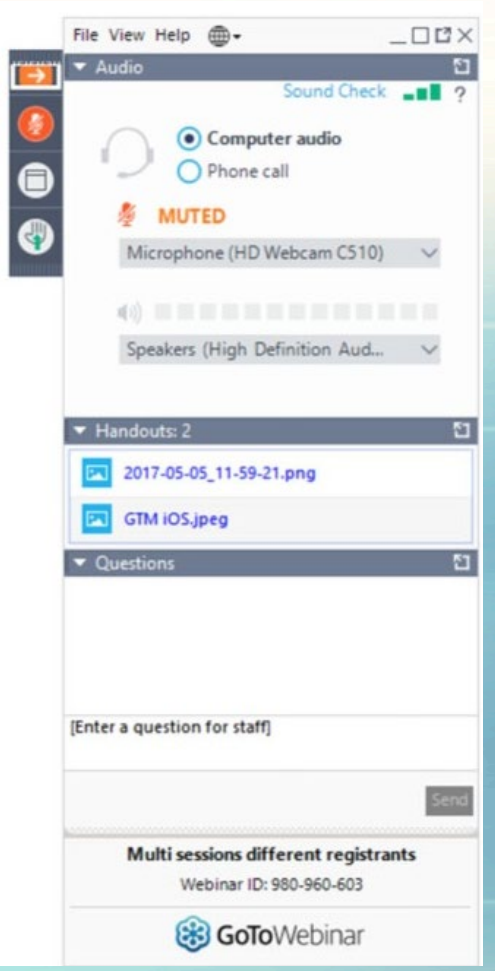
CALIFORNIA
AIR RESOURCES BOARD

Advanced Clean Cars (ACC) II Workshop

May 6, 2021

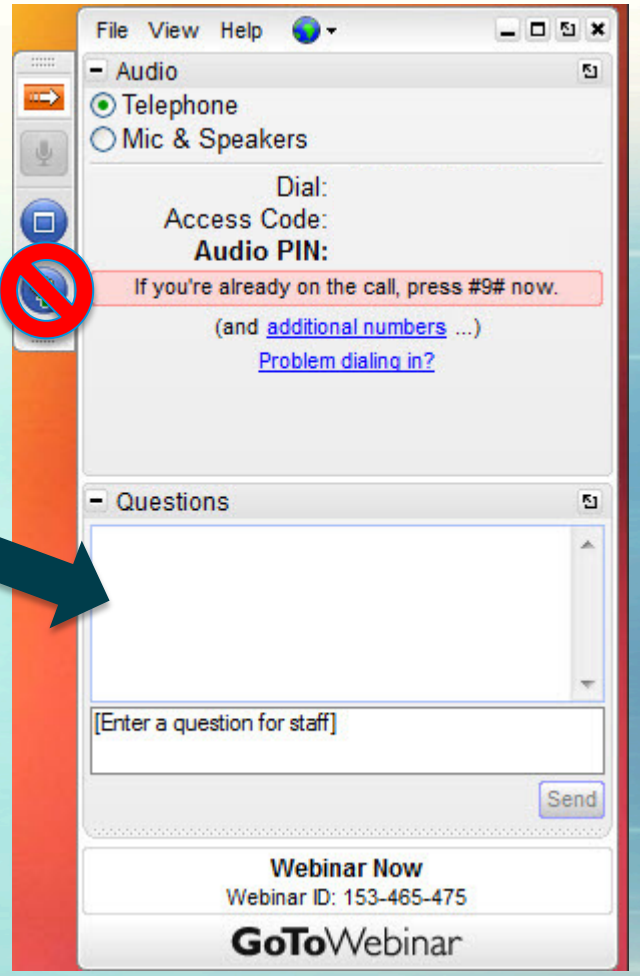
Today's Workshop Logistics

- Workshop is being recorded
- Slides and other downloads are available in the handouts section of your GoToWebinar control pane
- All handouts 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



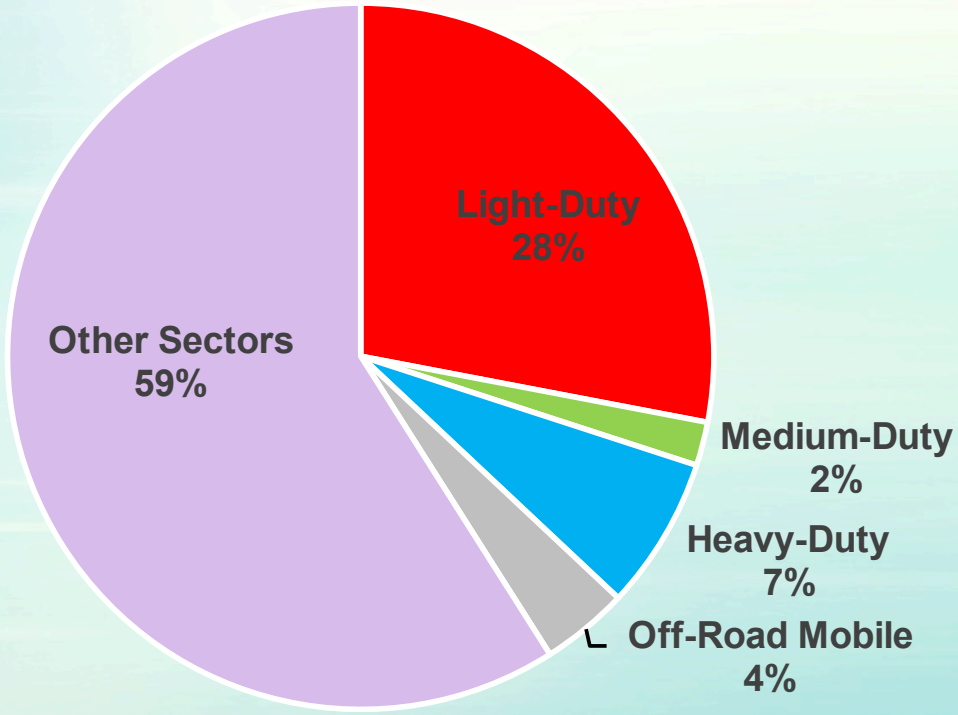
Workshop Questions

- Break for questions after each of the five sections
- All attendees will remain muted
- Questions can be sent via the GoToWebinar question box
  - Please include slide numbers in your question
- Written comments and additional questions may be submitted after today to: cleancars@arb.ca.gov

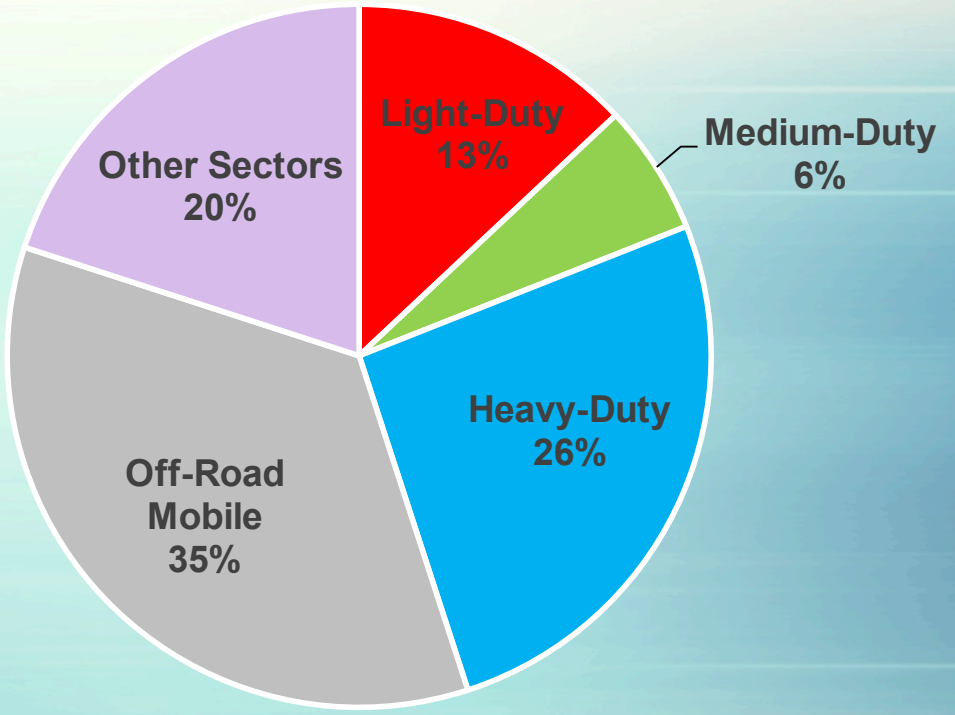


California's climate and air quality challenges still require deep reductions from light-duty vehicles

2017 Statewide GHG Emissions
Total = 424 MMTCO2e



2017 Statewide NOx Emissions
Total = 1294 tons per day



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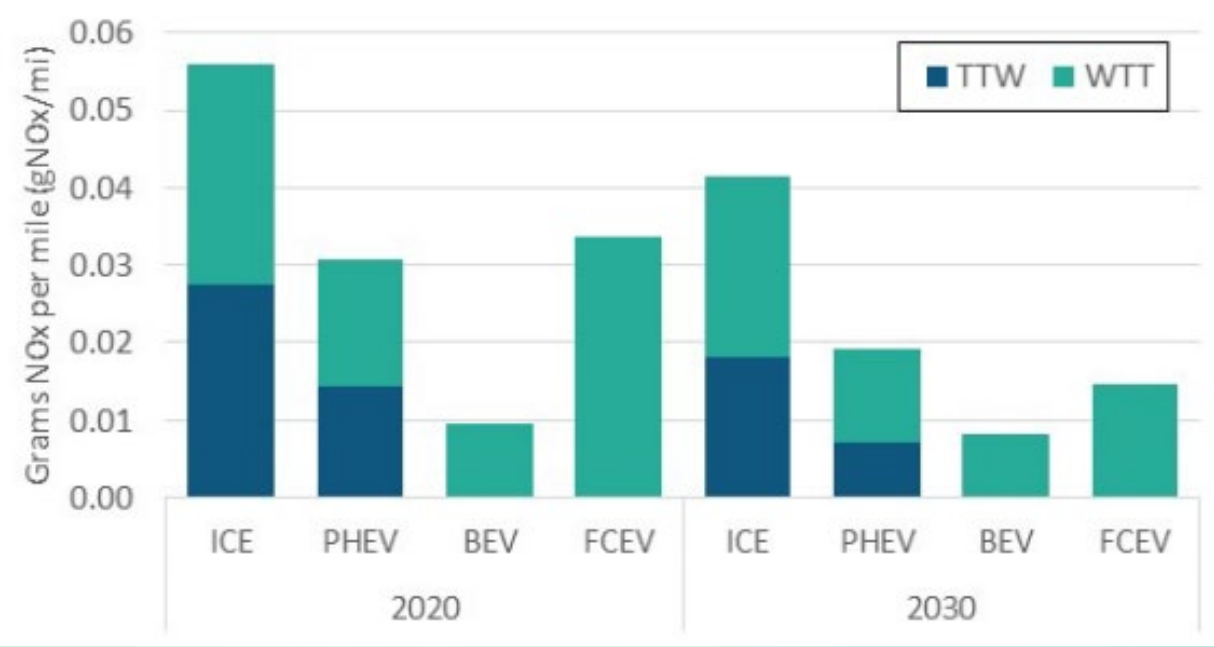
All paths to long term targets require transition to ZEVs

- PHEVs, BEVs, and FCEVs have less smog-forming and GHG well-to-wheel emissions



2020 Mobile Source Strategy
https://ww2.arb.ca.gov/sites/default/files/2021-04/Revised_Draft_2020_Mobile_Source_Strategy.pdf

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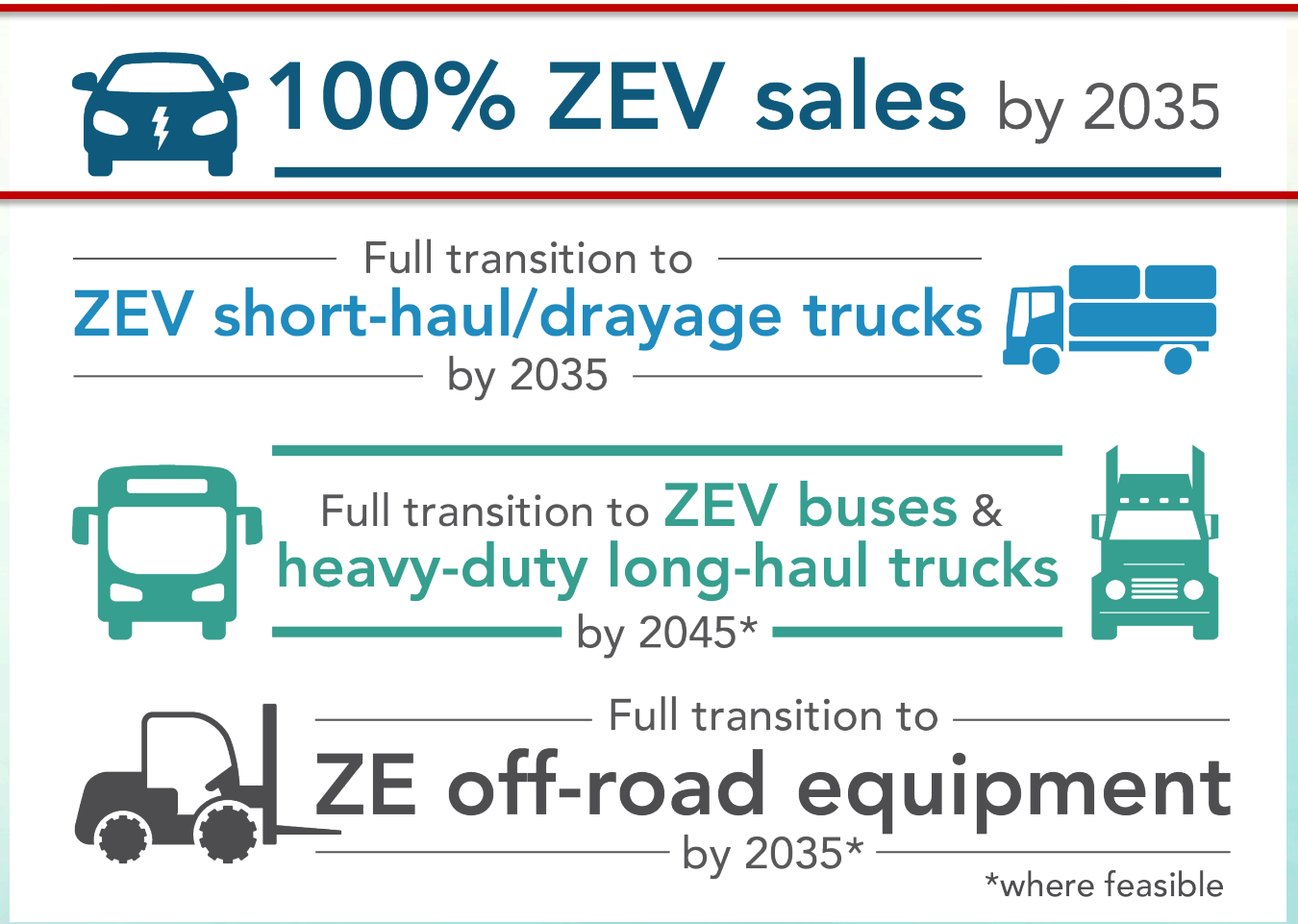
Governor's Executive Order N-79-20



Today's Workshop Agenda

1. LEV Criteria Updates
2. ZEV Regulation Proposal

   --- BREAK ---

3. ZEV Technology Cost Update
4. ZEV Assurance Measure Updates
5. Battery Labeling Proposal
6. Next Steps

LEV Criteria Emission Proposals

Overview of Updates

Today's Workshop

1. NMOG+NOx fleet average
2. SFTP emission standards
3. Intermediate soak cold-start emissions
4. Quick-drive away emissions
5. PHEV high power cold-start emissions
6. Evaporative emission standards
7. Robust emission control for heavier vehicles

Future Workshop

- US06 PM emission control

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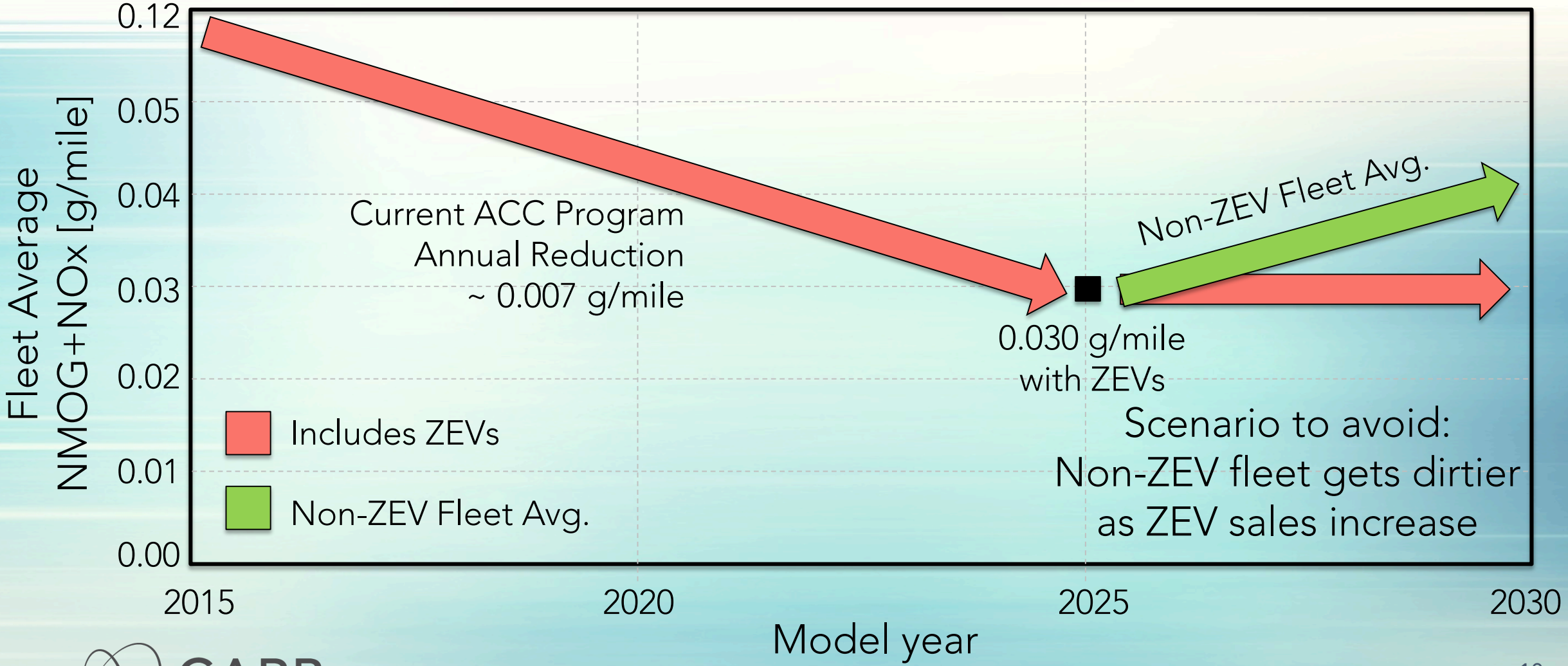
1. NMOG+NOx Fleet Average

Recap from Previous Workshop



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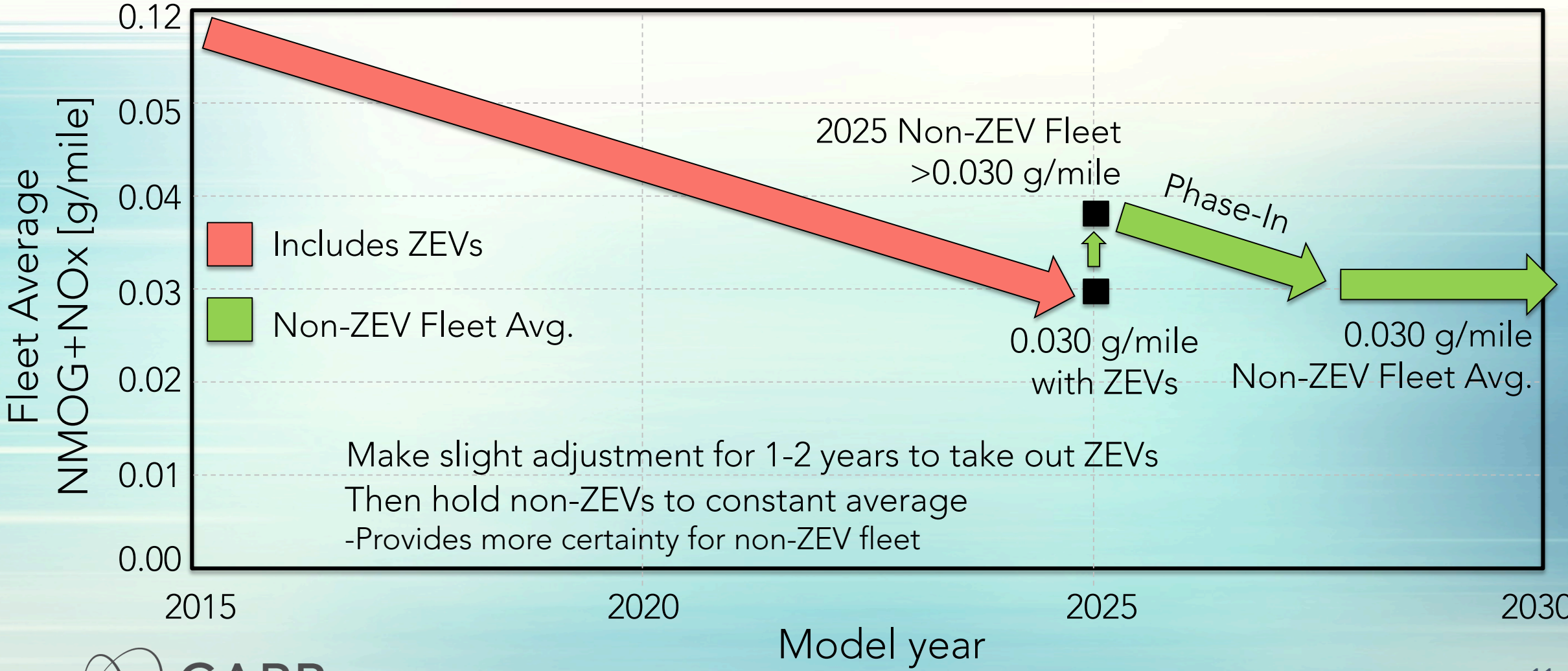
1. NMOG+NOx Fleet Average

