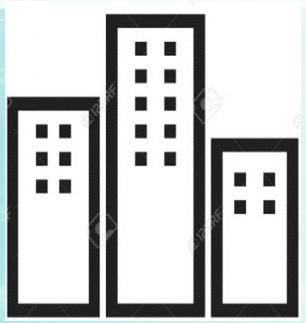
Most of these variables change over time

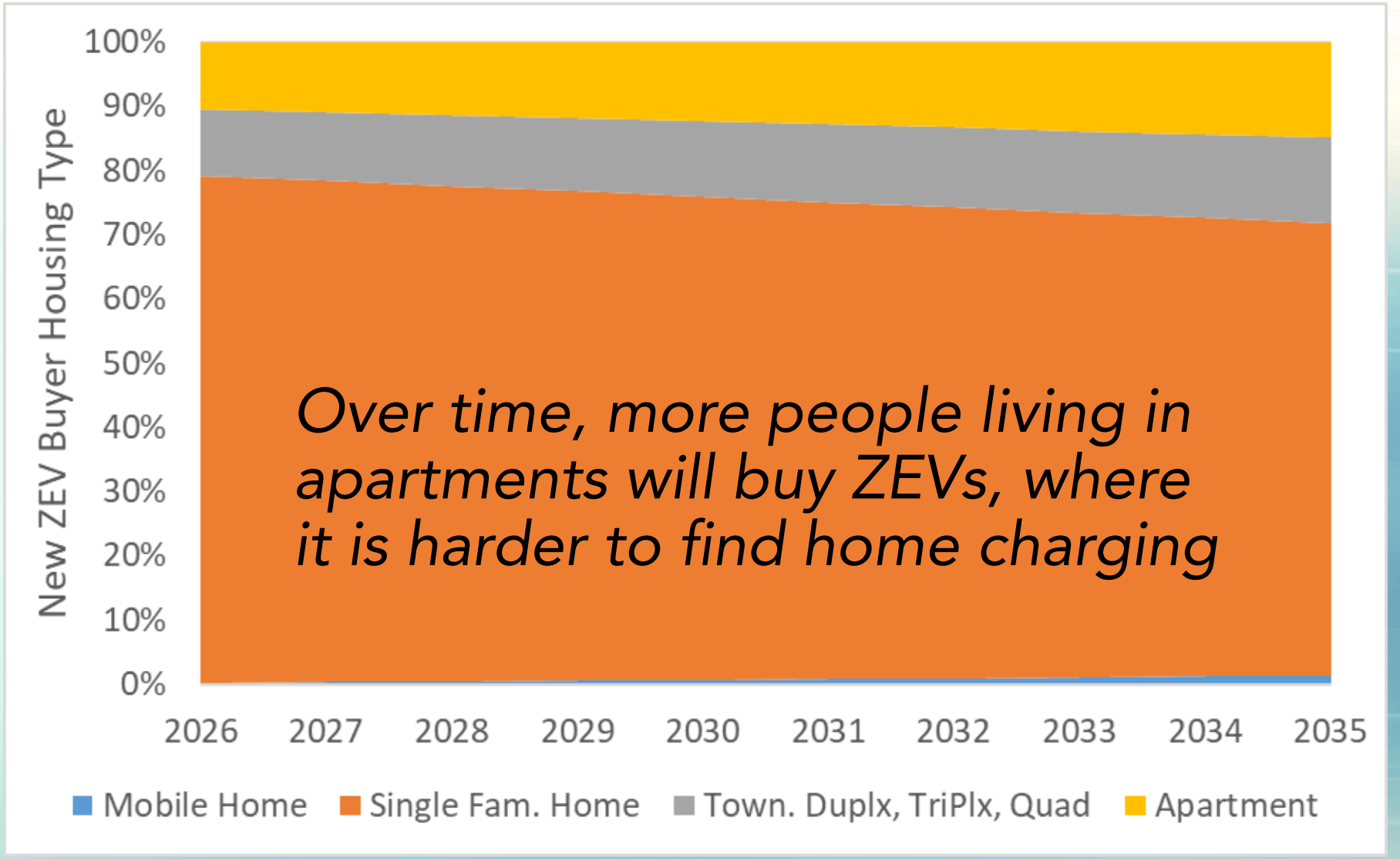


Determine *how many* drivers have home charging

