Informational Update On Zero Emission Vehicle Regulation Revisions

Overview

History

Path to 2050: GHG Reductions

Current Technology Status

Policy Alternatives

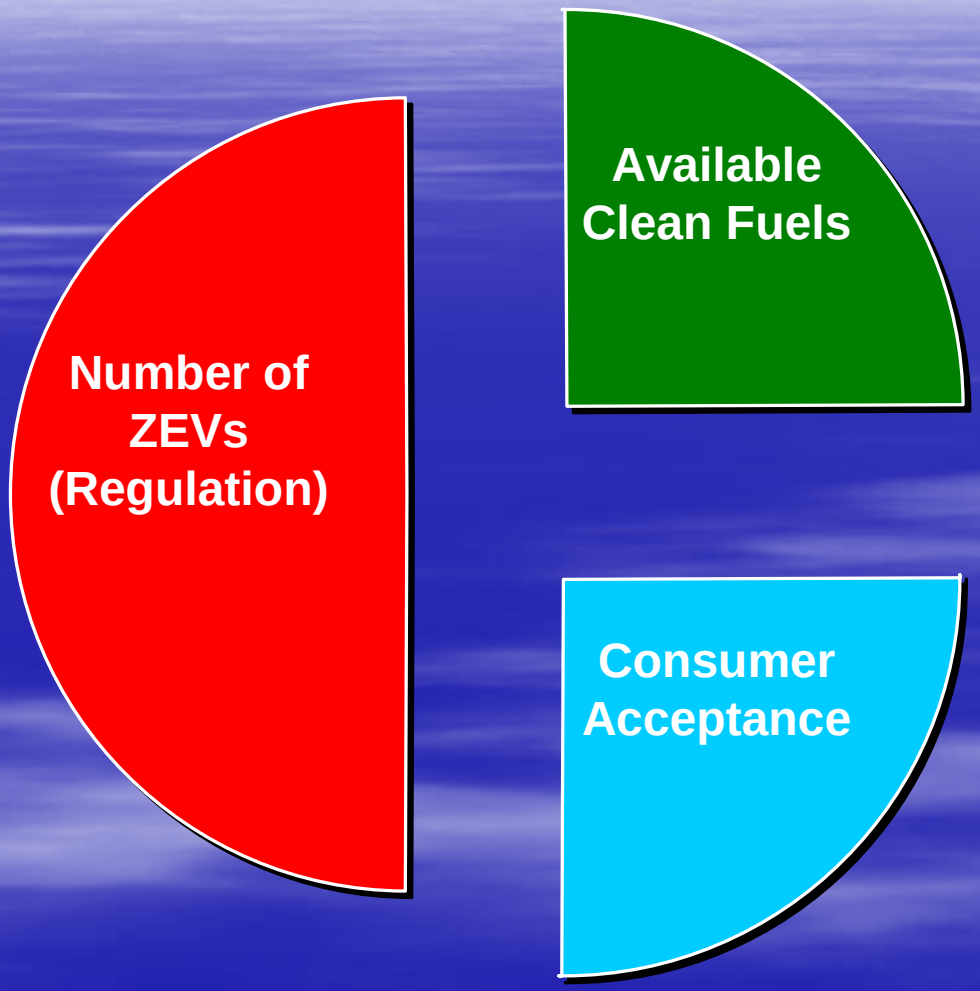
Complementary Policies

Summary and Next Steps

Presentation Overview

- All ZEV technologies are required to achieve 2050 GHG goal
- ZEV markets launched by 2020
- Regulatory mandate necessary
- Comprehensive policy approach needed to overcome market barriers unique to ZEVs

Successful ZEV Commercialization



ZEV Regulation History

- In 1990, requirement in LEV I to achieve ultimate criteria pollutant reductions
  - Improvements in conventional vehicle technology not sufficient to meet air quality standards, ZEVs were needed
- Modified to better align requirements with state of technology

ZEV Program Accomplishments

- Demonstrated ZEVs technically viable
  - Several thousand vehicle demonstration
  - Accelerated battery and fuel cell development
  - Initial public charging infrastructure
  - ZEVs on threshold of early commercialization
- Hybrids commercialized
- PZEVs widely available

Vehicle Type		Numbers
ZEV	Fuel Cell	250
	Battery Electric	4,800
	Neighborhood Electric	28,000
AT PZEV	Hybrid or CNG	258,000
PZEV	Conventional	1,158,000

Current ZEV Requirements

	2012-2014	2015-2017
ZEVs – Type IV Fuel Cells	7,500	25,000
Enhanced AT PZEVs – Plug-In Hybrids	~ 60,000	~ 85,000

Board Direction – 2008

- At the March 2008 Board Hearing, the Board adopted Resolution 08-24 directing staff to:
  - Review the LEV, Pavley (LEV-GHG), and ZEV programs, keeping in mind the need to reduce criteria pollutant emissions, climate change emissions, and dependence on petroleum,
  - Strengthen the ZEV program for model years 2015 and subsequent, focus on ZEVs and Enhanced AT PZEVs,
  - Ensure California is the center of ZEV commercialization development, and
  - Return to the Board by the end of 2009.