Proposal: Remove ZEVs from NMOG+NOx Fleet Average



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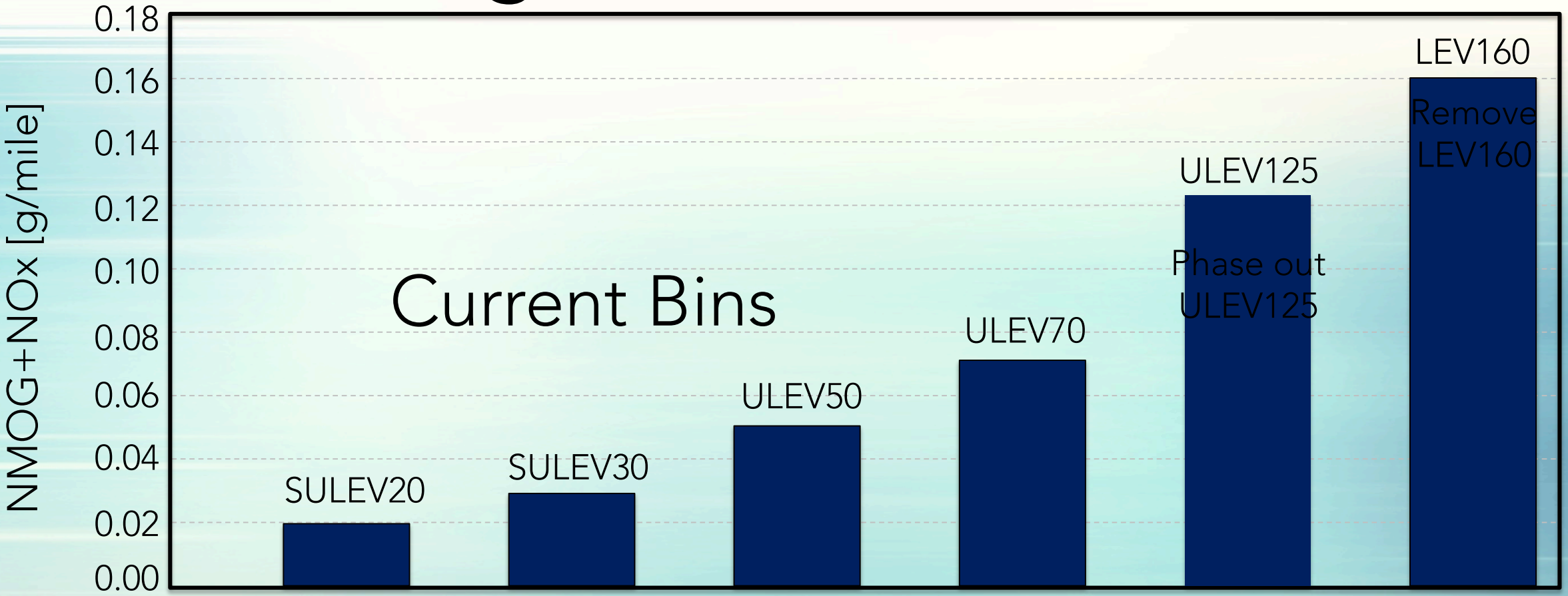
1. NMOG+NOx Fleet Average Changes to Certification Bins



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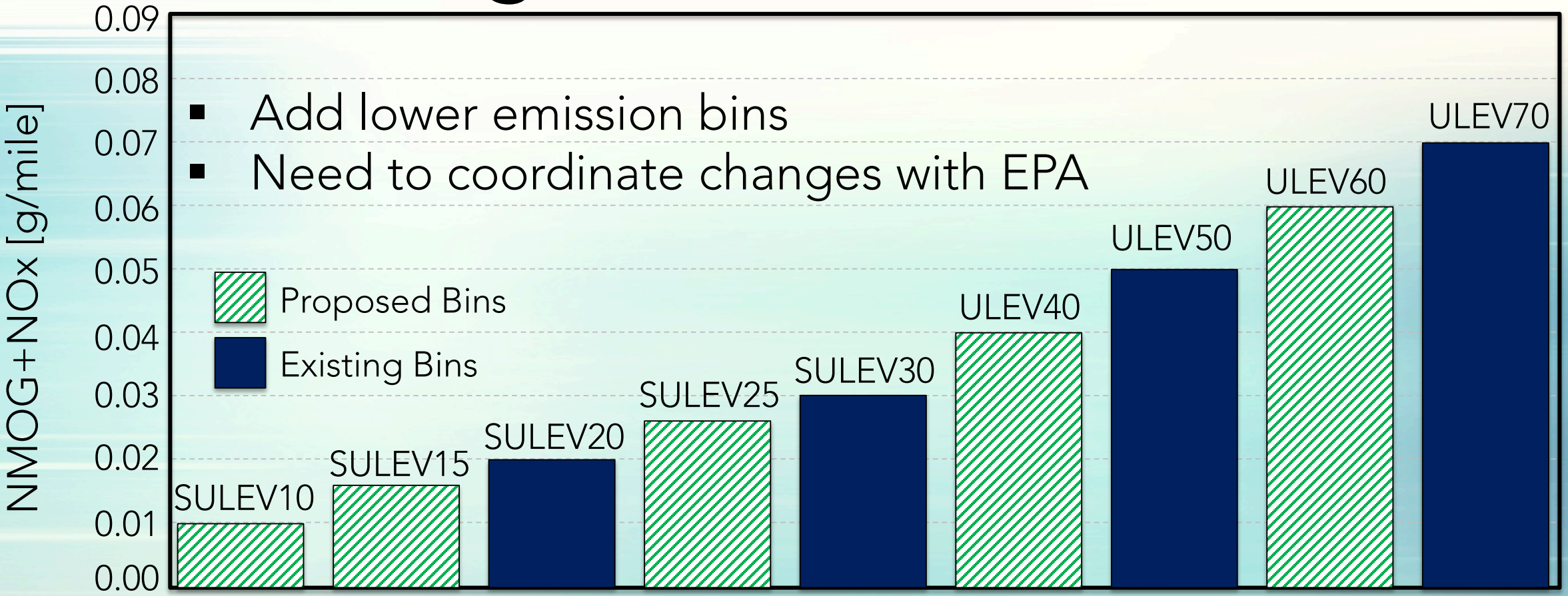
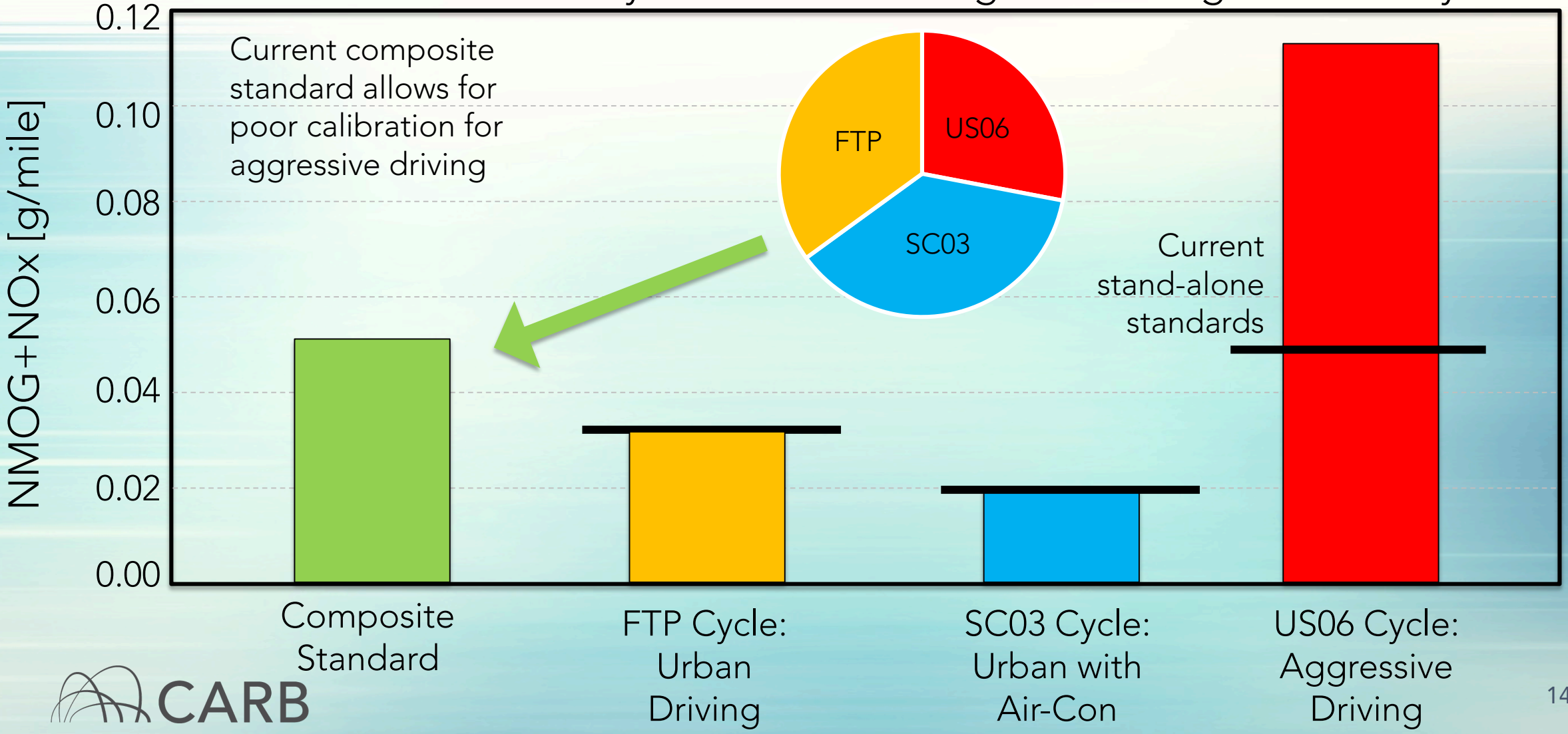
1. NMOG+NOx Fleet Average Changes to Certification Bins



2. Aggressive Driving NMOG+NOx

Current method used by most OEMs: Weighted average of three cycles



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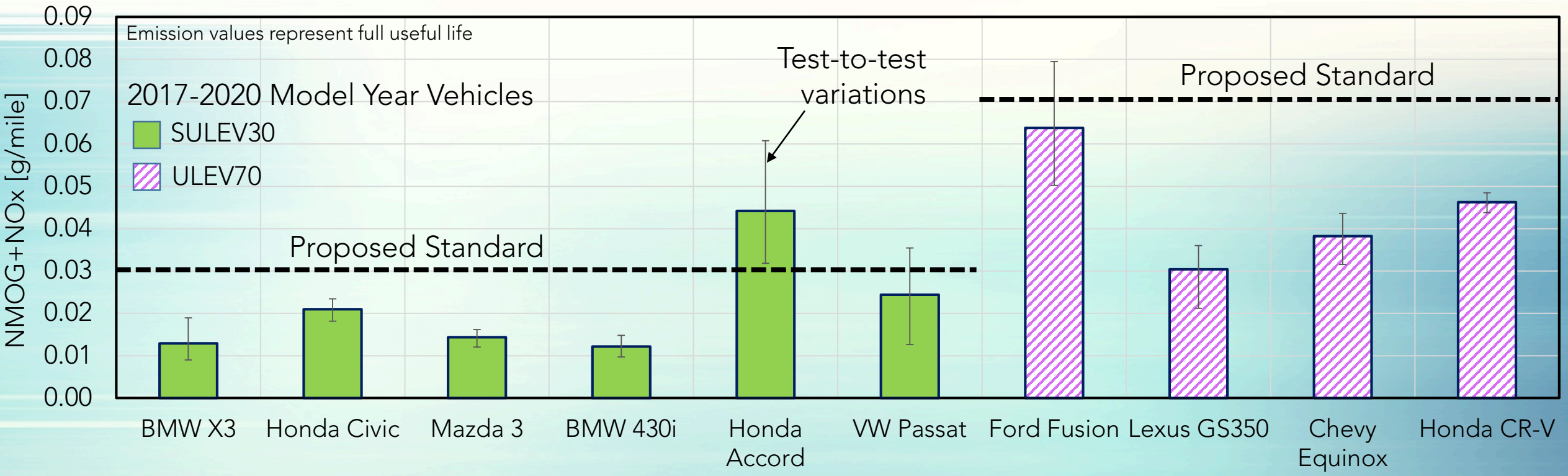
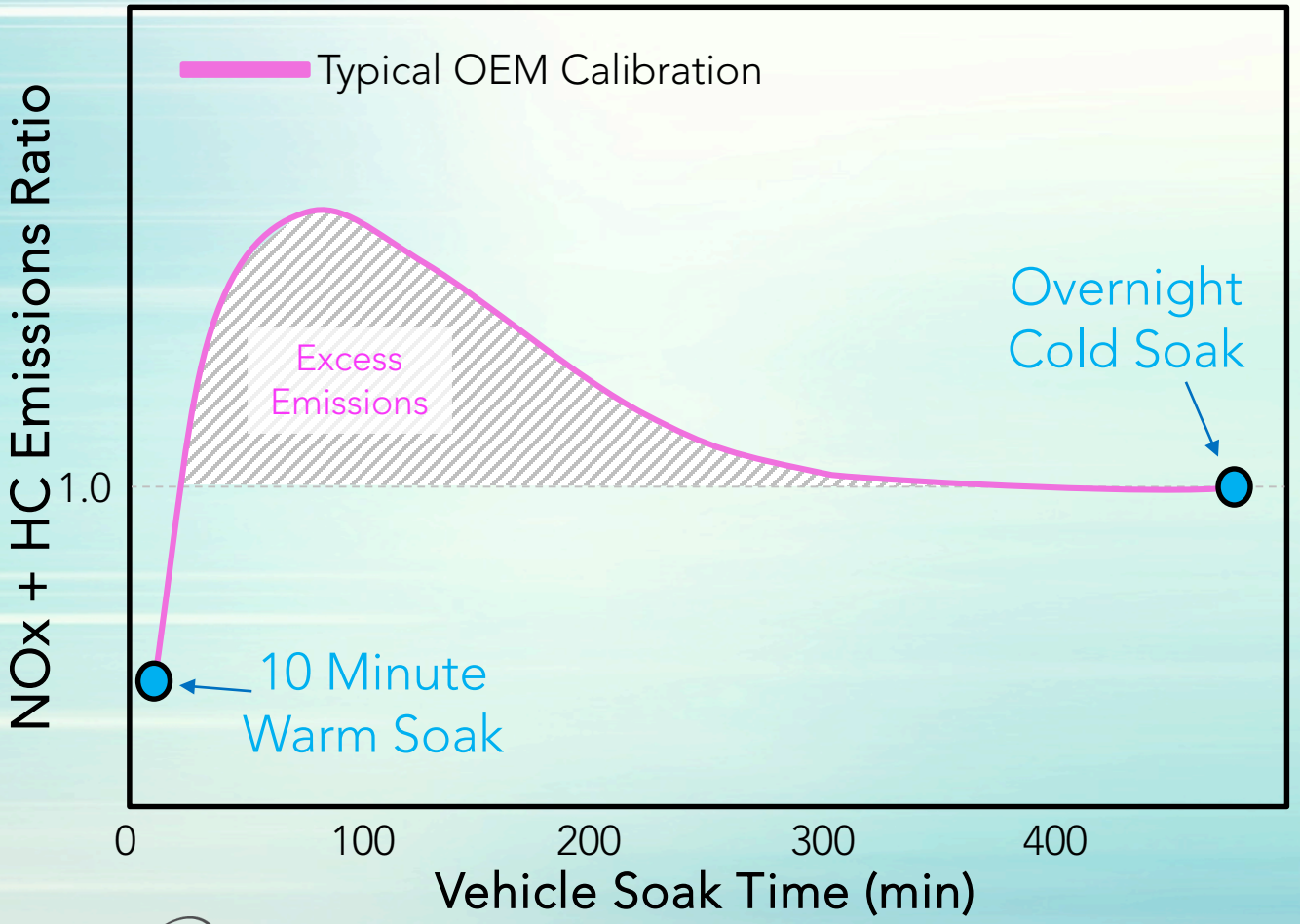
2. Aggressive Driving NMOG+NOx Proposal

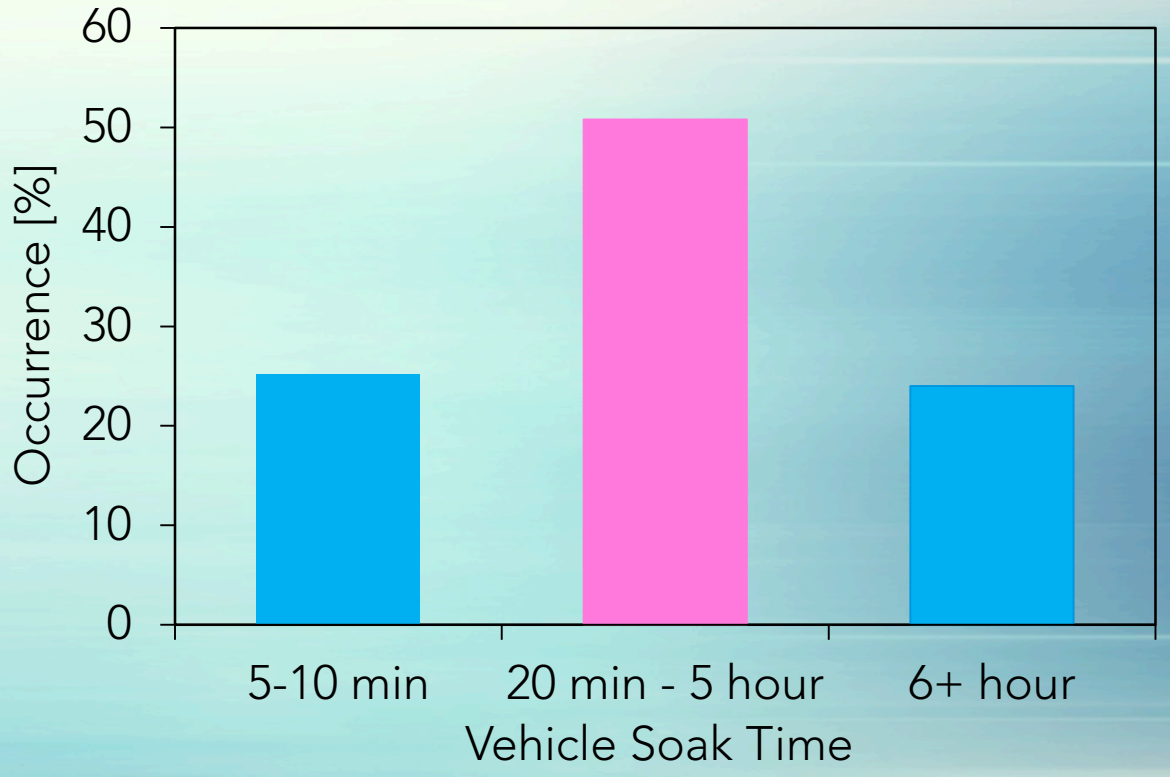


- Proposal: Require certification to new stand-alone US06 NMOG+NOx standard
  - US06 standard set to identical numerical value as FTP standard

3. Cold-Start Emissions: In-use Driving Patterns for Soak Time



More than 40% of real-world vehicle starts follow intermediate soaks



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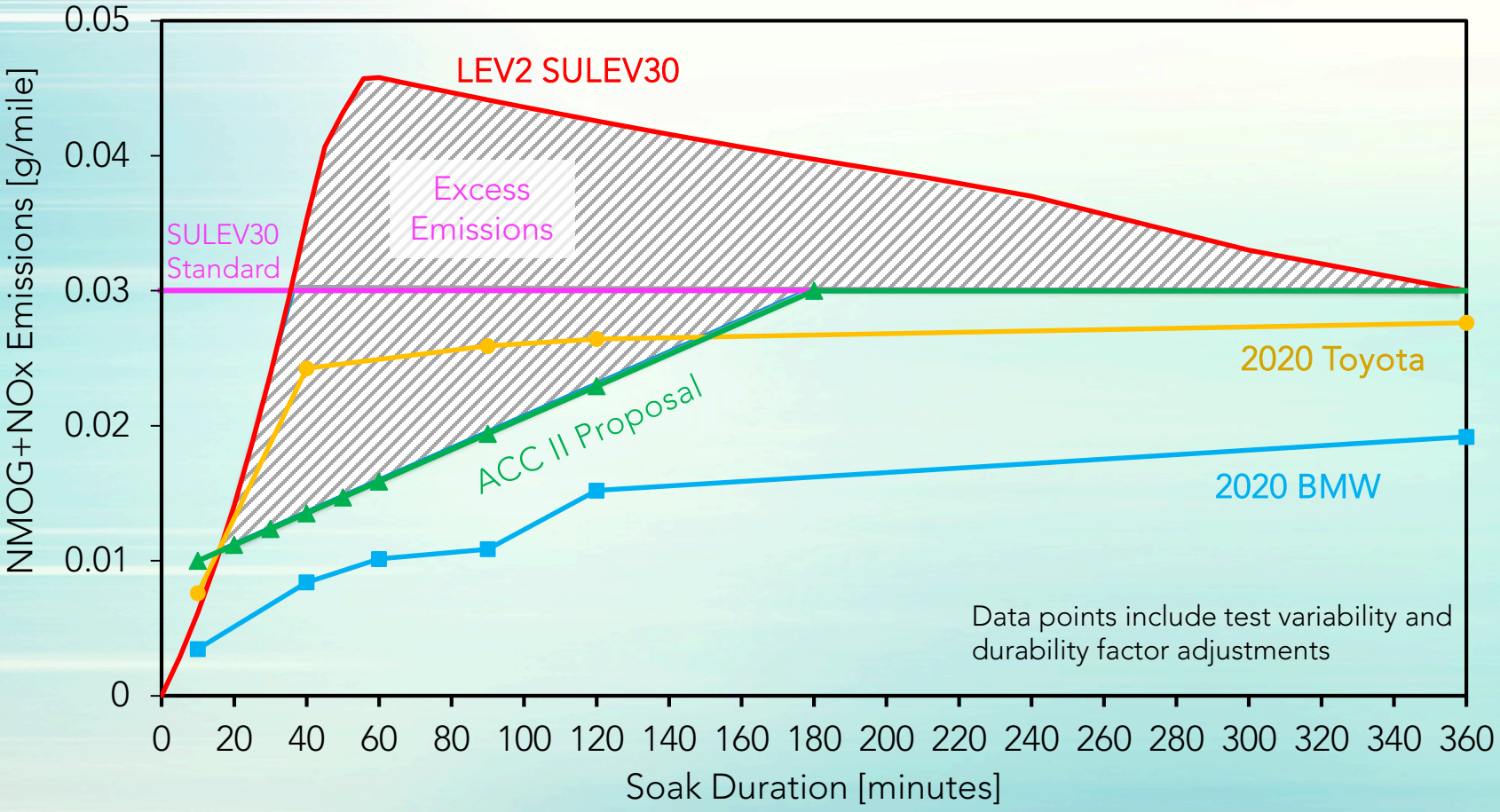
3. Cold-Start Emissions Intermediate Soak Proposal



- CARB tested new 2020 model year vehicles with new calibration
- All showed improved performance but some were better than others

ACC II Proposal

- Do not exceed overnight soak emissions for soaks greater than 3 hours
- Require emission linearity between 10 min soak and 3 hour soak
  - Cost-effective emission reductions can be gained