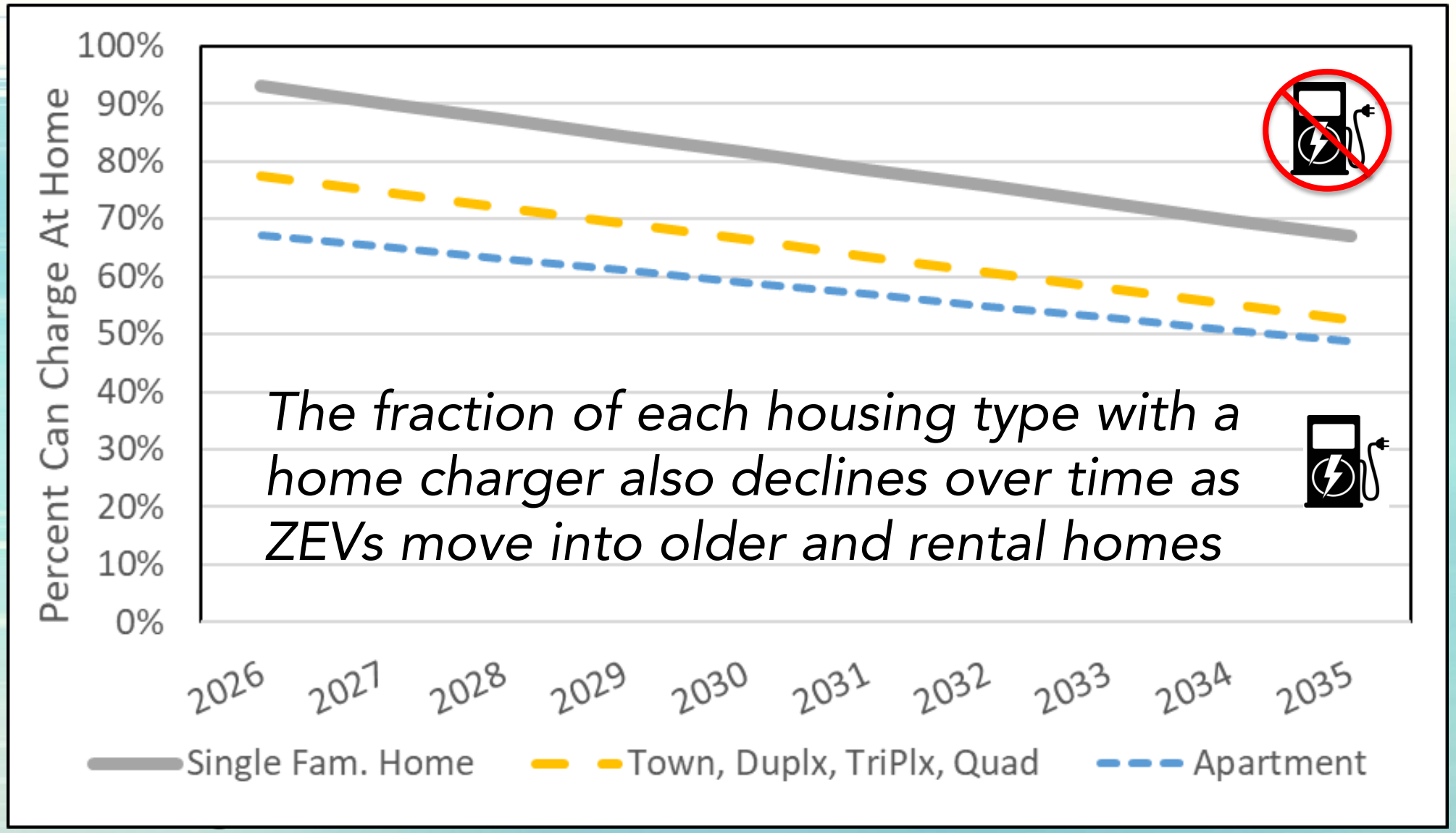
Calculate *different* average electricity costs for drivers based on home and public charging