Implications: Policy Integration

- Add GHG reduction to ZEV program goals
  - Match vehicle requirements to achieving 80% GHG reduction goal by 2050
- ZEV focus: Moving technology from development to early commercialization
  - PZEV and Hybrids are commercial
    - Remove from ZEV program
    - Consider in setting more stringent LEV and GHG standards
  - Enhanced AT PZEVs (plug HEV) and ZEVs (BEVs, FCVs) not yet commercial
    - Focus of revised ZEV program
    - Sunset program when commercialization successful

ZEV Redesign Process

- 2050 GHG Analysis

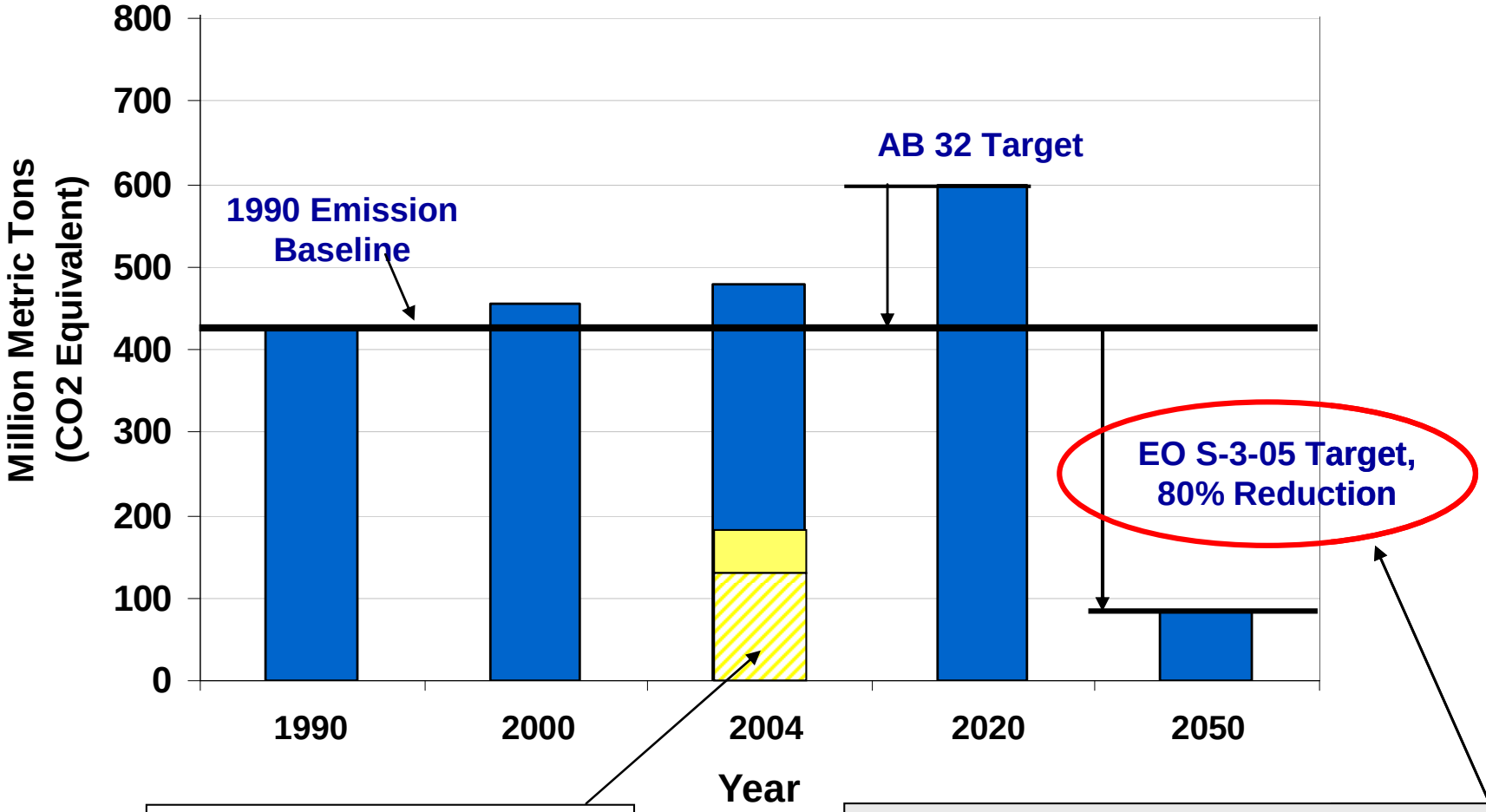
  Policy Question: How many ZEVs are necessary to achieve an 80% GHG reduction by 2050?
- Technical Review

  Policy Question: What is the current status of ZEVs and ZEV enabling technologies?
- Policy Structure

  Policy Question: What ZEV Regulation structure sets a path to 2050 yet provides appropriate incentive structure for industry success?
- Review of Complementary Policies

  Policy Questions: What other policies, besides the ZEV regulation, are needed to prevent or remove market barriers?