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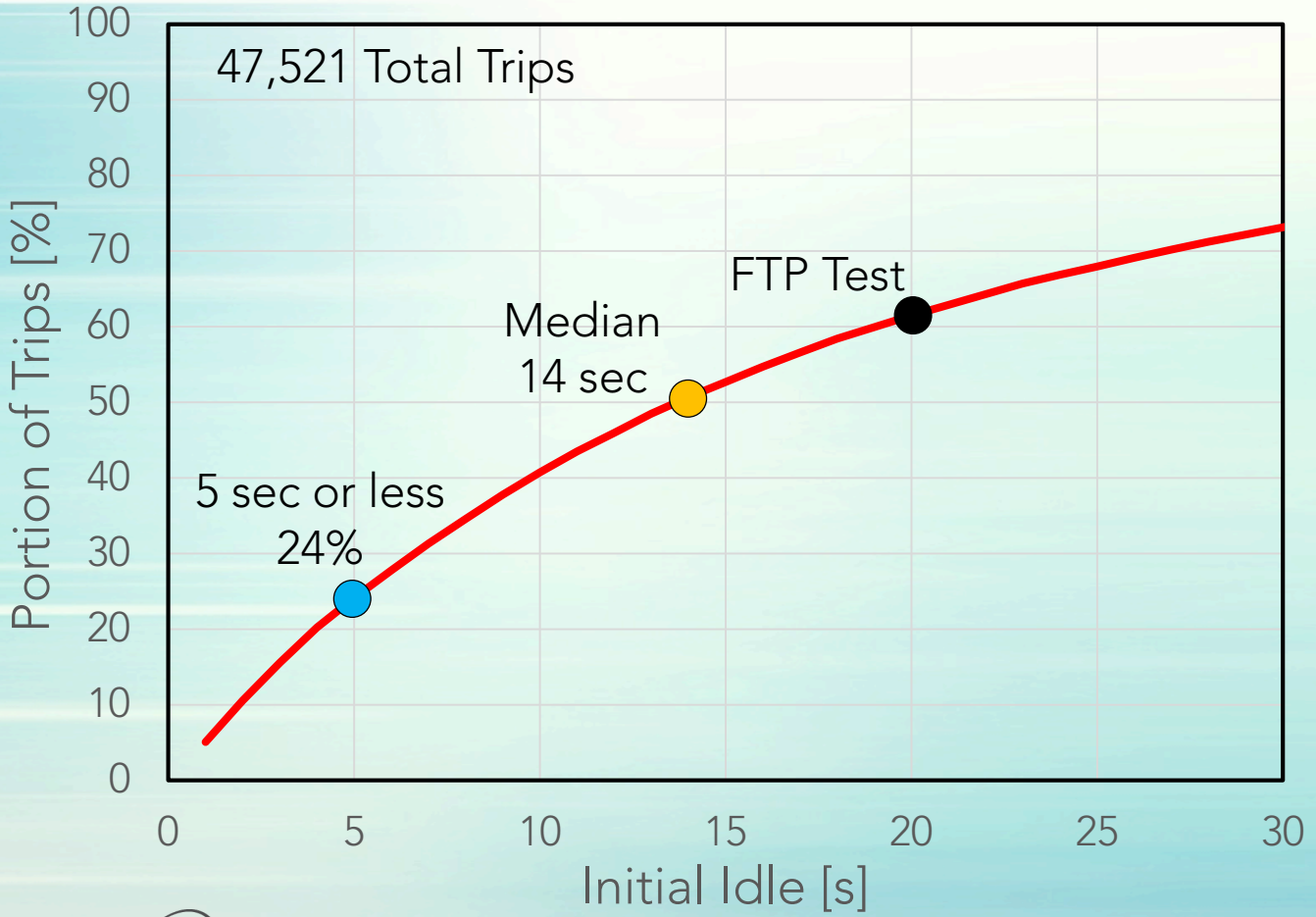
4. Cold-Start Emissions Quick Drive-Away



Real-World Data

- CARB analyzed recent data from UC Davis Household Contract
  - Large portion (61%) of in-use trips had quicker drive-away than FTP lab test cycle
  - Median time was 14 sec
- Confidential data analysis shared by OEMs indicated:
  - Median idle was 16-23 sec
  - 25th percentile was 8-10 sec
- Separately analyzing aggressiveness of initial drive-away

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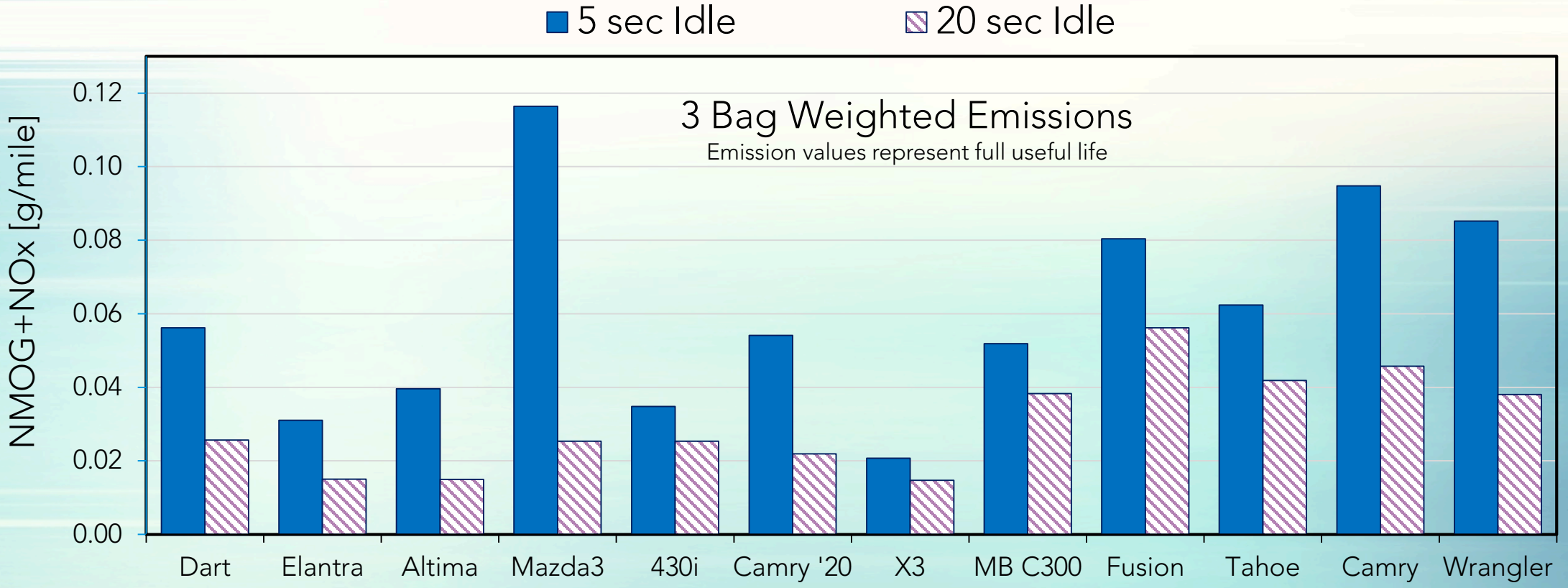
4. Engine Start Emissions: Quick Drive-Away Emission Testing



ACCII Proposal Status

- Continue to evaluate in-use driving and emission data
- Data analysis will help determine whether new standard or guidance language will provide more robust emission control

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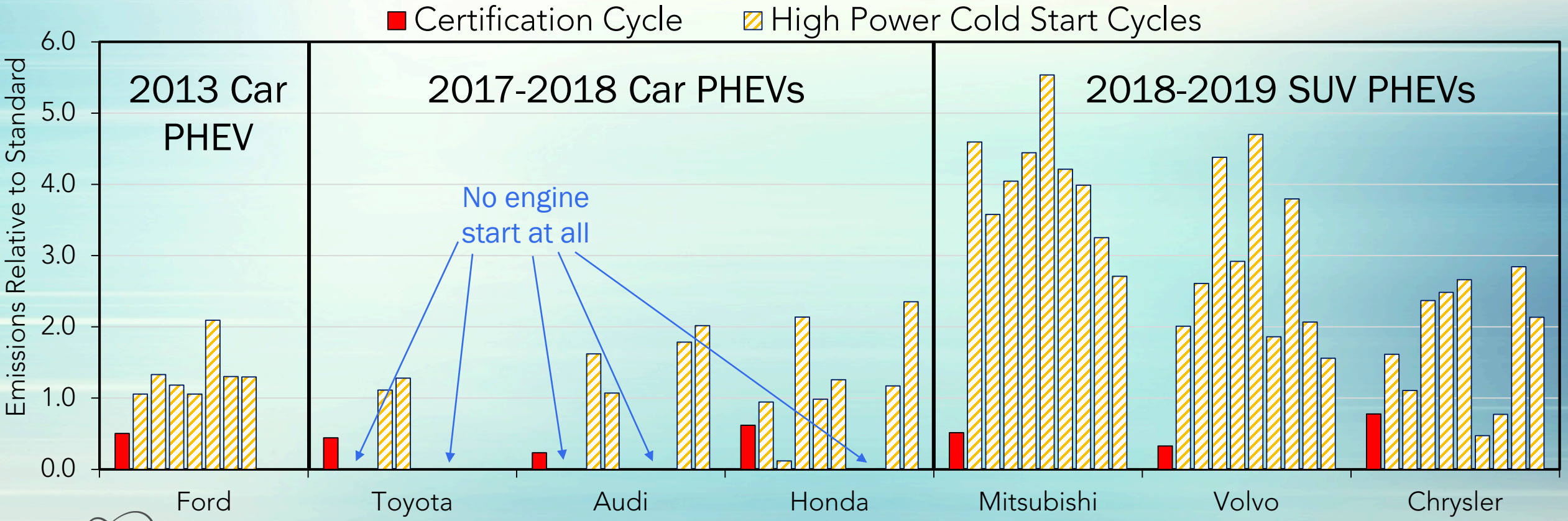
5. Cold-Start Emissions: PHEV High Power Starts

Car PHEVs

Trending to stronger electric powertrains so can complete many high power cycles without using ICE

SUV/Minivan PHEVs

High cold-start emissions observed on nearly all high power cycles



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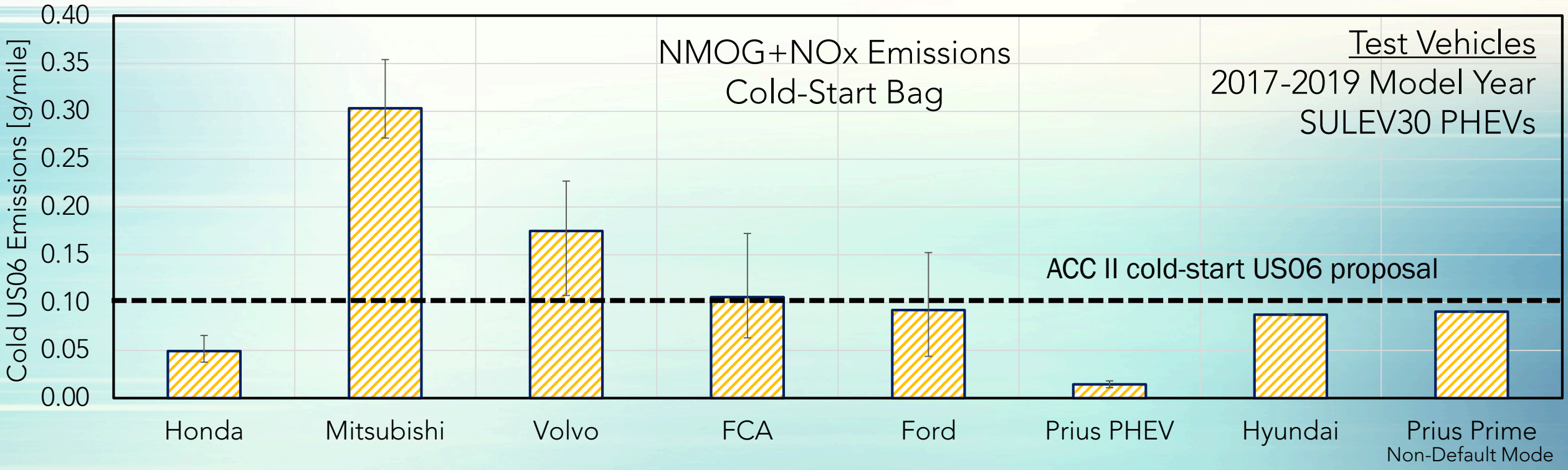
5. Cold-Start Emissions: Propose Standard for PHEV High Power Starts



ACC II Proposal:

- Develop cold-start US06 standard based on best performers
- US06 all electric capable PHEVs are exempt

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6. Evaporative Emissions: Tighten Running Loss* Standard

- Last workshop: Change standard from 0.05 to 0.010 g/mile
  - Most vehicles meeting this now but some higher emitting
  - Eliminate dirtiest, ensure good designs remain the norm
- **New proposal: 0.01 g/mile**
  - Rounding gives some flexibility but nominally still designed as clean

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* Running loss emissions are the evaporative emissions which occur when the vehicle is driven, primarily due to fuel vapors escaping the fuel system.

6. Evaporative Emissions: Protect for "Puff" Emissions

- Unique to special sealed NIRCOS* gasoline tanks common on PHEVs (and some HEVs)
  - ~6% of total vehicles in CA fleet and growing
- Specific sequence of driving on hot day + refueling can overwhelm canister and create a 'puff' of HC emissions
  - Vent tank vapor to canister to allow refueling, then push more vapor through during refueling

* NIRCOS: Non-Integrated Refueling Canister Only System

6. Evaporative Emissions: Puff Emissions Proposal

- Problem: Current test procedures don't capture this worst case event
  - Allows undersized canisters that let vapors breakthrough during refueling
  - ~80-90% vehicles with NIRCOS tanks have large enough canister
- Proposal: Specify minimum canister size in regulation
  - OEMs would demonstrate compliance using CARB-defined evap model/calculation with vehicle specific parameters
  - High confidence puff emissions will be accounted for without adding test burden

7. Medium-Duty Vehicle (MDV) Background

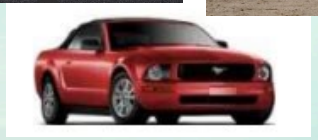
Light Duty Vehicles | Medium Duty Vehicles | Heavy Duty Engines

< 8.5k lbs. PC/LDT	Class 2b: 8.5k-10k lbs. *Gasoline (54%) *Diesel (36%)	Class 3: 10k-14k lbs. *Gasoline (26%) *Diesel (65%)	>14k lbs.

LDV Chassis Certification

HD Engine Certification



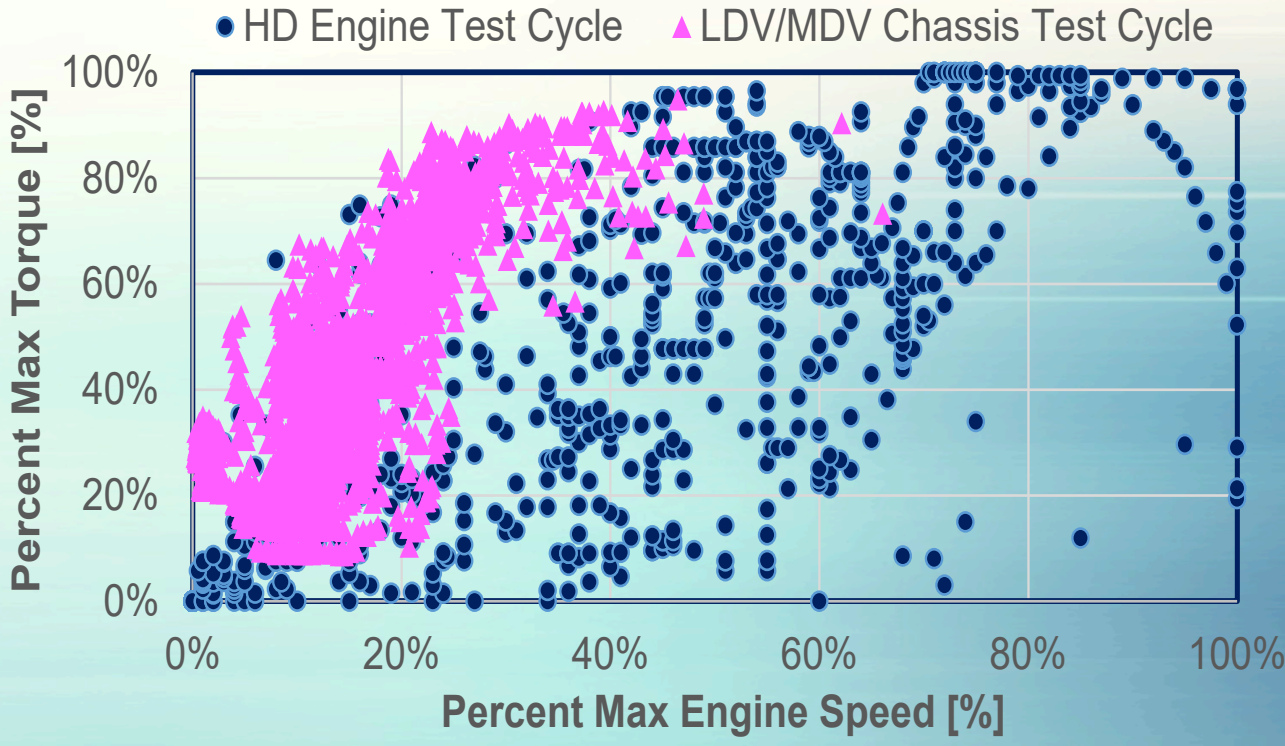





*Percentages based on MY 2026 from EMFAC 2021

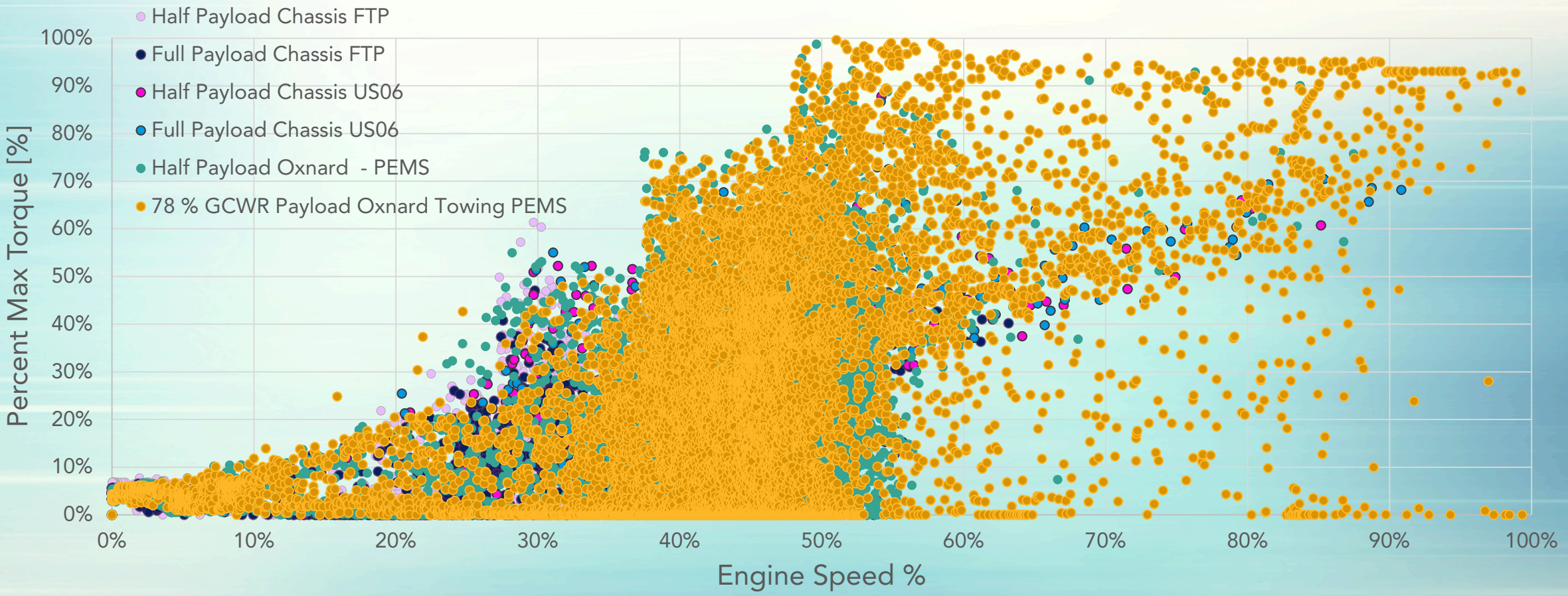
7. Update on Emission Control for MDVs

- **Last Workshop**
  - We were exploring the effects of higher loads (full payload) and towing on emissions
  - Evaluate a 'HD-like' in-use standard for this category
    - 3 Bin Moving Average Window (MAW) method using PEMS*



*PEMS: Portable Emission Monitoring System used to measure tailpipe emissions while driving on-road