① Housing Type for CA New ZEV Buyer





② Home Charging Access by Housing Type

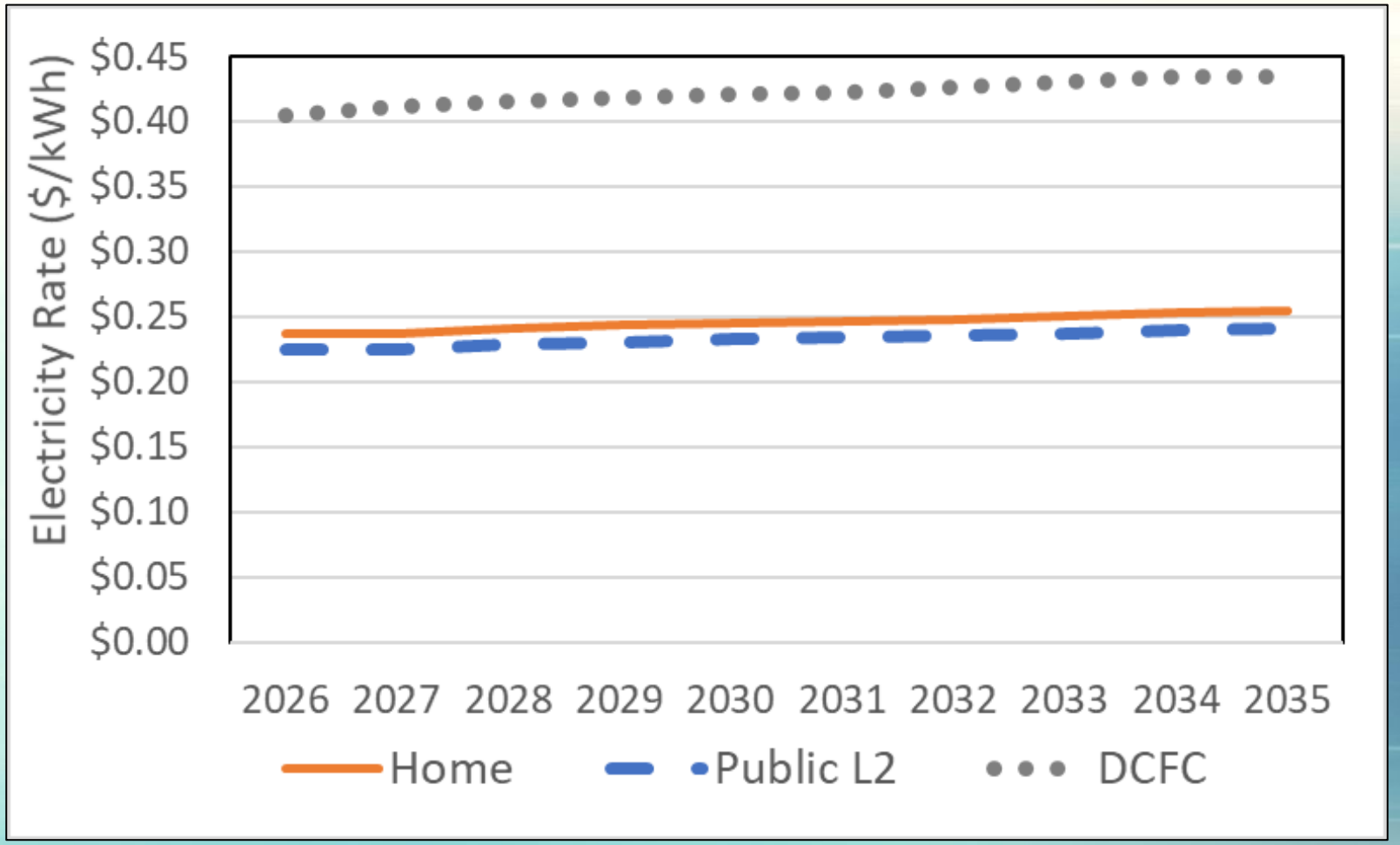


The result: Fraction of new ZEV owners with home charging:

- 89% 2026
- 63% 2035

③ Electricity Rate Projections

- **Home**: CEC mid-case projection from draft 2021 IEPR
- **Public Level 2**: NREL study + CEC Commercial Growth Rate
- **DCFC**: EVgo, EA + CEC Commercial Growth Rate



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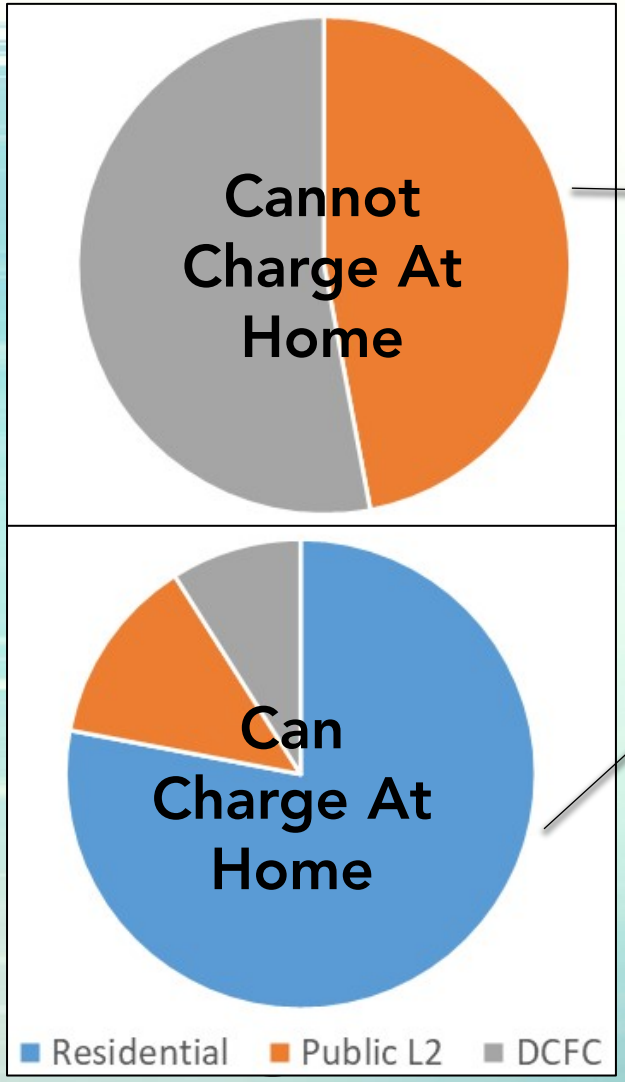