7. MDV Engine Operation on Chassis Dyno Different from On-Road



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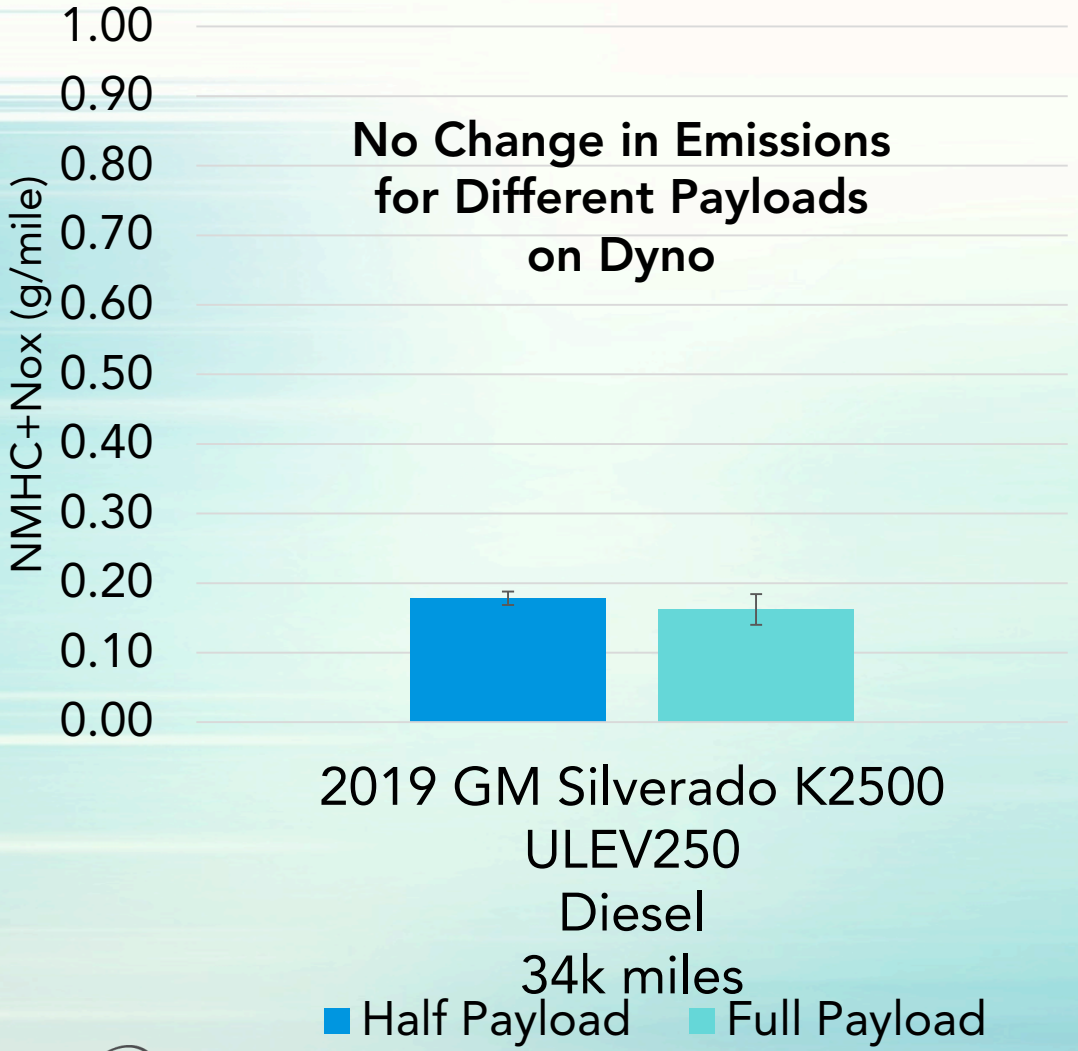
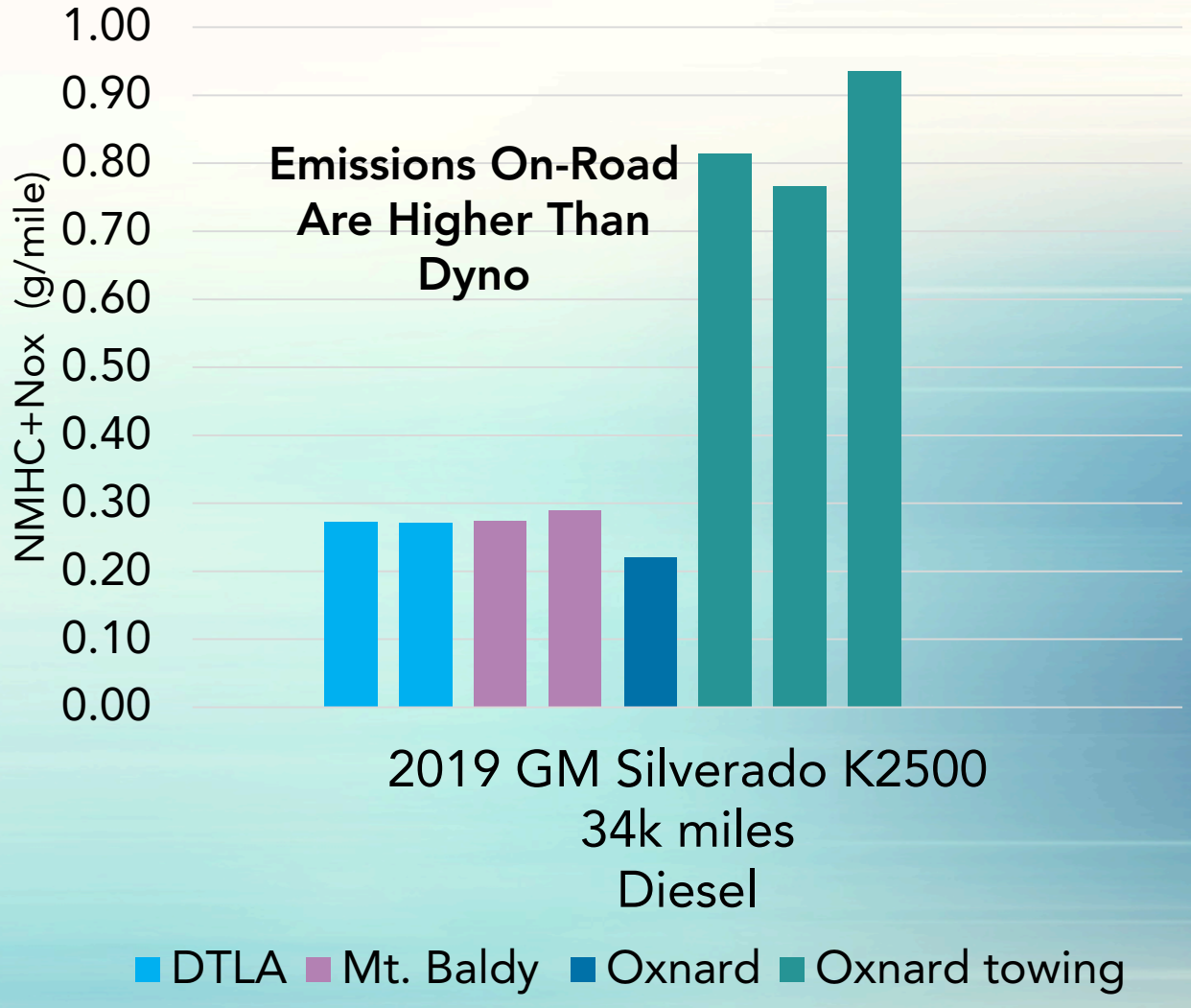
FTP Dyno Emissions



On-Road Emissions



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7. Update on Emission Control for MDVs

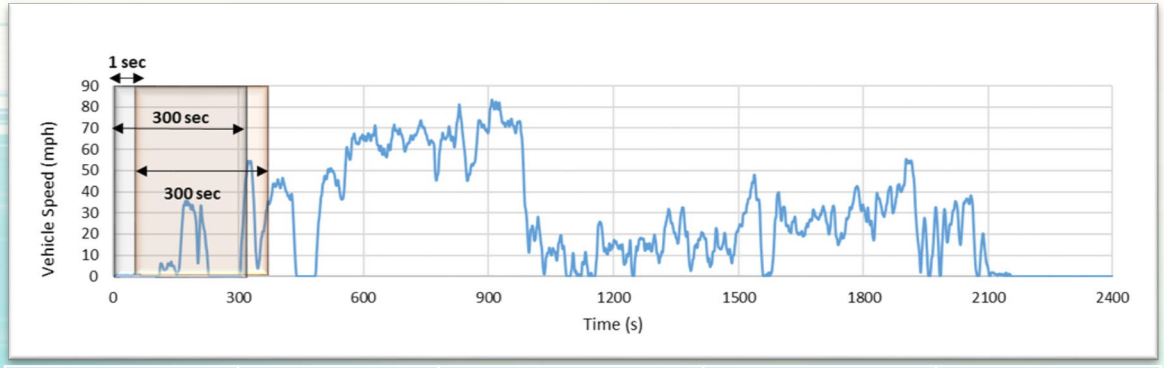
Conclusions from Testing

- Full Payload during chassis dyno testing does not lead to increased emissions
- PEMS on-road testing is showing that emissions increase on-road and it increases even more with towing
- Furthermore, chassis dyno testing can not cover the full range of engine operation that occurs on-road

Updated Proposal

- Align all MDVs: same in-use testing procedures and standards from HD Omnibus Rulemaking for both engine and chassis certified products

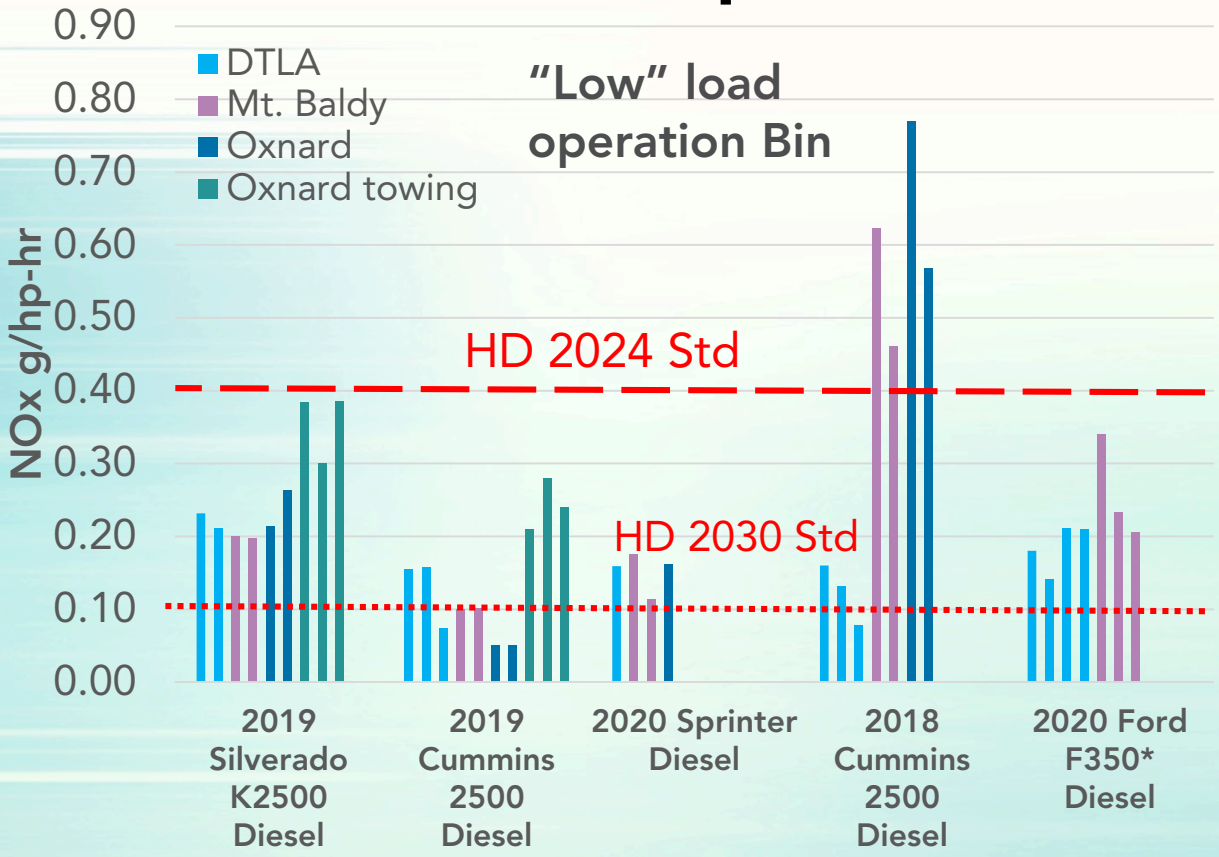
7. Heavy-Duty (HD) In-Use Method for Chassis Certified MDVs

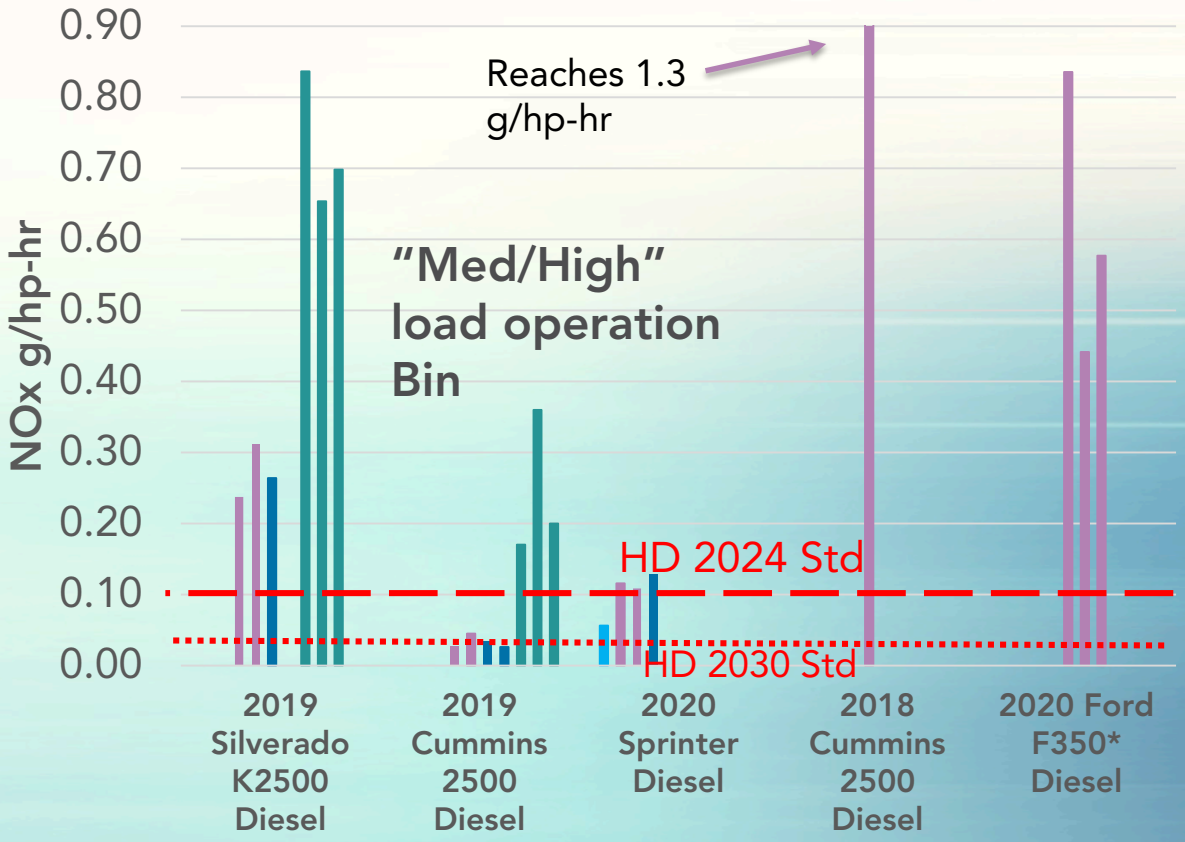


	Idle bin	Low Load bin	Med/High Load Bin	Otto bin
Diesel	≤6% Engine Load	>6 and ≤ 20% Engine Load	> 20% Engine Load	
Gasoline				0-100% Engine Load

- Data is collected on-road with a PEMS
- Data is analyzed using continuous 5 minute overlapping windows for the entire test
- Each window is binned by average engine load
- Emissions for each bin is calculated using the equations in the HD regulation
- Each bin is compared to the standard specific to that bin in the HD regulation

7.Current Chassis Certified MDV Performance Compared to Proposed Standards





- All diesel chassis certified MDVs we tested could meet the idle bin standard for 2030
- We are still evaluating the Otto bin for gasoline MDVs

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8. New MDV Proposal: New Standard for US06* Test Cycle

- Currently, MDVs must certify to a composite supplemental FTP standard similar to LD vehicles
  - Like LD vehicles, good emission control during the US06 cycle is not guaranteed with this approach
- Now have tested several current model year MDVs on the US06 cycle

- **Proposal:** Adopt new stand alone US06 standard for MDVs to ensure robust control under broader conditions

*US06: For Class 2b MDVs, the aggressive high speed US06 test cycle is used. For heavier/slower-accelerating Class 3 MDVs, the Unified test cycle is used.

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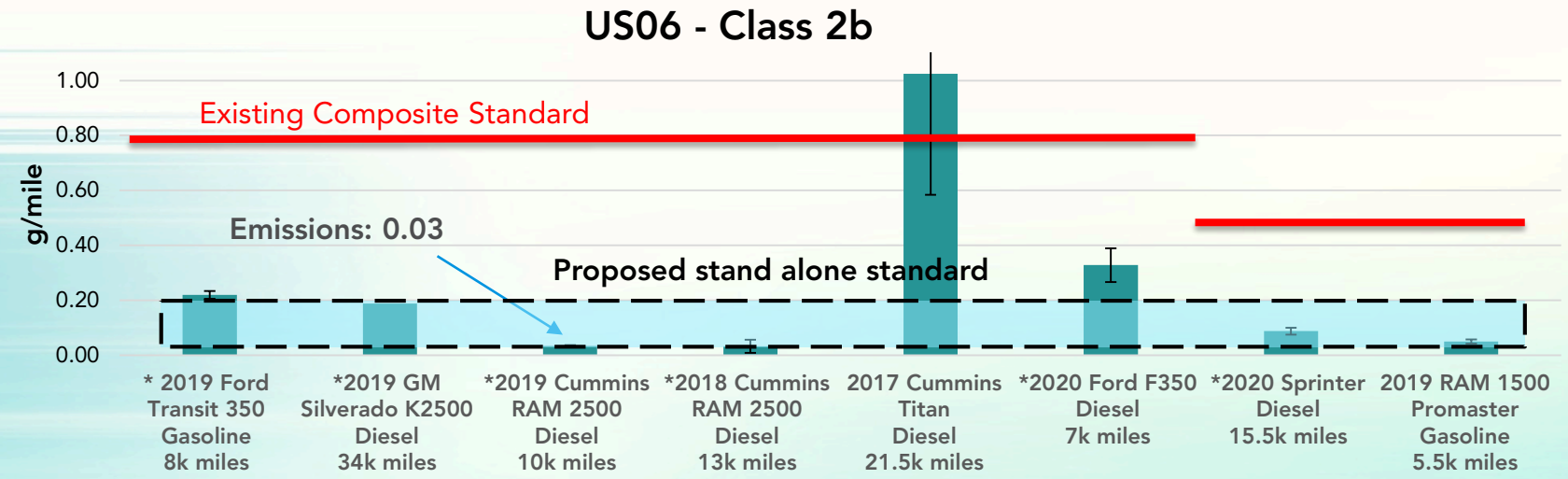
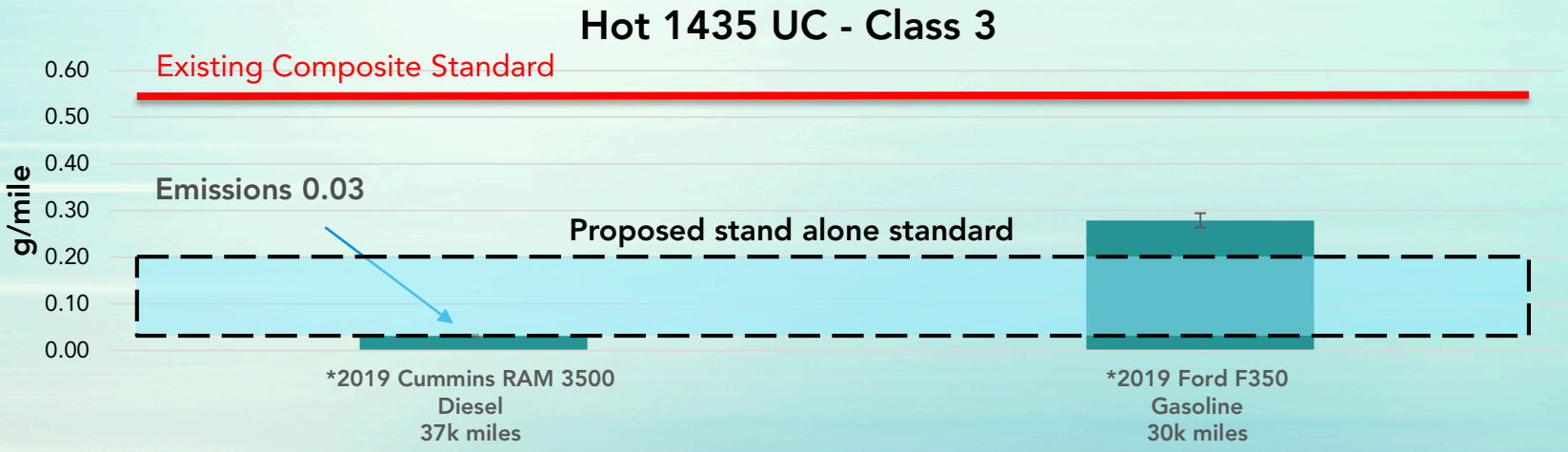
8. Proposed SFTP MDV Standards





Newer MDVs can readily meet lower stand-alone SFTP standards even before considering future aftertreatment changes like HD Omnibus is expected to require

*fully aged after treatment system or DF applied

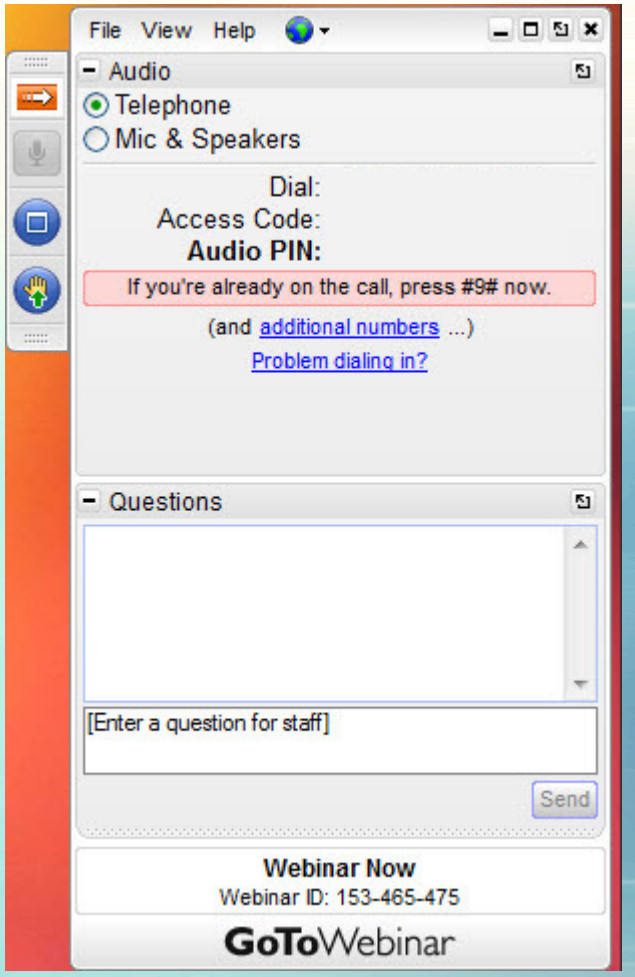
MDV Proposal Next Steps

- Soliciting feedback on the proposed In-use emissions calculations and standards
- Continue to test more vehicles to propose new SFTP standards
- Finish PEMS on-road testing
- Develop MDV regulation language
- Assess environmental justice impacts

Please use GoToWebinar pane to ask

QUESTIONS

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



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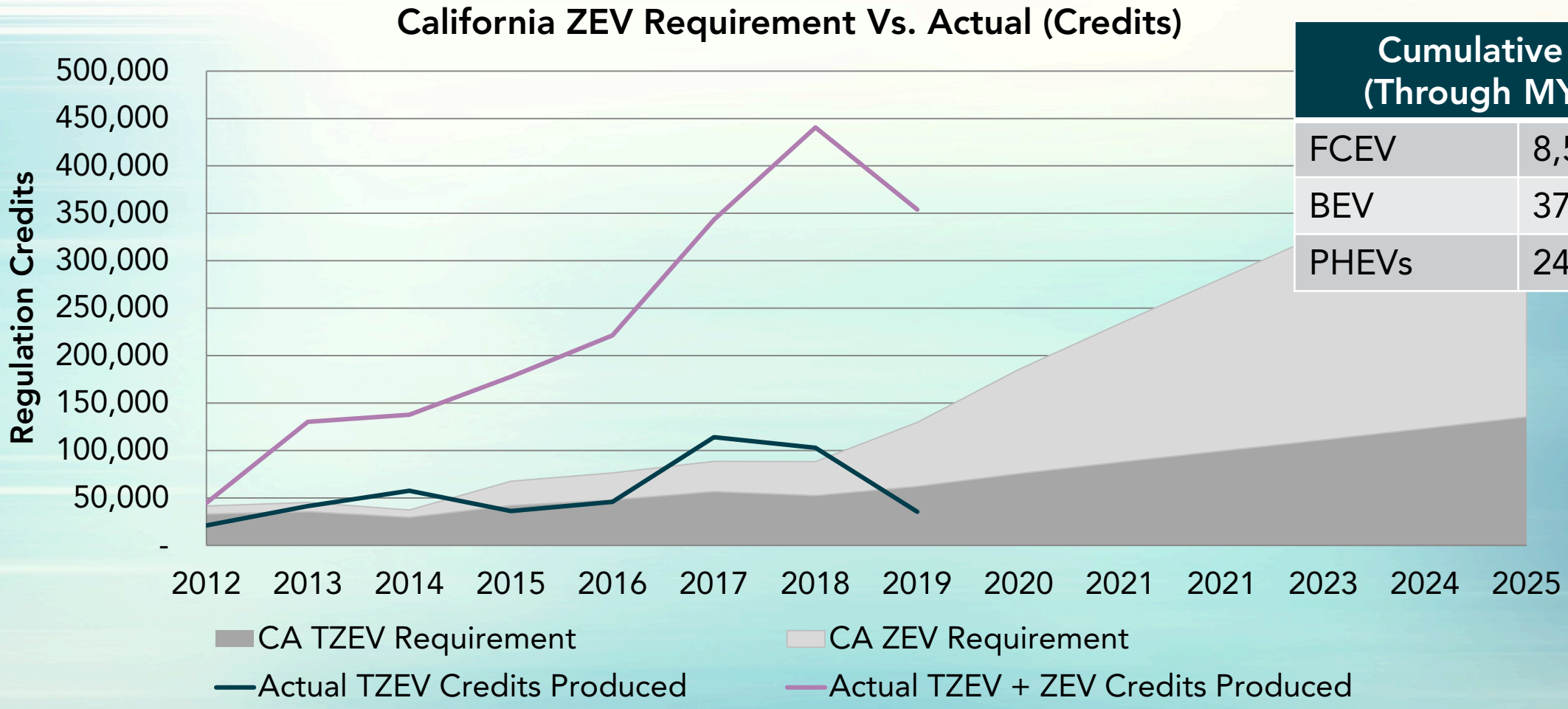
ZEV Credit Requirement Proposal