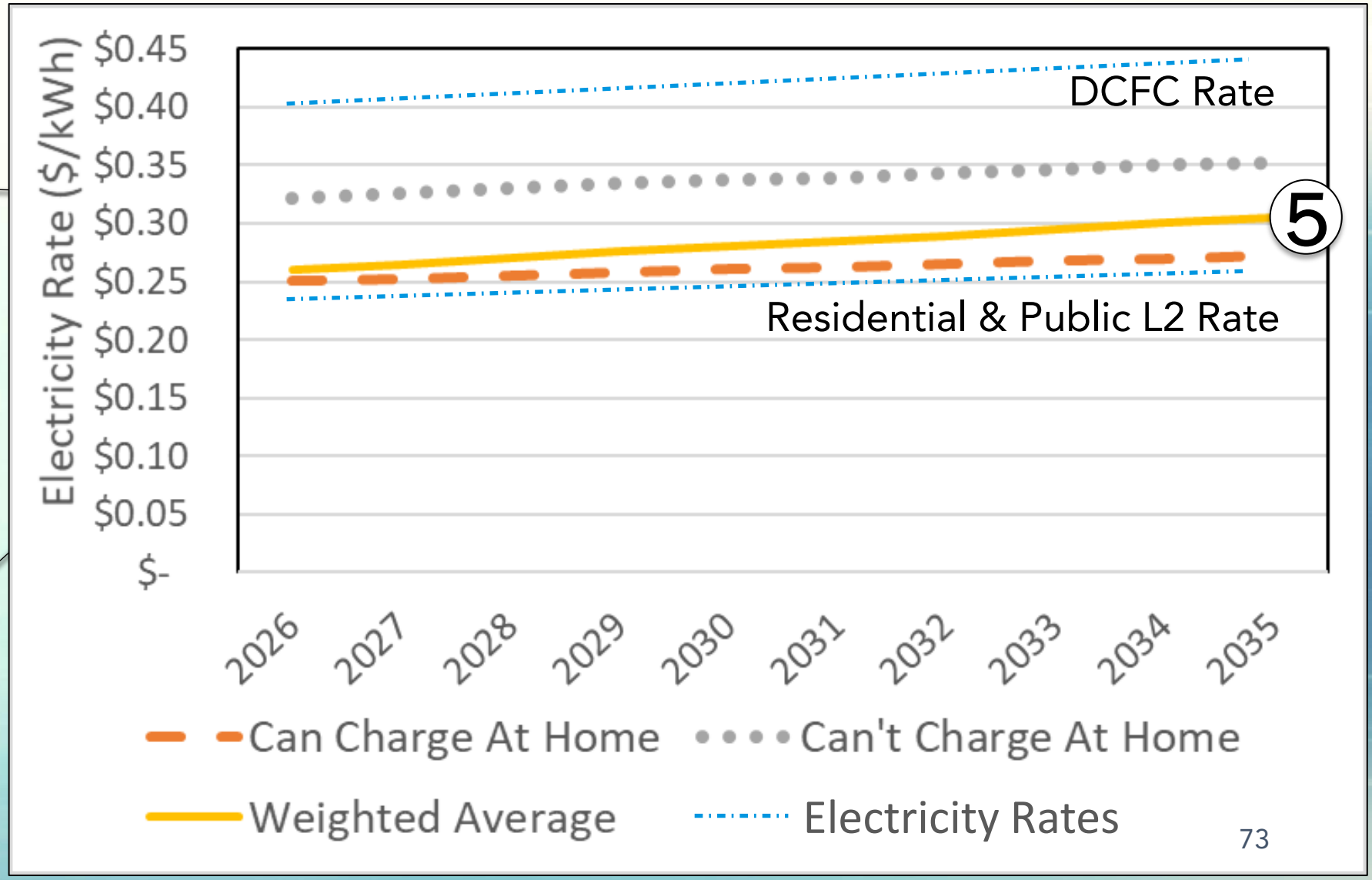
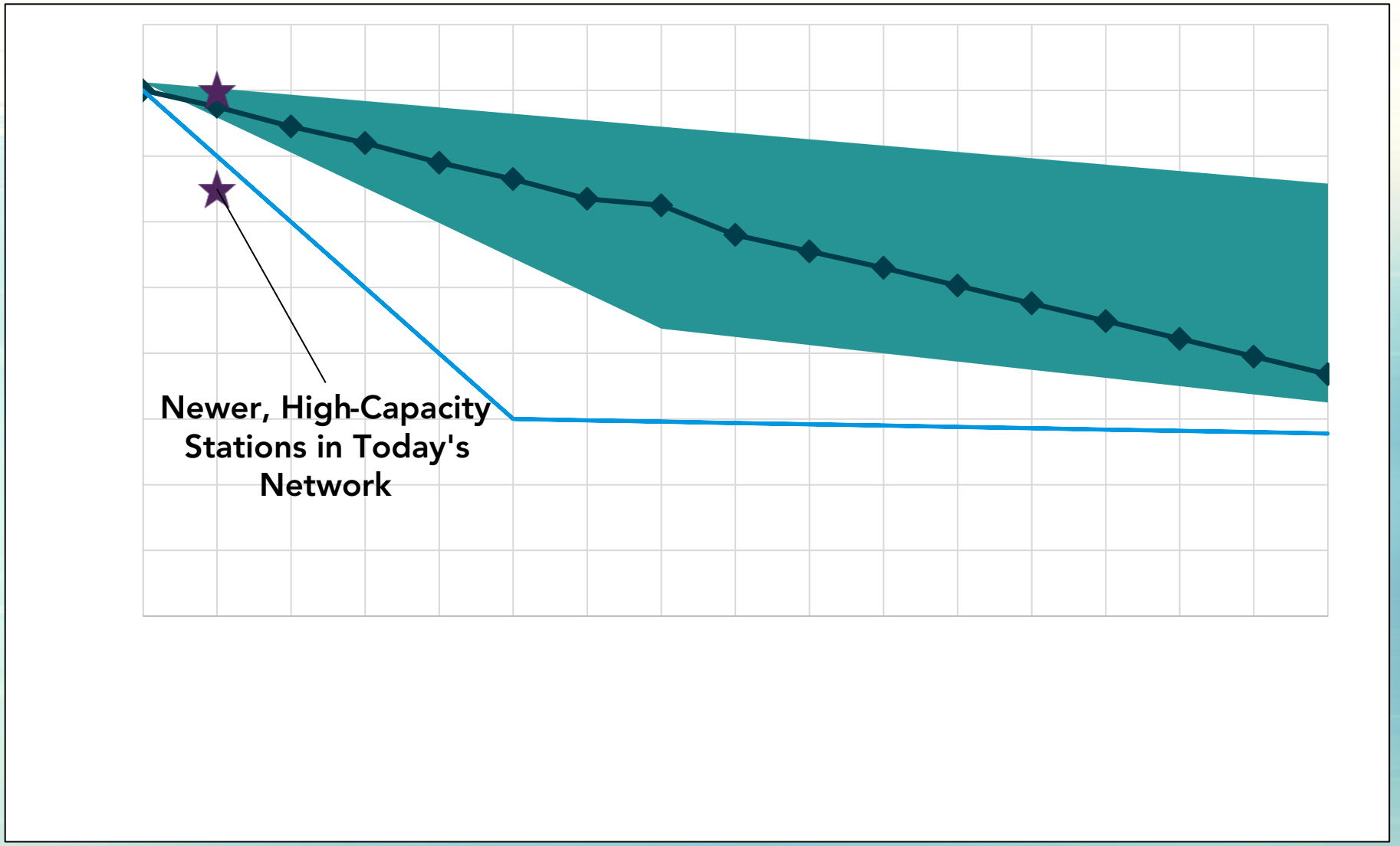
4 Charging Behavior & Average Electricity Cost