Manufacturers continue to comply with the ZEV Regulation



Cumulative Sales (Through MY2019)	
FCEV	8,500
BEV	371,200
PHEVs	245,000

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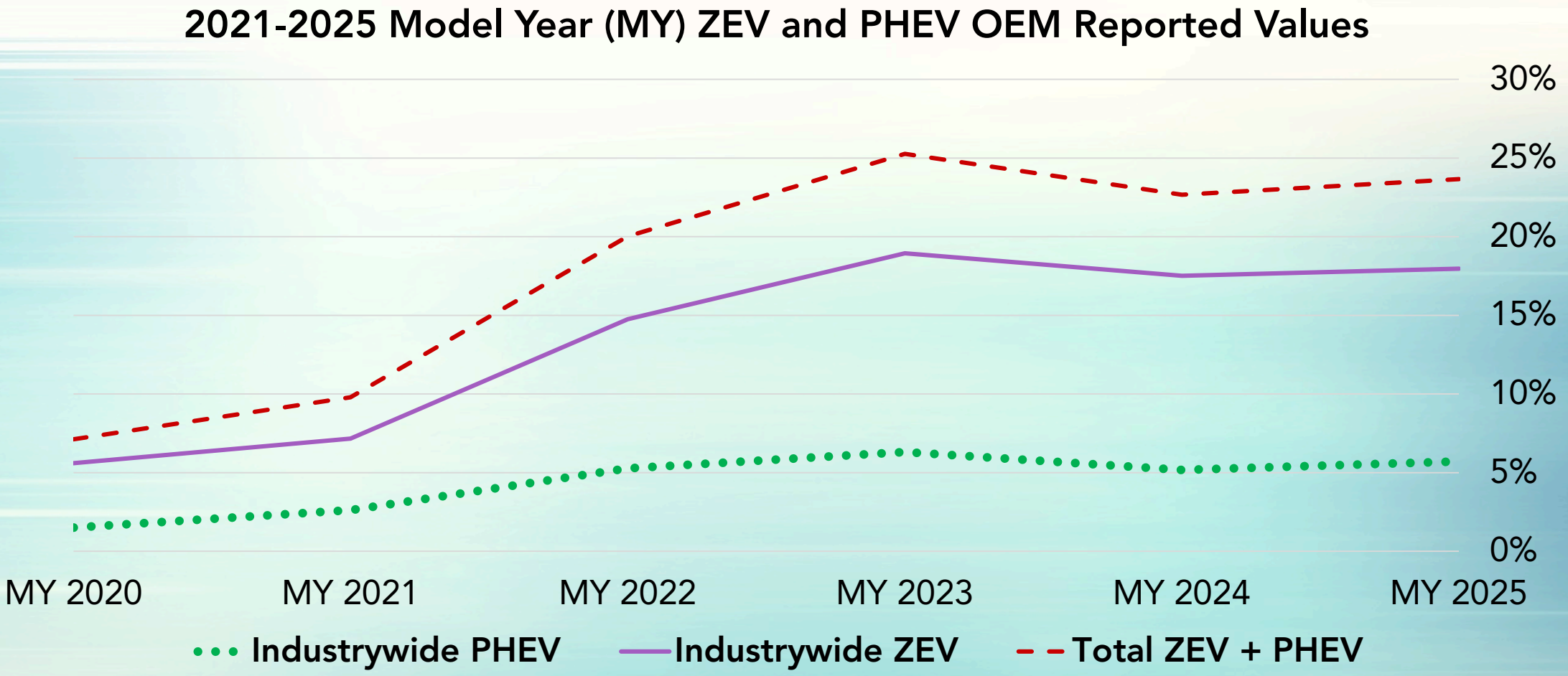
ZEV and PHEV Sales Projections



A market continues to emerge

- EV owner base is solid and growing
  - Most EV owners are intent on repurchasing (JD Power)
- ~70% of CA car buyers may consider EVs in the future; still concerns among skeptics remain
  - ~25% surveyed are actively considering EVs for their next purchase (UCD)
- Other studies focused on US show 30-44% may consider future EV purchase
- Education/experience translates to EV interest

Automakers are going Electric

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GM to Phase Out Gas- and Diesel-Powered Vehicles by 2035

Auto giant's plan to eliminate tailpipe emissions is part of a goal to be carbon neutral by 2040

Volvo Plans to Sell Only Electric Cars by 2030

VW expects half of U.S. sales to be electric vehicles by 2030

Ford Motor Vows To Sell Only Electric Cars In Europe By 2030

Honda Will Go Electric- and Fuel Cell-Only by 2040

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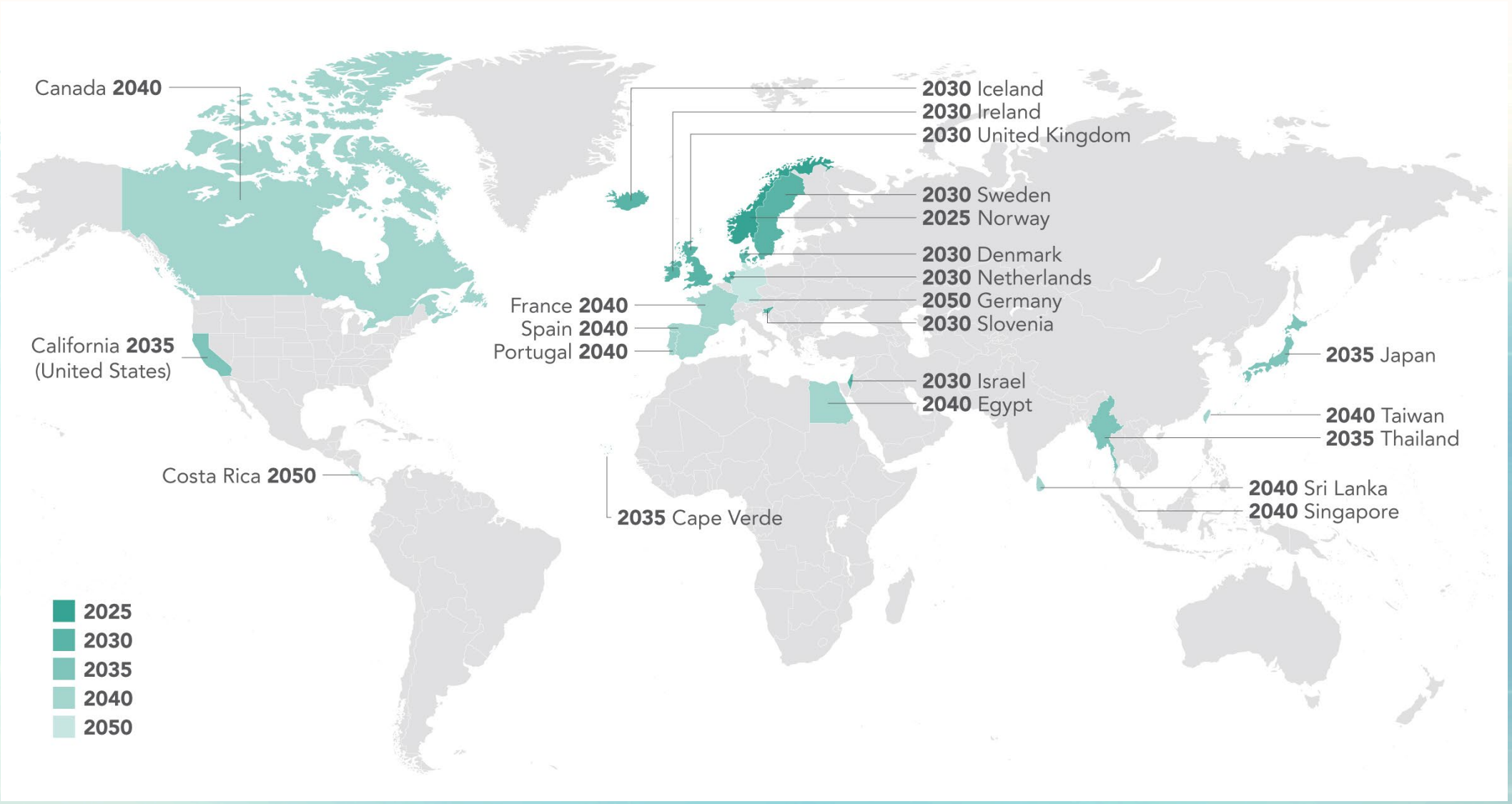
Electrification Commitments Worldwide



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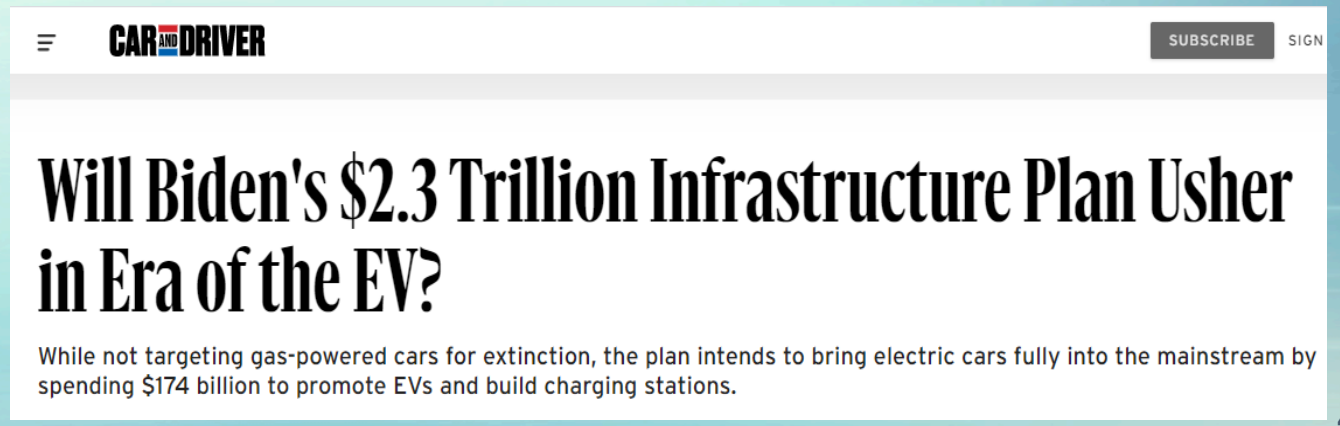
Federal Support Growing

- Federal (U.S.) commitment to cut GHG emissions 50% by 2030
- EPA directed to revisit greenhouse gas rules
- U.S. rejoins Paris Climate Agreement
- Proposed $174 billion to promote electric vehicles and EV charging stations


CAR AND DRIVER

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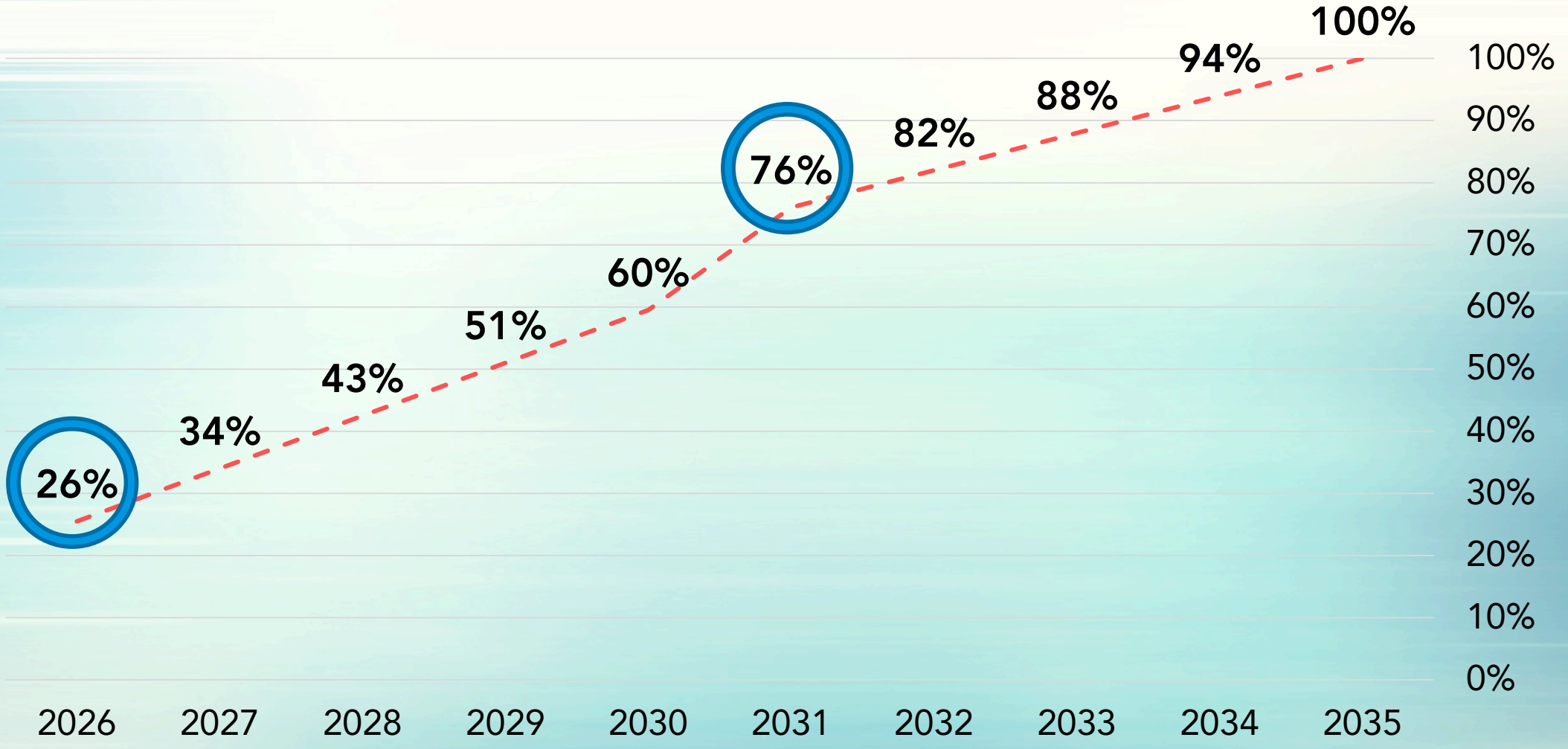
Will Biden's $2.3 Trillion Infrastructure Plan Usher in Era of the EV?

While not targeting gas-powered cars for extinction, the plan intends to bring electric cars fully into the mainstream by spending $174 billion to promote EVs and build charging stations.

Starting Stringency: Real Vehicles



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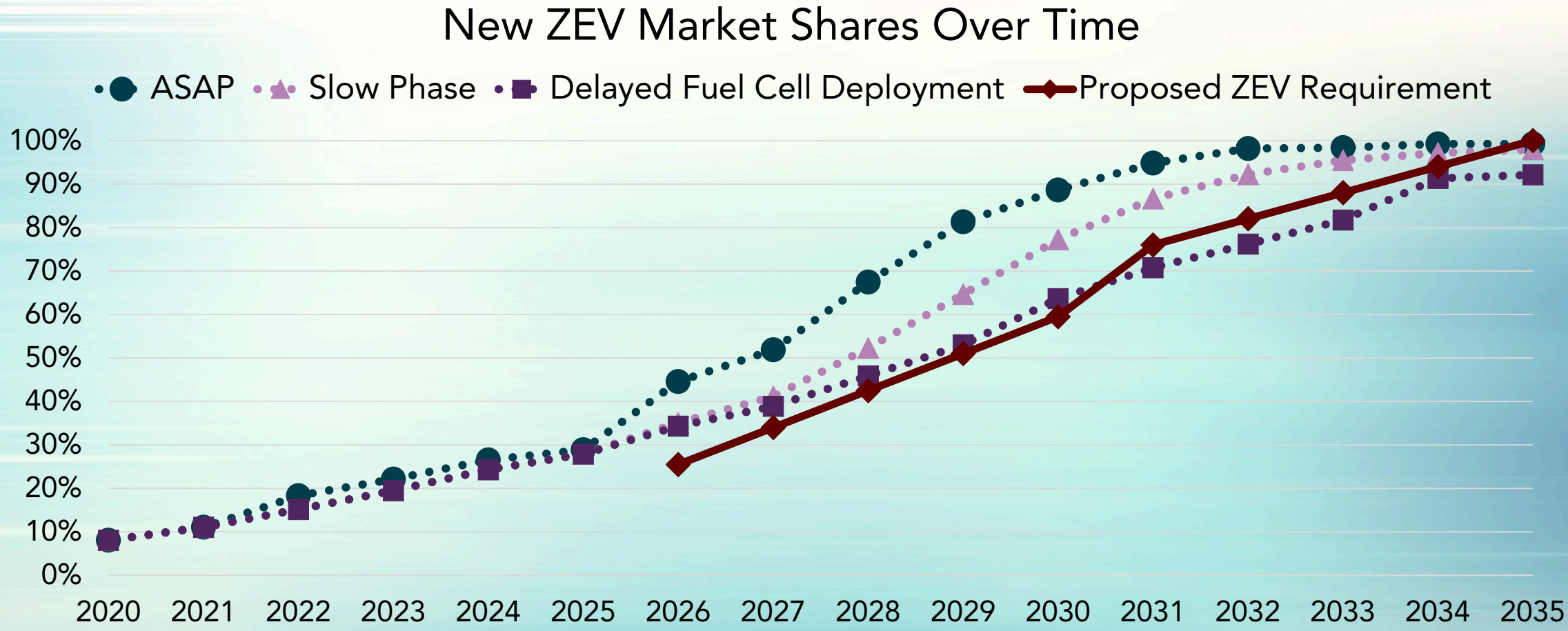
Proposed ZEV requirement plausible with aggressive ZEV model rollouts



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Regulatory Considerations

- Treatment of ZEVs
- Treatment of PHEVs
- Historical Credits

New ZEV Treatment

- Credits are still the currency of the regulation
- Increase assurance around vehicle numbers to achieve ultimate goal
- Proposal:
  - One ZEV credit per ZEV (BEV or FCEV)
  - 5 year credit life
    - Example: 2026 model year ZEV could satisfy obligation through 2030 model year

The Role of Plug-in Hybrids

- Midterm Review findings
  - Electric miles traveled is highly consumer dependent
  - Real world emission can be higher than shown on test cycles
- Increased consumer choice and model diversity remains important when achieving 100%
- PHEVs may remain an important choice among lower income consumers
    - PHEVs have been preferred over BEVs in CARB's Clean Cars 4 All program
- New controls proposed earlier will ensure benefits

Proposed Post-2026 Model Year Minimum PHEV Qualifications

- 50 miles all-electric range (label)
- US06 all electric capable throughout charge depleting mode
- Existing qualifications that are maintained:
  - SULEV 30
  - Zero evaporative emissions
  - 15/150,000 warranty on emission related parts
  - 10/150,000 on traction battery

New PHEV Treatment

- Even with higher minimum qualifications for PHEVs, increased emission reduction assurance needed for light duty
- Proposal:
  - 20% cap any year on number of PHEVs allowed to fulfill OEMs obligation
  - 5 year credit life
  - Continue separate tracking of PHEV credits and limit credit usage to only the portion allowed to be met with PHEVs

Historical ZEV Credits

- Manufacturers will continue to amass credits through 2025
  - Sufficient credits already exist in the bank to satisfy industry's obligations through 2025
- To achieve 100%, historical credit usage will need to be limited
- Proposal:
  - Pre-2026 credits expire after 2030 MY
  - Cap on usage of historical credits of no more than 15% of each category (ZEVs and PHEVs)

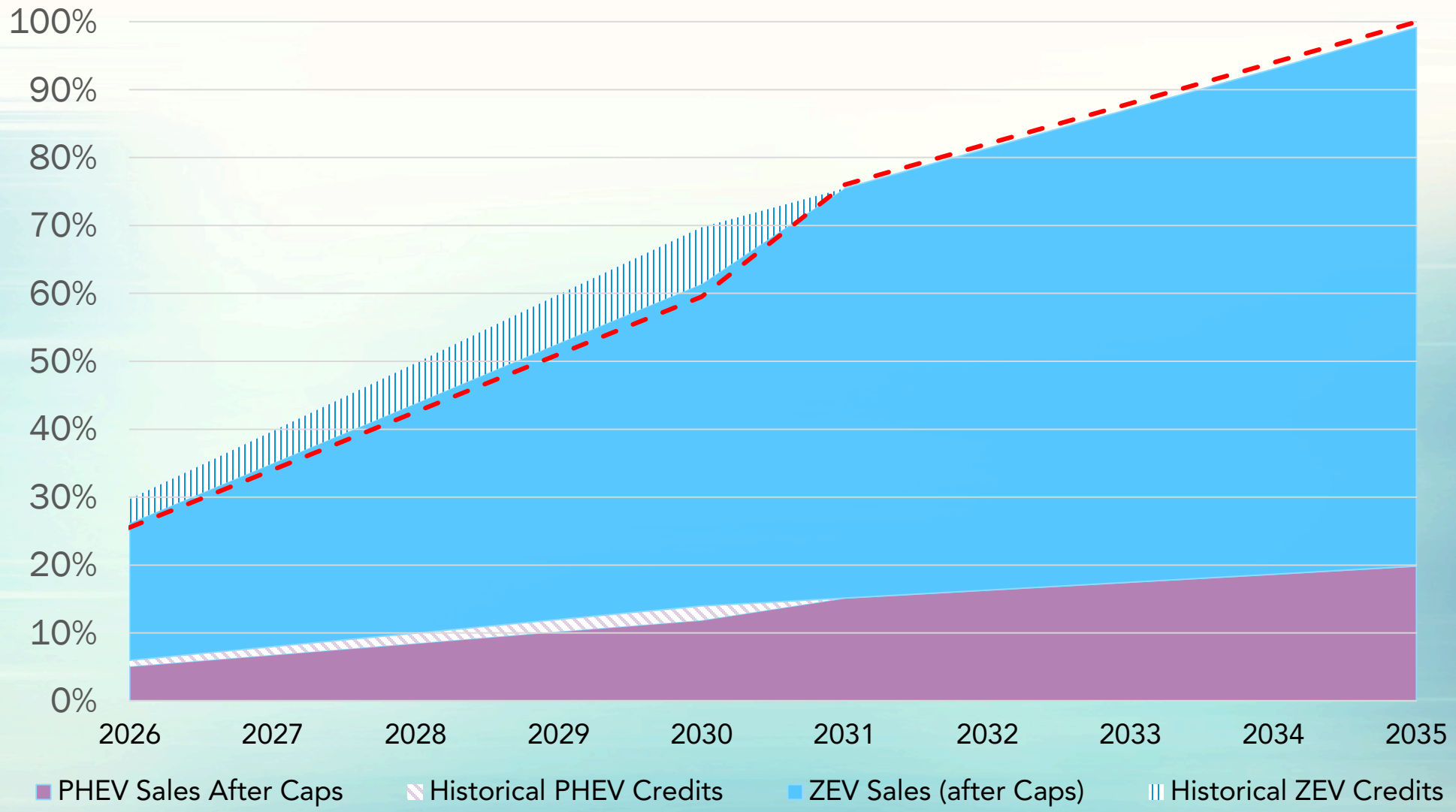
Converting the bank for 2026 and beyond

- Divide the 2025 Model Year credit banks by the maximum credit per vehicle, by technology type

$$\frac{\text{5.5 mil ZEV Credits}}{\text{4 credits}} = \text{1,375,000 converted ZEV credits}$$

$$\frac{\text{146,000 PHEV Credits}}{\text{1.1 credits}} = \text{137,200 converted PHEV credits}$$

Potential CA ZEV Requirement Outcome



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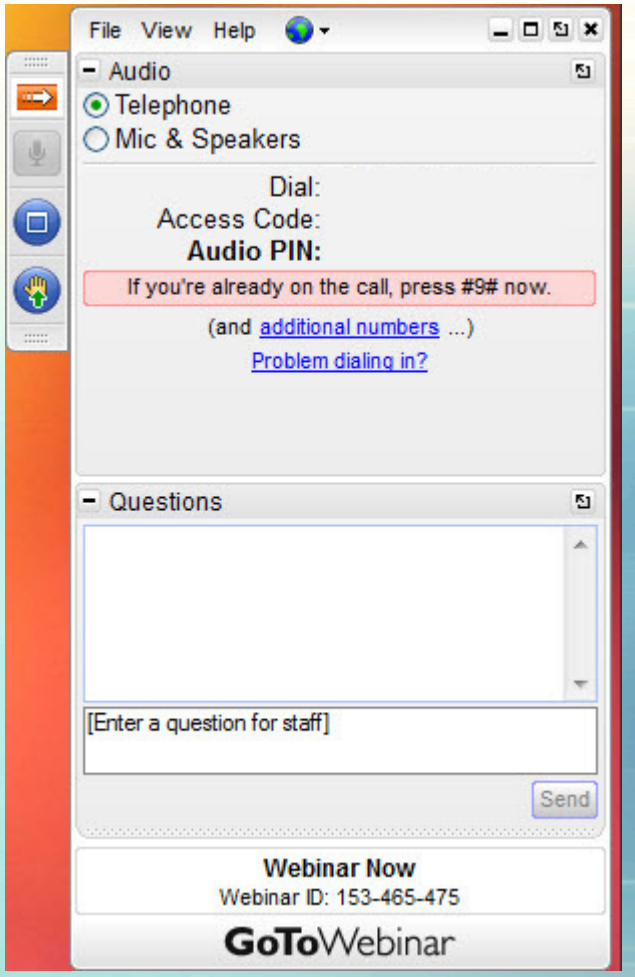
Staff Seeking Input

- Should BEVs have any minimum criteria to qualify? Should minimum requirements change over time?
- How can we meaningfully ensure equitable outcomes from the ZEV regulation? How can we increase accessibility to ZEV technology?
- Should PHEVs remain capped, given higher minimum requirements? Should the cap remain at 20% or change over time? Should the minimum requirements (e.g., range, criteria pollutant certification, allowable vehicle class) change over time? Are further options available to encourage high charging frequency?
- Are the caps for historical credits reasonable?