Charging Behavior



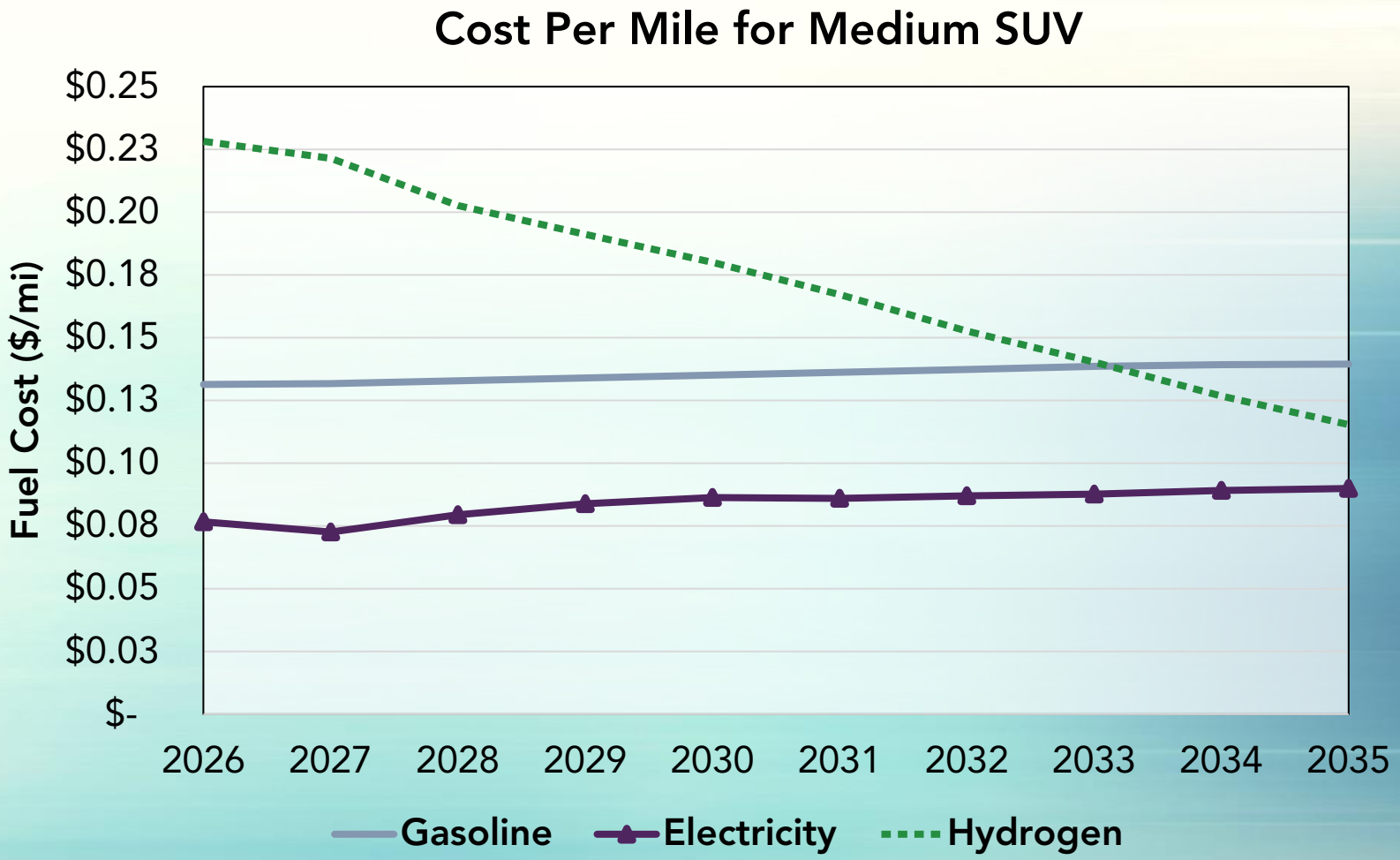


Hydrogen Fuel Price Projection



Fuel Cost Comparison

- **Gasoline**: CEC mid-case projection from draft 2021 IEPR ($3.77/gal 2026, $4.00/gal 2035)
- **Electricity**: Weighted average
- Vehicle efficiencies for Medium SUV