Please use GoToWebinar pane to ask

QUESTIONS

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



We are on a short break -

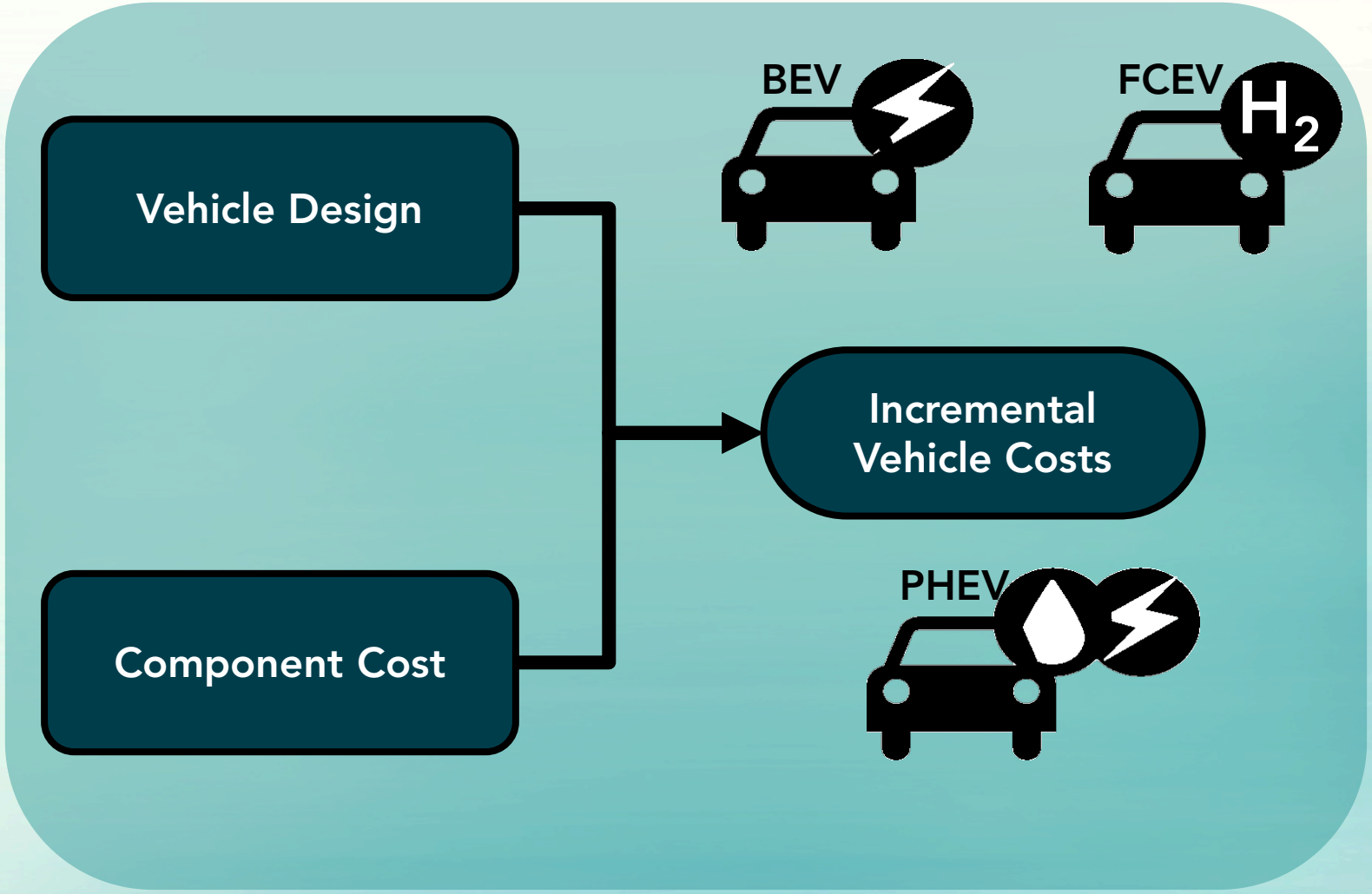
Will Resume at 11:10 am

ZEV Cost Projections

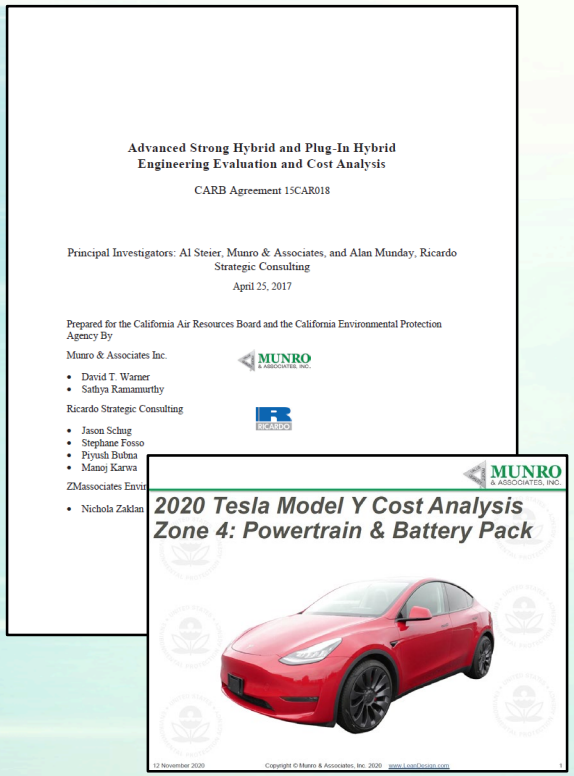
ZEV Costs Overview

- Costs Covered in the Presentation
- Technology Updates and Sources
- Modeling the Fleet
- Incremental Cost Example
- Consumer Preferences and Cost Projections for Additive Technology
- Additional Data and Next Steps

Costs Covered in the Presentation

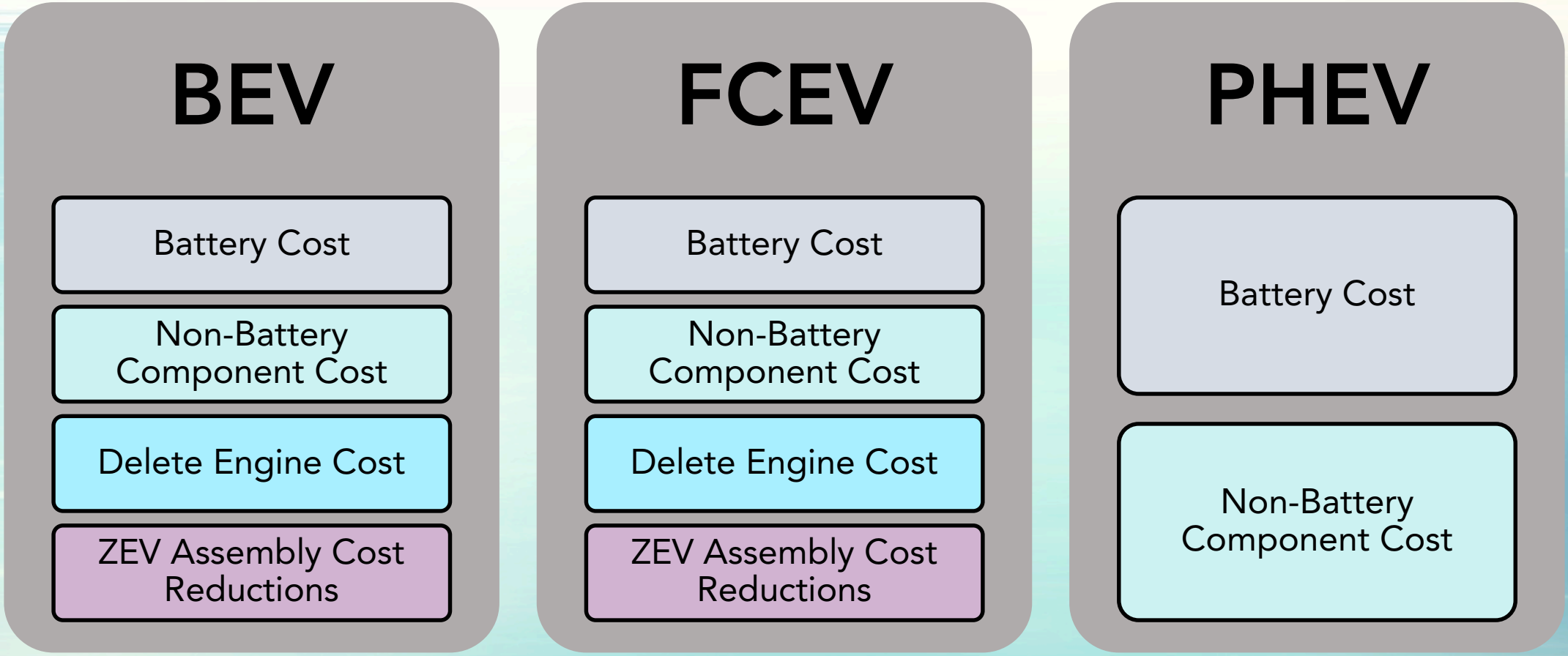


Technology Updates

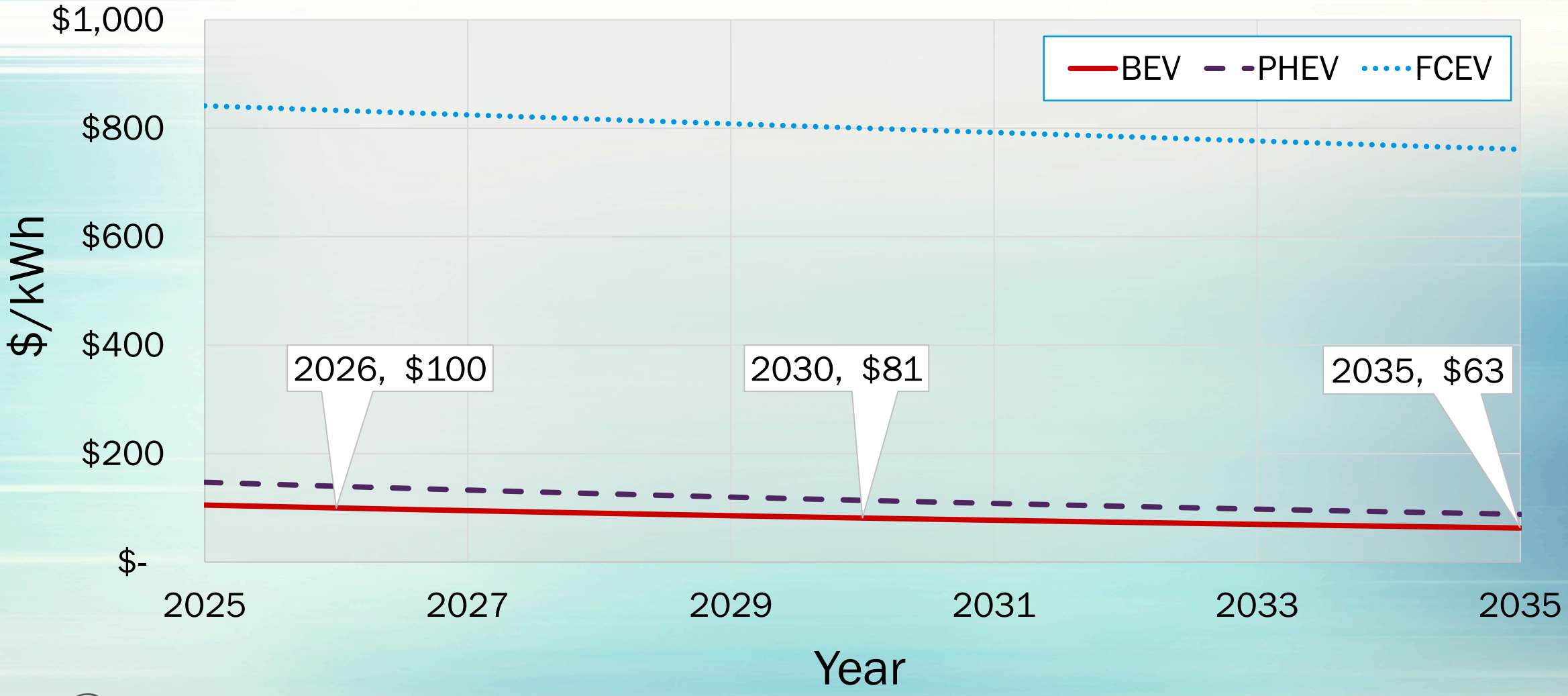


- Technology trend updates
  - Cheaper batteries
  - Smaller, longer lasting and cheaper fuel cell stacks
  - Smaller, more efficient and more powerful non-battery components
- Cost updates since last workshop
  - Refined non-battery costs based on additional tear-down data
  - Adjusted battery costs downward based on updated modeling with higher battery volumes and carrying forward cost reduction rate out to 2035
  - Developed BEV, FCEV, PHEV incremental technology costs

Vehicle Cost Modules



Battery Pack Costs



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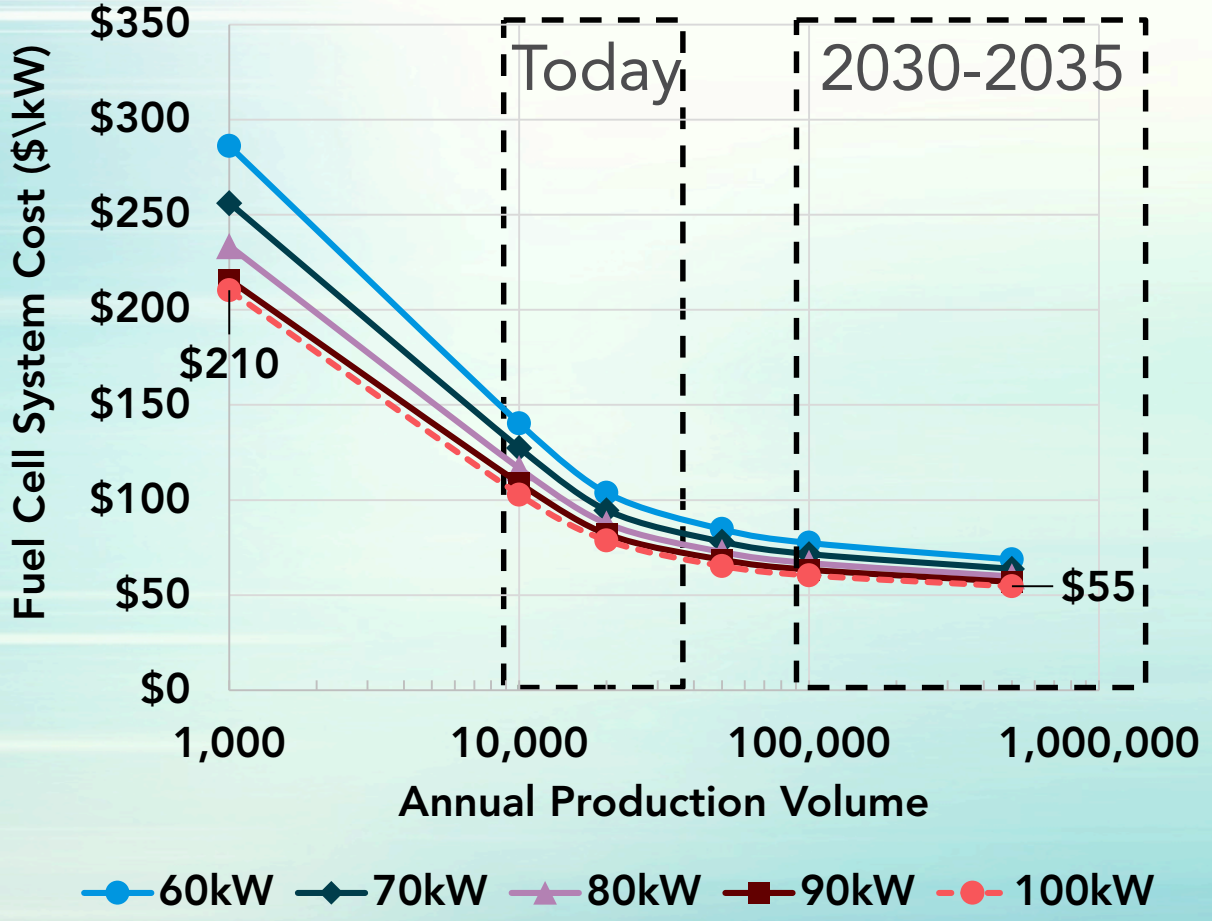
Fuel Cell System Costs



- Autonomie 2020 model results for vehicle attributes
- Strategic Analysis (SA) cost models for fuel cell and hydrogen tank systems
- SA 2020 cost models consider high-durability fuel cell systems
- CARB method accounts for cost reductions due to technology learning and production capacity

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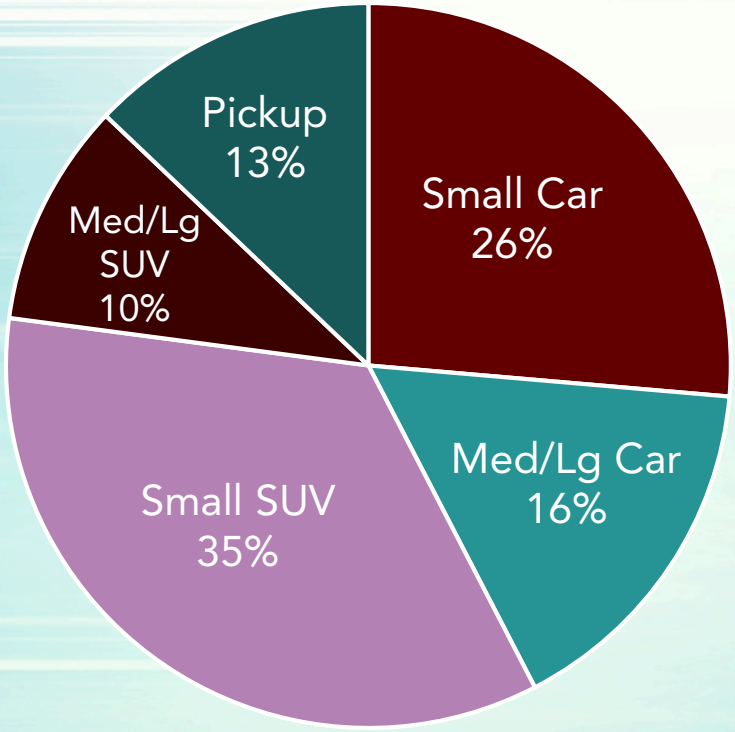
Modeling the California Fleet

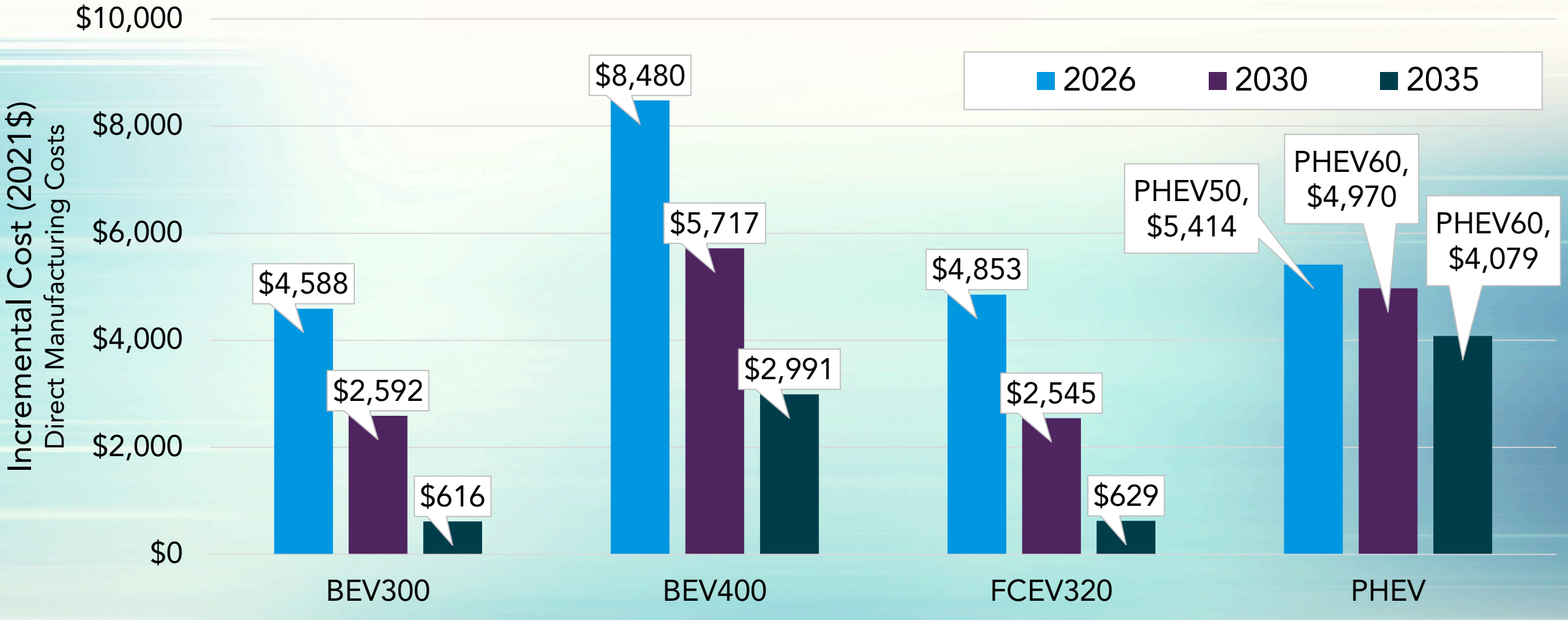


Model Year 2019 – California Sales

Technology	Range (mi)*
BEV	300
Premium/High Performance BEV	400
PHEV Car & Small SUV (2025 → 2030)	50 → 70
PHEV Bigger SUV & Truck (2025 → 2030)	50 → 60
FCEV	320

*Modeled ranges are EPA label all-electric-range equivalent

Medium SUV Incremental Cost Example



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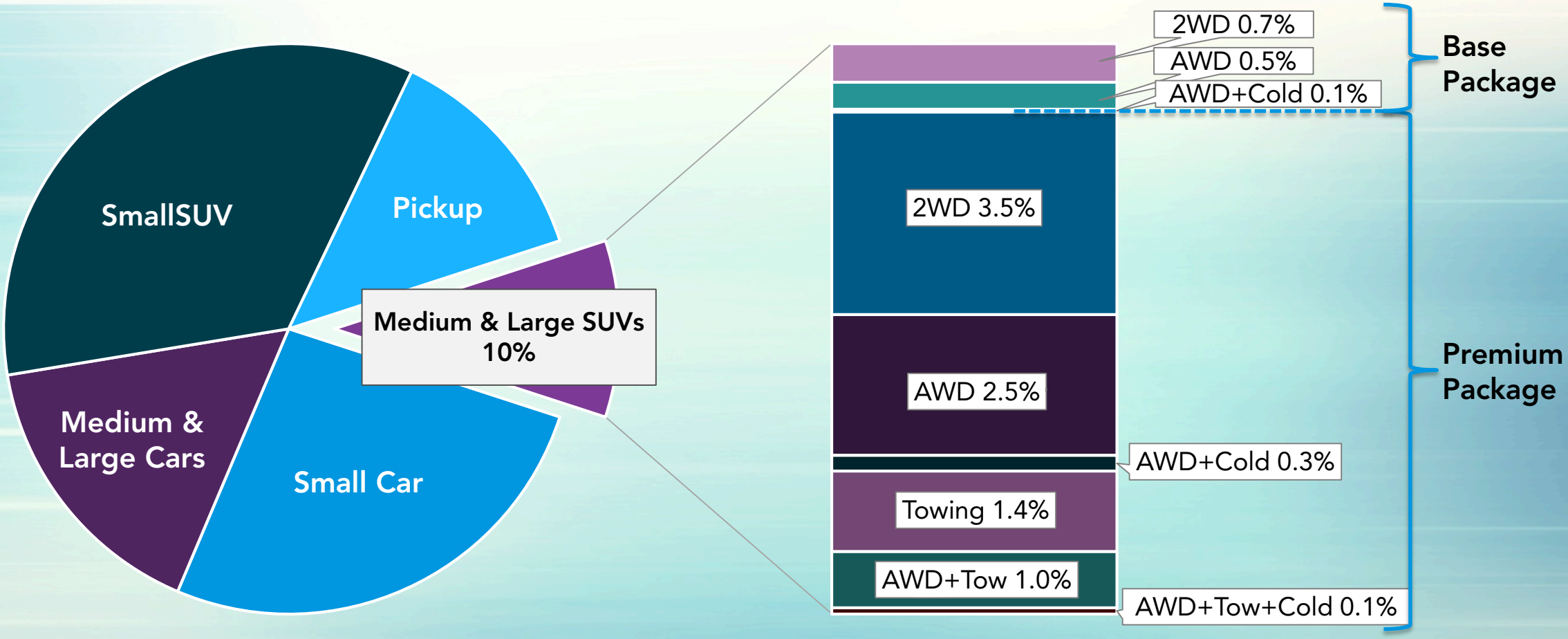
Capturing Consumer Preferences for Certain Technology Attributes

- A single vehicle of each ZEV technology (PHEV, FCEV, or BEV) in each vehicle class is not representative of the market
- Consumer preferences and accompanying technology packages have additional cost implications

Additive Technology Package	Required for
Cold Weather	BEVs in colder climates
Towing	Larger BEVs with towing capability
AWD/4WD	BEVs, FCEVs, and smaller PHEVs where ICE equivalent had AWD/4WD

Example of Tech Package Distribution in Medium and Large SUVs



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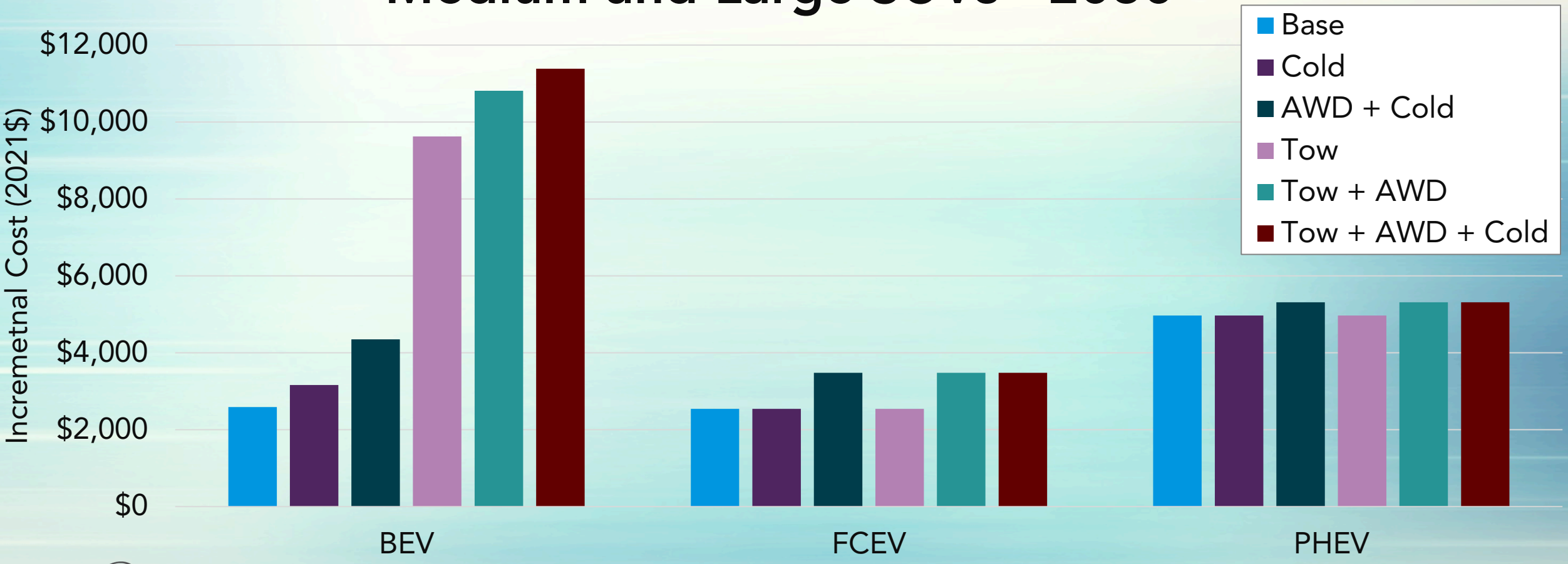
Additional Tech Packages Have Greater Cost Impacts on BEVs

Medium and Large SUVs - 2030



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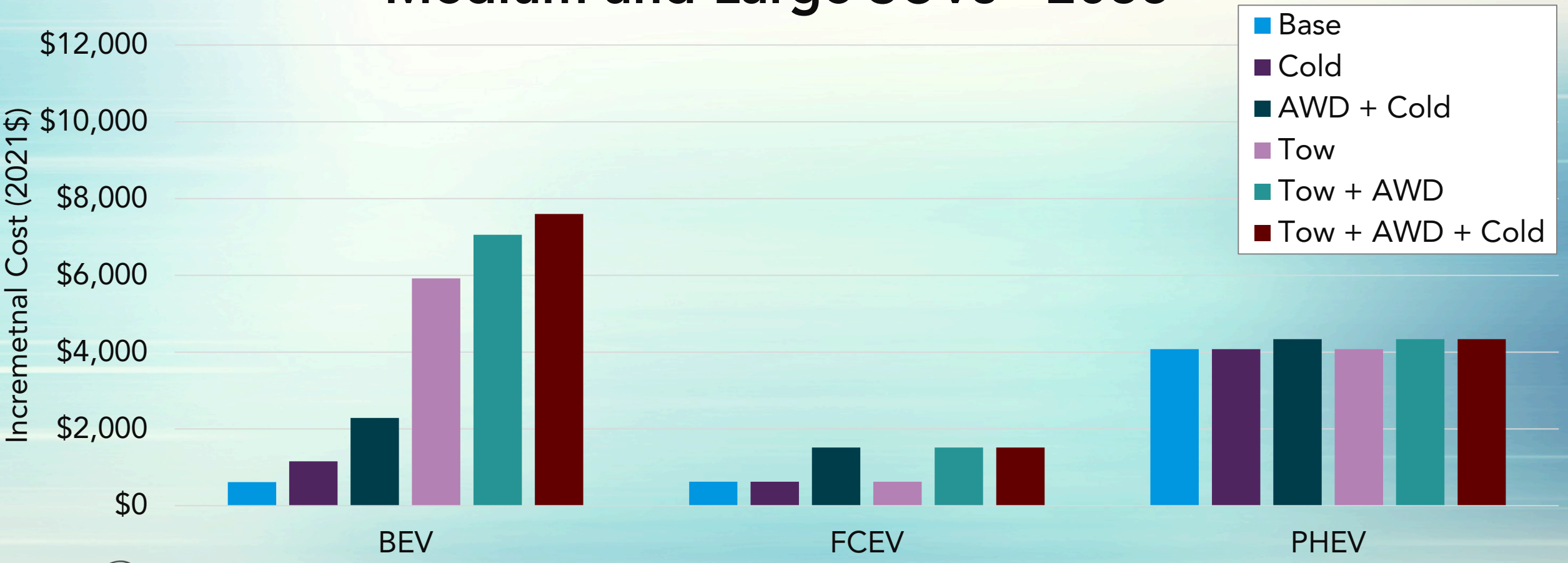
Additional Tech Packages Have Greater Cost Impacts on BEVs

Medium and Large SUVs - 2035



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Staff Seeking Additional Data

- Avoided conventional powertrain costs for a BEV and FCEV (engine delete cost)
- ZEV assembly cost reductions
- Projections for efficiency improvements across all ZEV platforms
- Cost accounting for ZEV assurance measures

Other Costs – ZEV Reductions

- FCEVs and BEVs having fewer moving components and are simpler to assemble
- Both ZEV technologies do not utilize ICEs, so those costs must be removed

ZEV Assembly Cost Reductions	
BEVs	($-1600)
FCEVs	($-800)

ICE and Transmission Delete Cost	
Cars and Small SUVs	($-5,300)
Bigger SUVs and Trucks	($-7,500)

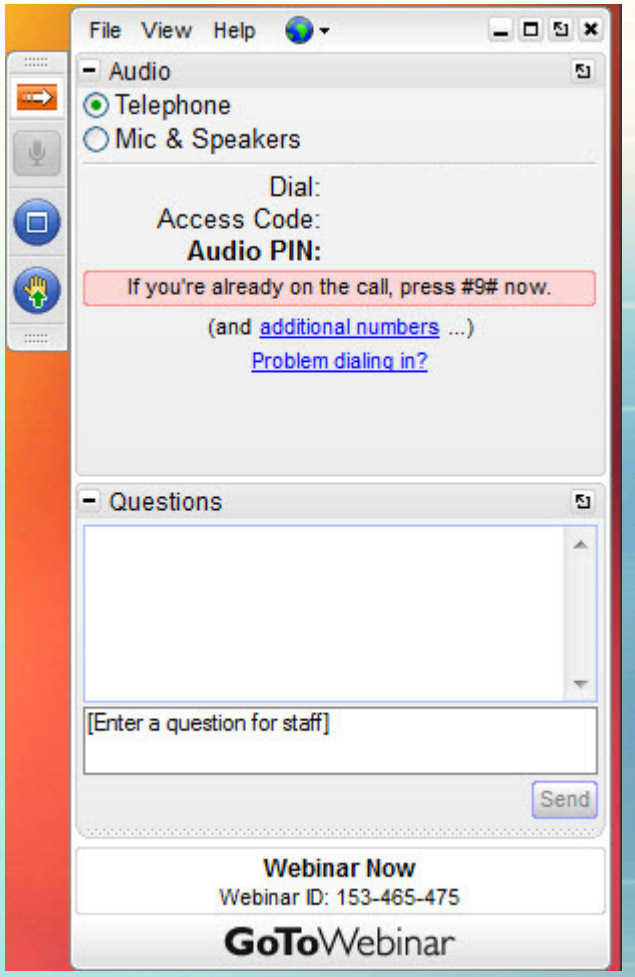
Next Steps

- Release ZEV cost modeling workbook for feedback
- Refine packages and costs based on updated data
- Overall costs and benefits to society and consumers as part of total cost of the proposed regulation (Future Workshop)
- Develop fleet-wide costs from proposed ZEV stringency as inputs to total costs of the proposed regulation (Future Workshop)

Please use GoToWebinar pane to ask

QUESTIONS

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



Update on ZEV Assurance Measures

The Importance of Assuring Consumers about ZEVs

- Protecting Emission Reductions: Assuring ZEVs can fully replace gasoline vehicles for a consumer
- Keeping All Consumers In Mind: Ensuring ZEVs meet unique needs for affordability, durability, and charging over the vehicle's life
- Transparency: Requires disclosure in battery health and warranty coverage to build consumer confidence
- Transitioning to new technology: Bringing independent repair industry into the fold
- Simple Charging: Standardizes fast charging for ease of use

Current Approach to Vehicle Durability

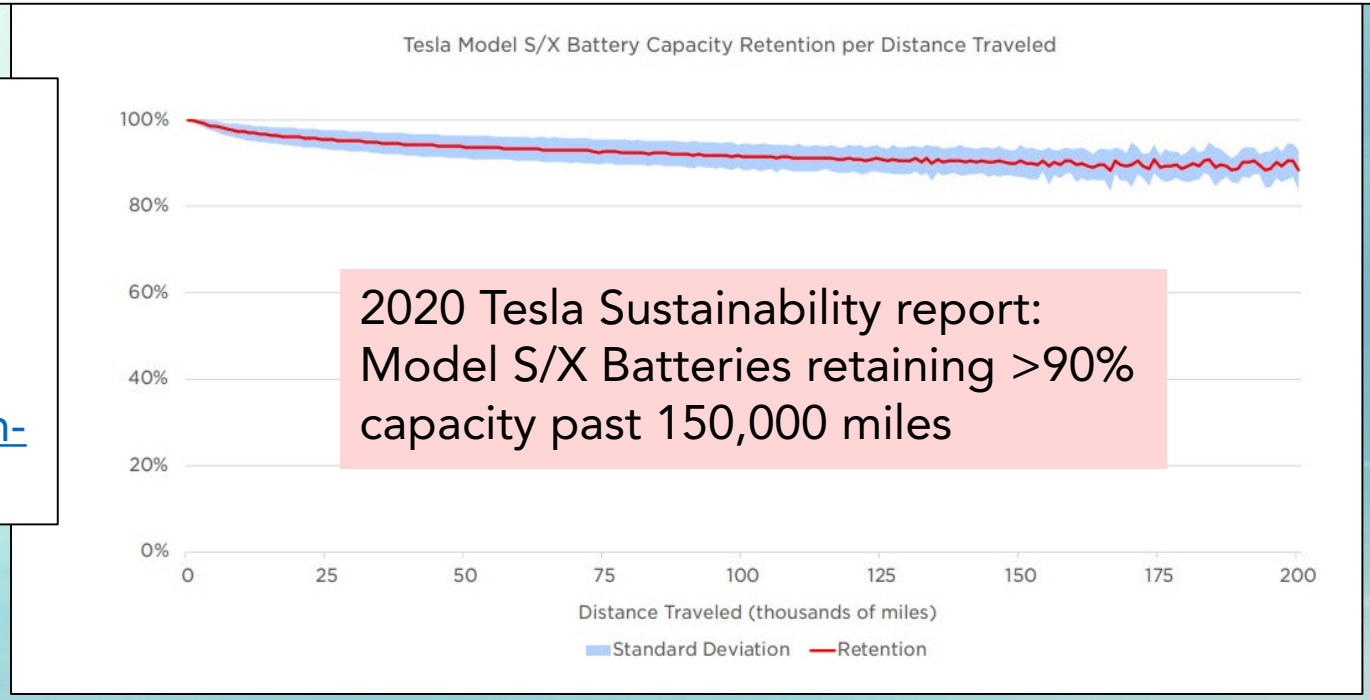
- **Durability (or Full Useful Life) standard**
  - Ensures robust design of components to nominally meet standard
  - Relies on In-Use Compliance Testing to evaluate
- **Warranty**
  - Ensures individual emission-related part failures are OEM's responsibility
  - Partnered with warranty reporting to CARB
- **Currently, these regulations do not apply to ZEVs**

Growing Indications of Battery Longevity in Vehicles

A Wide Range of Testing Results on an Excellent Lithium-Ion Cell Chemistry to be used as Benchmarks for New Battery Technologies

"cells of this type should be able to power an electric vehicle for over 1.6 million kilometers (1 million miles)"
- Harlow J E et al., 2019 A wide range of testing results on an excellent lithium-ion cell chemistry to be used as benchmarks for new battery technologies *J. Electrochem. Soc.* 166 A3031

Nissan says its Leaf batteries will outlast the car by 10-12 years, looks for reuse solutions
https://electrek.co/2019/05/24/nissan-leaf-batteries-outlast-car/



2020 Tesla Sustainability report: Model S/X Batteries retaining >90% capacity past 150,000 miles

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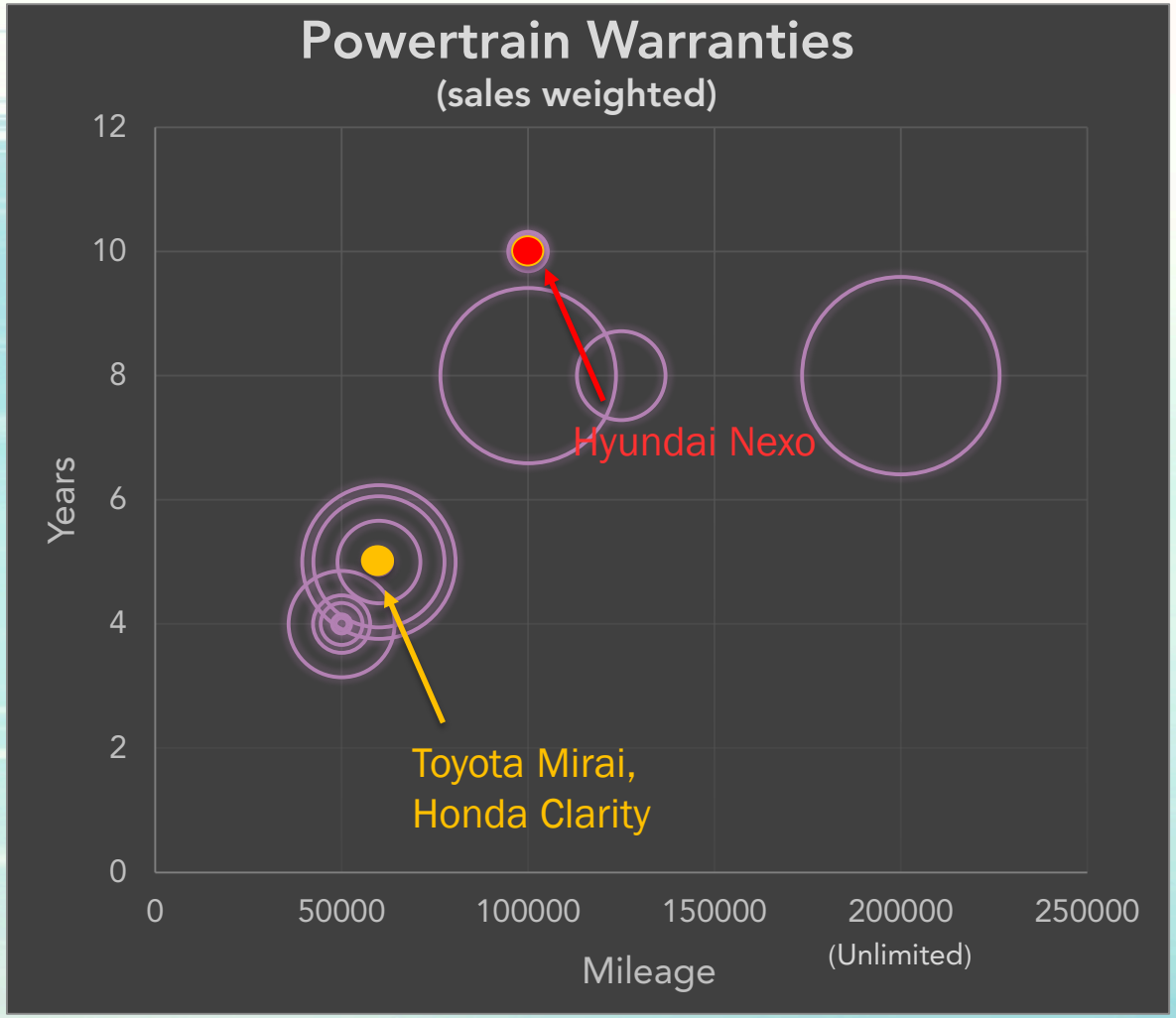
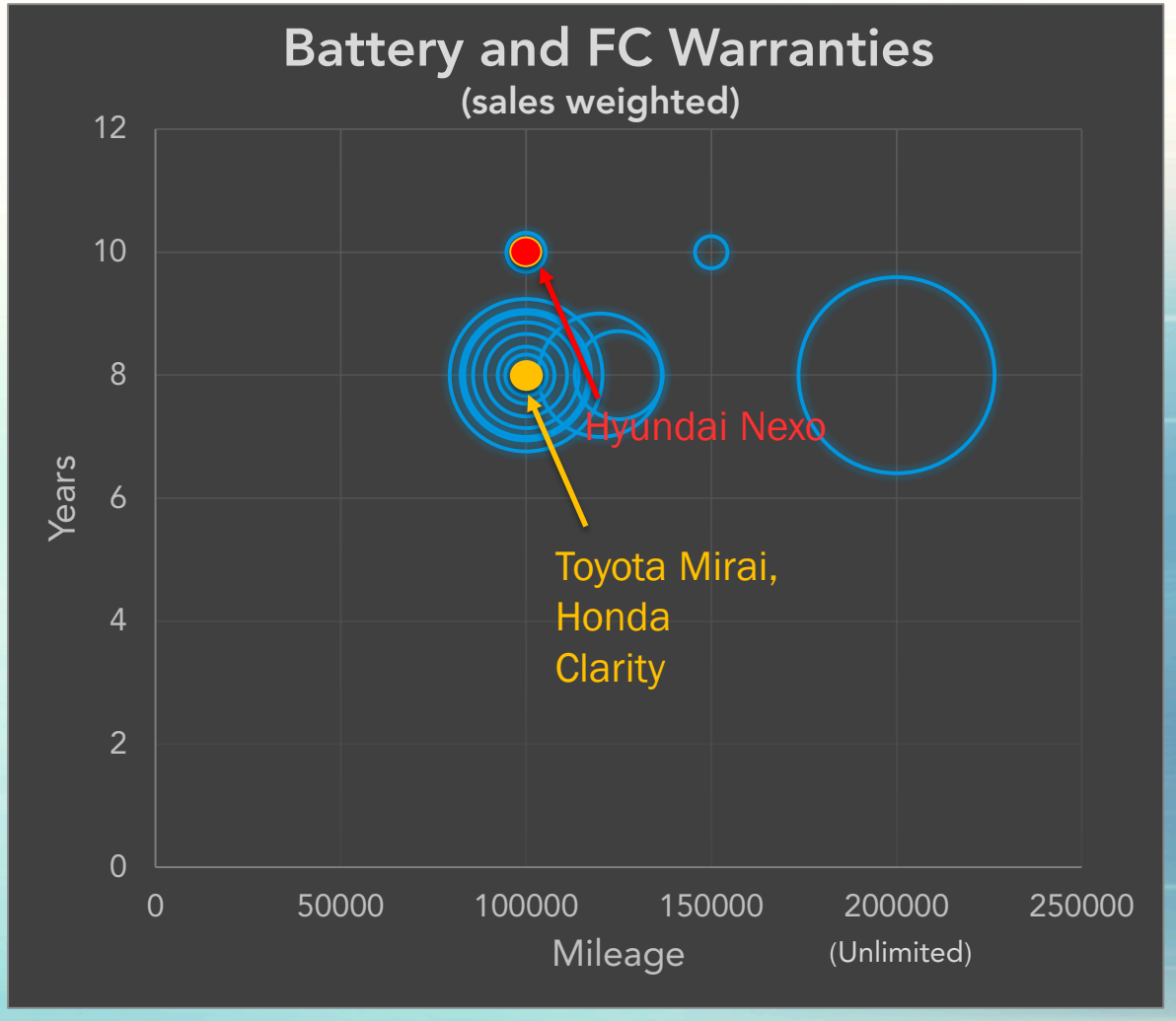
Fuel Cell Durability is Improving