Charging Equipment Costs Assumed

Housing Type	Outlet Upgrade*	EVSE Unit **	Total/home
Single Family Home (SFH) - Detached	$680	---	$680
SFH - Attached, Duplex, Triplex, Quad	$2,000	---	$2,000

** Costs are constant over regulation period*

*** No direct costs assumed given convenience cord requirement*

- **Large MUD** → Assume public Level 2 rates capture install costs
- **DC fast charging** → Assume retail rates capture install costs

Vehicle to Grid Integration Assumptions

V1G (2026+)

- 100% of drivers have ability to use time-of-use (TOU) rates
- Ongoing analysis to consider current and future usage of TOU rates in California

V2G (Mostly 2030+)

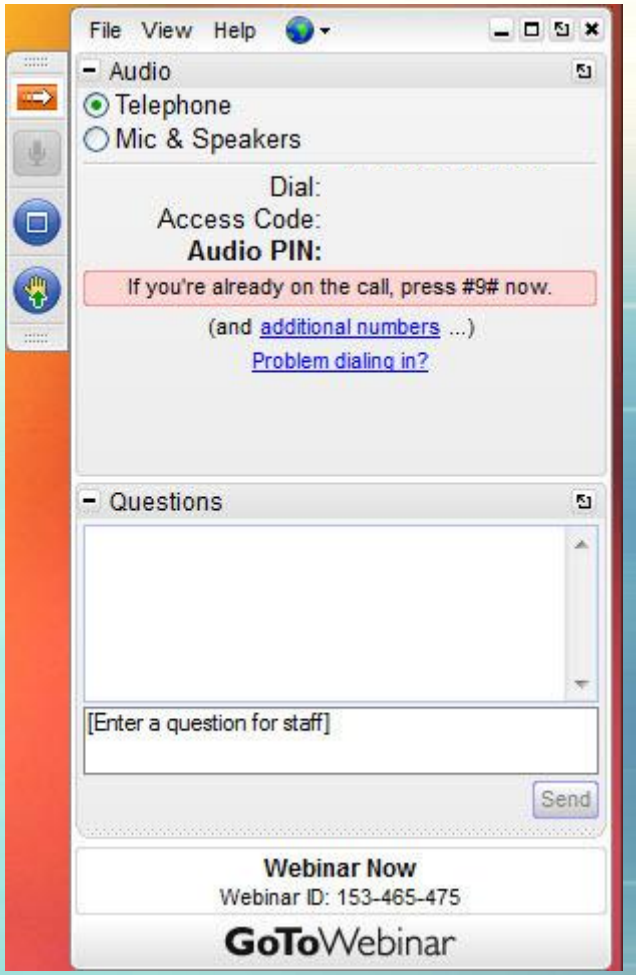
- Home V2G used to mitigate peak rates and usage
  - 6-10kWh per veh session (2026-2035), 5 days/week
- Mainly for single family homes
- Cost savings ~32% per event
- Small phase-in of BEV driver access

Additional TCO Assumptions

Category	Assumption
Maintenance savings	ANL 2021 (BEVs, PHEVs); FCEVs assumed same as PHEVs
Insurance cost difference	Scale with vehicle incremental cost (5%, Fulton 2018)
Registration difference	SB1 EV annual registration fee + 0.65% of vehicle value
Finance for vehicle and charger upgrade	5% interest over five years
Vehicle incentives	Not included in analysis

- Most cost assumptions vary over time
- Net cost calculations not available at this time

Please use GoToWebinar pane to ask
QUESTIONS
(include a slide number in your question, if possible, and your name and affiliation, if desired)



ACC II Timeline

SRIA Submitted to DOF: January 8, 2022
ISOR Release: May 3, 2022

Other Opportunities for Comments

- Written comments may be submitted through October 27, 2021 using the ACC II workshop informal comment submittal form
- Comments submitted can be viewed on the ACC II workshop comments log webpage
- Subscribe to the Clean Cars email list for updates on document availability and future workshops