- US DOE reports current technology status can maintain approximately 4,100 hours of operation with less than 10% loss in system output power.[1]
- US DOE near-term and long-term goals to enable estimated 150,000 mile durability are:
  - Near-Term: 5,000 hours with less than 10% power loss
  - Long-Term: 8,000 hours with less than 10% power loss

[1] https://www.hydrogen.energy.gov/pdfs/review20/fc135_borup_weber_2020_o.pdf (slide 12)

Current ZEV Warranty Offerings





Draft Durability Requirement

- Applies to 2026 and subsequent model years
  - BEVs must be designed to maintain 80% of certified UDDS range for 15 years/150,000 miles
  - FCEVs must be designed to maintain at least 90% fuel cell system output power after 4,000 hours of operation
- In development: Corresponding in-use compliance testing regulations

Draft Minimum Warranty Requirements

- BEVs and FCEVs: Defined minimum warranty for powertrain components for 3yr/50k (7yr/70k high-priced), *excluding* batteries for traction power
- BEVs: Require warranty *term* of 10yr/150k for batteries
  - BEVs and PHEVs: OEM required to explicitly disclose threshold and tie it to customer readable state of health metric
  - BEVs and PHEVs: OEM to determine *threshold* for warranty failure
- BEVs and FCEVs: Emulate warranty reporting requirement of gasoline and PHEVs
- All existing requirements for PHEVs remain

Service Information

- In California, there are over 10,000 independent repair shops
  - Compare to less than 2,000 new vehicle dealers
- What is the purpose of California's service information regulations?
  - Requires emission-related repair information to be available for non-dealer technicians
  - Requires tooling to be able to access on-vehicle information to be available to non-dealer technicians

Draft Service Information Proposal

- Require same access & disclosure for ZEVs throughout CCR 1969, California Service Information Regulation
  - For ZEVs, require information disclosure for all propulsion-related components
- Require standardized tooling to reprogram ECUs (SAE J2534)
- Require standardization for some vehicle data
  - Vehicle to tool connector (SAE J1962)
  - Communication protocol of info from vehicle to tool (UDS on CAN)
  - Propulsion related component fault codes
  - Minimal vehicle usage data

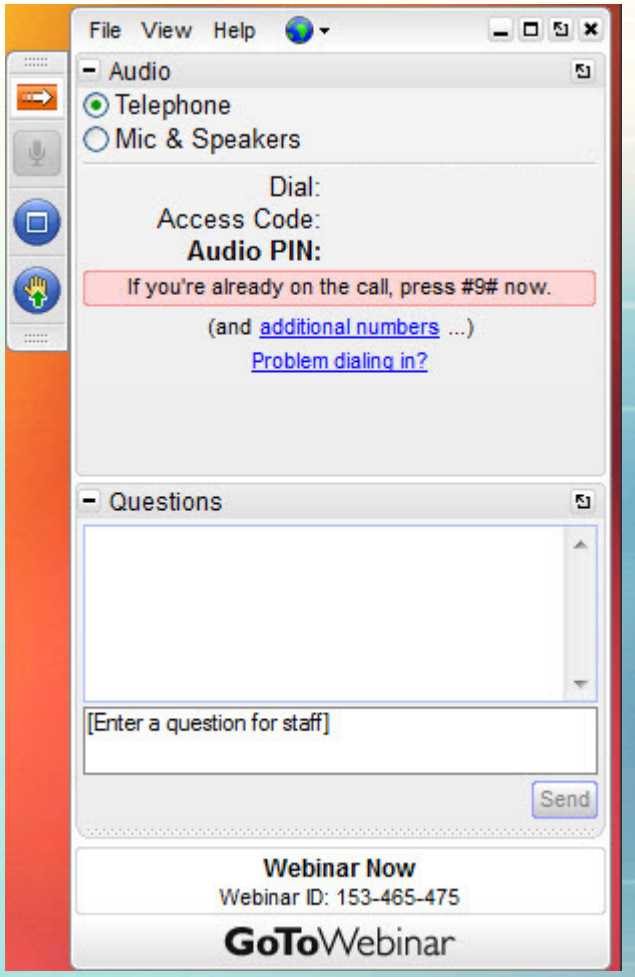
Draft Battery State of Health Standardization Proposal

- Require OEM to calculate a State-of-Health (SOH) of battery
  - Minimum accuracy (±5%) tied to remaining amount of 'Usable Battery Energy' (as measured by SAE J1634 lab test methods)
  - Readable by driver without a tool
  - Normalized (100% equals new on all cars)
- Require OEM to define and disclose SOH value that qualifies for warranty repair

Please use GoToWebinar pane to ask

QUESTIONS

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



Battery Recycling Proposal

Key Issues for Battery Recycling and Reuse

- Large scale retirements of EV batteries will begin to occur within the next 5 to 10 years (~30 GWh of early EVs in US)
- Mineral resources are unlikely to limit battery manufacturing over the short term, but recycling is critical in the long term
- Logistics, infrastructure, and knowledge sharing are key barriers for end-of-life (EOL) management
- Low-value of recovered materials could be a barrier to capital/investment
- Battery reuse is a promising strategy to increase the value of batteries

Lead Battery Recycling: A Good Example?

- Lead acid batteries have a high percentage of recycled content
- Lead battery recycling has been associated with significant and negative environmental impacts, particularly to local communities

https://circuitdigest.com/tutorial/lead-acid-battery-working-construction-and-charging-discharging

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Critical Energy Minerals

- Current EV Batteries rely on a short list of key materials
- 7 of 35 elements on US Department of Critical Minerals List

Battery Critical Energy Materials	Lithium	Graphite	Aluminum	Manganese	Cobalt	Nickel	Copper
	Li 3	C 6	Al 13	Mn 25	Co 27	Ni 28	Cu 29

Rare Earth Elements	Scandium	Yttrium	Lathanum	Cerium	Presdynium	Cerium	Samarium	Europium	Europium	Terbium	Dysprosium	Ytterbium	Lutetium
	Sc 21	Y 39	La 57	Ce 58	Pr 59	Nd 60	Sm 62	Eu 63	Eu 64	Tb 65	Dy 66	Yb 70	Lu 71

Platinum Group and Precious Metals	Ruthenium	Rhodium	Palladium	Silver	Osmium	Iridium	Platinum	Gold
	Ru 44	Rh 45	Pd 46	Ag 47	Os 76	Ir 77	Pt 78	Au 79

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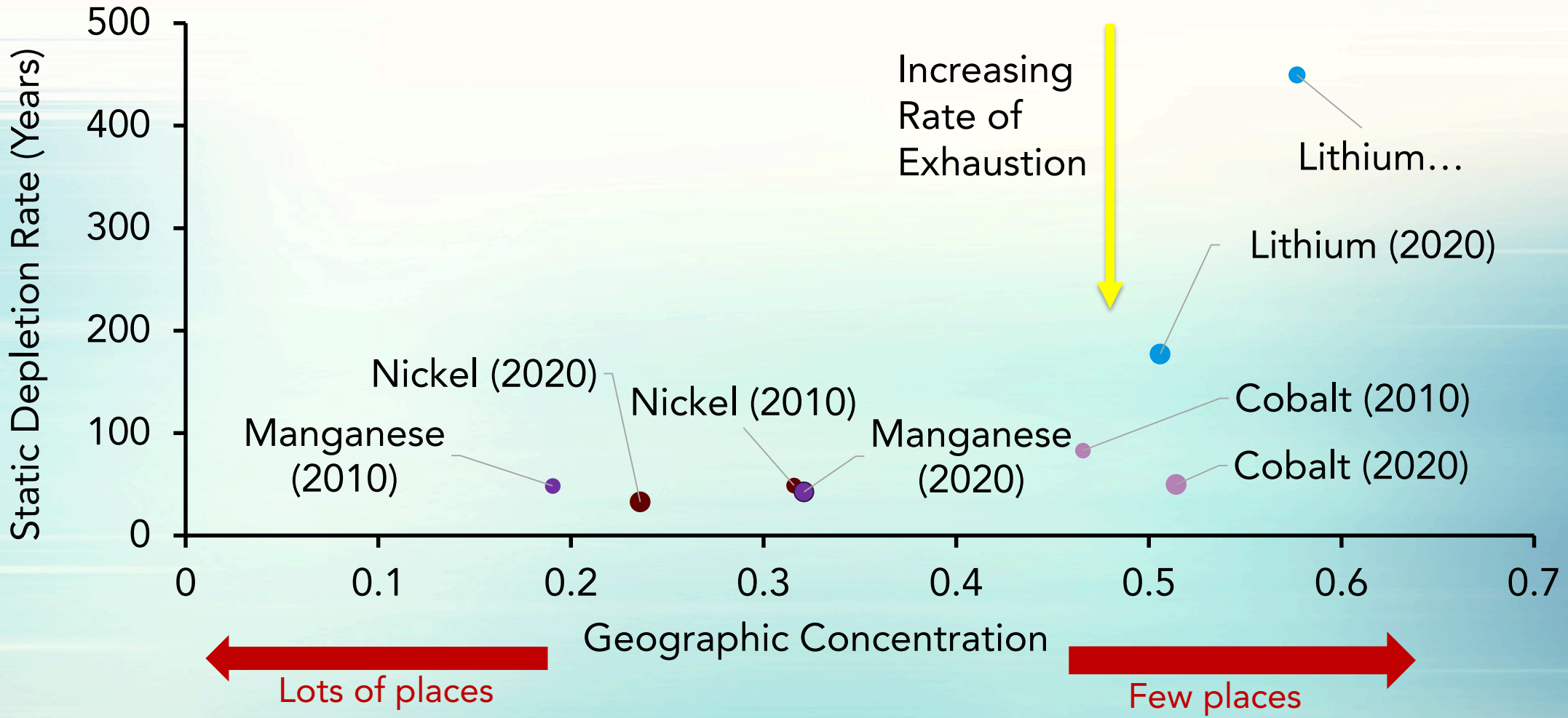
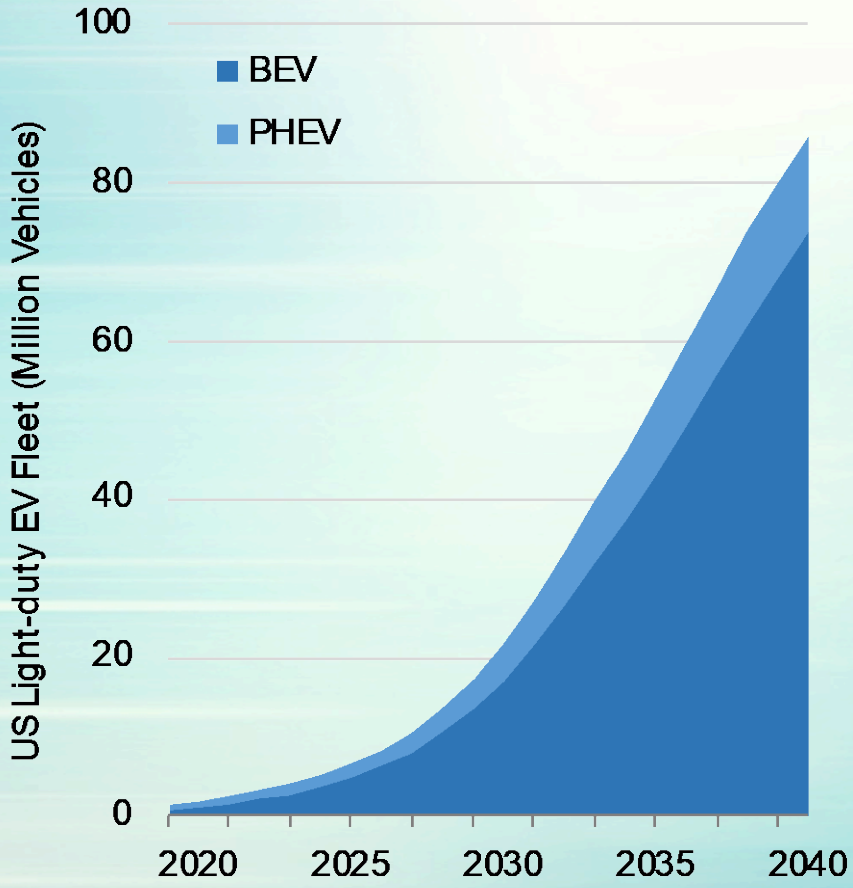
Critical Energy Minerals

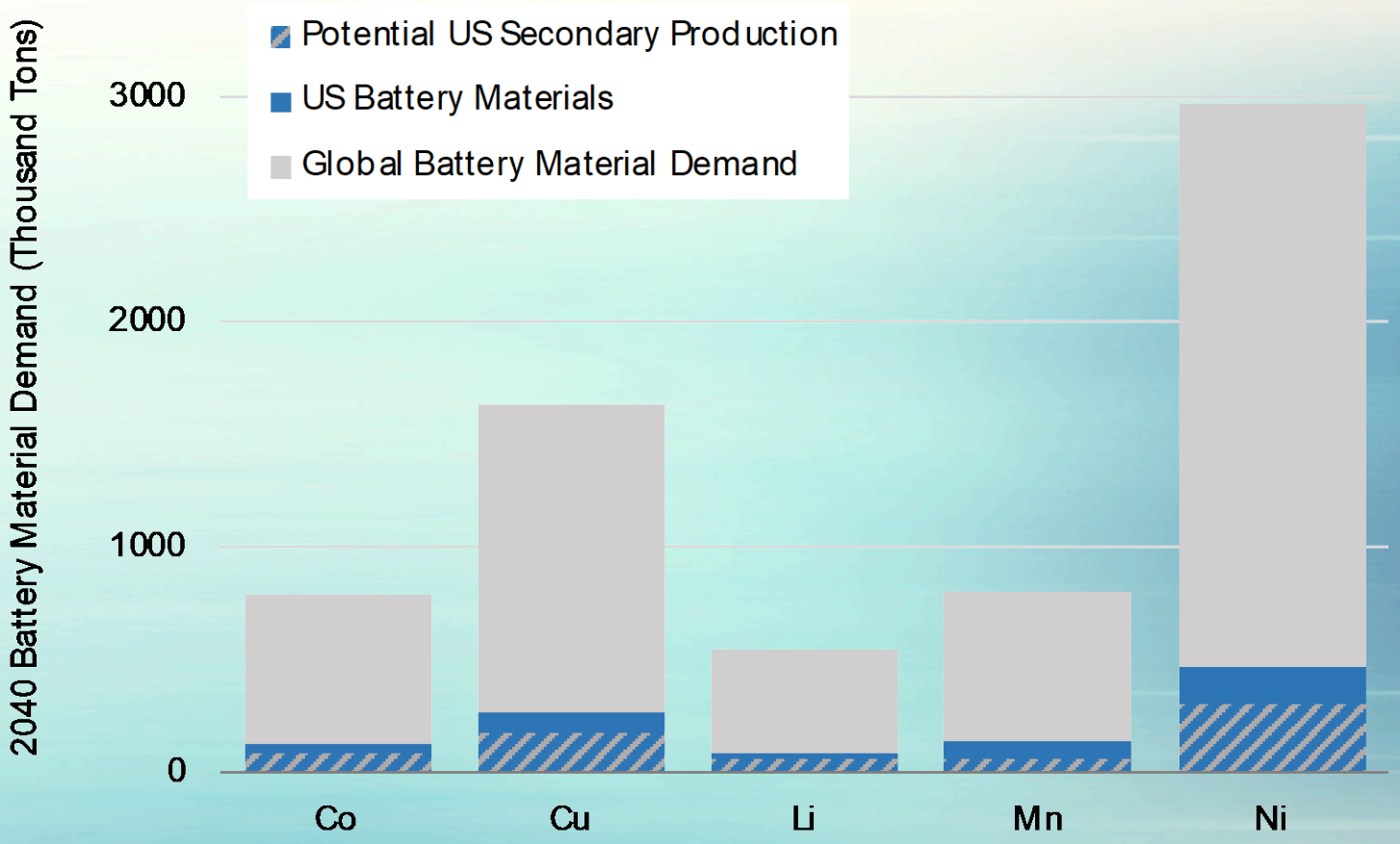


Static depletion rate is the estimated global reserves divided by the annual production from that year. Geographic concentration is the largest identified reserves by country divided by the estimated global reserves for the year. Data from the USGS Mineral Commodity Summaries (2019).

Battery Recycling and Material Recovery

- US could meet more than half of material demand for new batteries with recycled materials by 2040





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Dunn, J., Slattery, M., Kendall, A., Ambrose, H., & Shen, S. (2021). Circularity of Lithium-Ion Battery Materials in Electric Vehicles. *Environmental Science & Technology*.

Problem Statement – *Why a label?*

- Batteries need to be recycled to support continued deployment of ZEVs
- Future ZEV batteries should increasingly rely on recycled/secondary electrode materials
- A mixed chemistry waste stream is a barrier to promising high value recycling technologies
- Critical information must be included with the battery system throughout the value chain to enable sorting, tracking, and promote responsible design

Battery Labelling

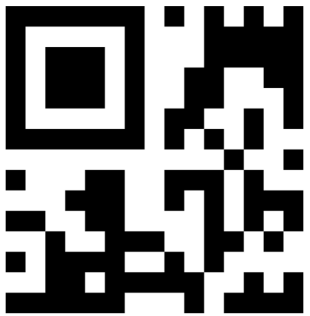
Improving the flow of information down the value chain

- Enable efficient sorting
- Improve the economic efficiency of material recovery
- Enable reuse or second life applications including repurposing
- Prevent improper disposal or exposure to hazards

For illustrative purposes only:

Applies to Pack and Module Components

OEM



Chemistry: NCA

Rated: 1000 cycles @ 200A

Specifications: 28.8V

Composition: (8 x 3.65V / 56.3Ah)

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Label Comparison

Requirement/ Standard	This Proposal	Society of Automotive Engineers (SAE2936)	European Union (EU) Directive	People's Republic of China RoHS
Manufacturer	✓	✓	✓	✓
Chemistry	✓	✓	✓	✓
Voltage	✓	✓	✓	✓
Performance/Capacity	✓	✓	✓	✓
Product Alert Statements/Hazards	✓	✓	✓	✓
Composition/Process Related Information	✓		✓	✓
Electronic Information Exchange/Digital Identifier	✓		✓	

Next Steps

- CARB is continuing to evaluate potential actions to support EV battery recycling and reuse
- Staff will continue to work with other State agencies (CEC, CalRecycle, and DTSC) to develop further policy concepts:
  - CA Lithium Battery Recycling Working Group
  - Multi-agency white paper on end of life management
- Staff plan to participate in SAE standard setting process

Please use GoToWebinar pane to ask

QUESTIONS

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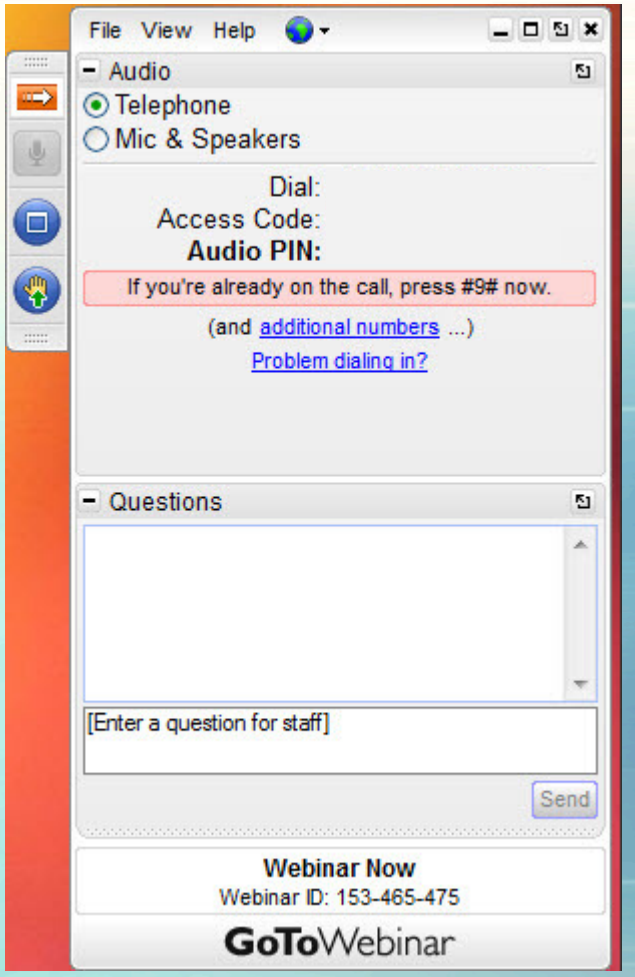

Updated ACC II Timeline

- Proposals to increase ZEV accessibility to priority communities
- ZEV test procedure modification for BEV range certification
- ZEV credit reporting modifications
- Air-conditioning refrigerant updates
- Other updates on proposals discussed today/previously

Other Opportunities for Comments

- Written comments may be submitted through June 11, 2021 to: cleancars@arb.ca.gov
- Subscribe to the Clean Cars email list for updates on document availability and future workshops