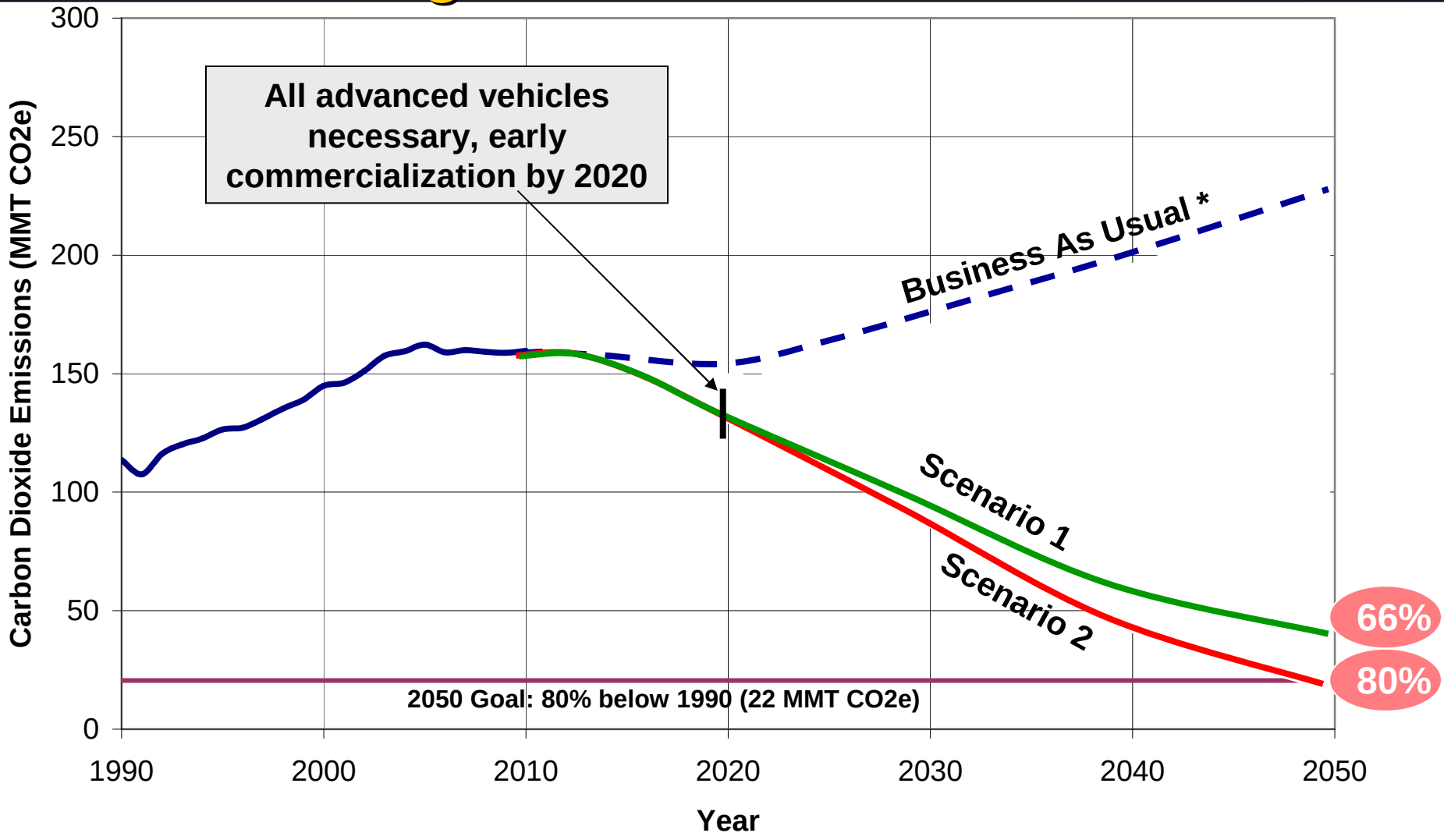
Total GHG Emissions and Policy Targets



Trans. sector 38%, LDV Sub-sector, 28% of GHG total

Most relevant for ZEVs, will require dramatic changes in vehicle markets starting in 2020

Passenger Vehicle GHG Scenarios

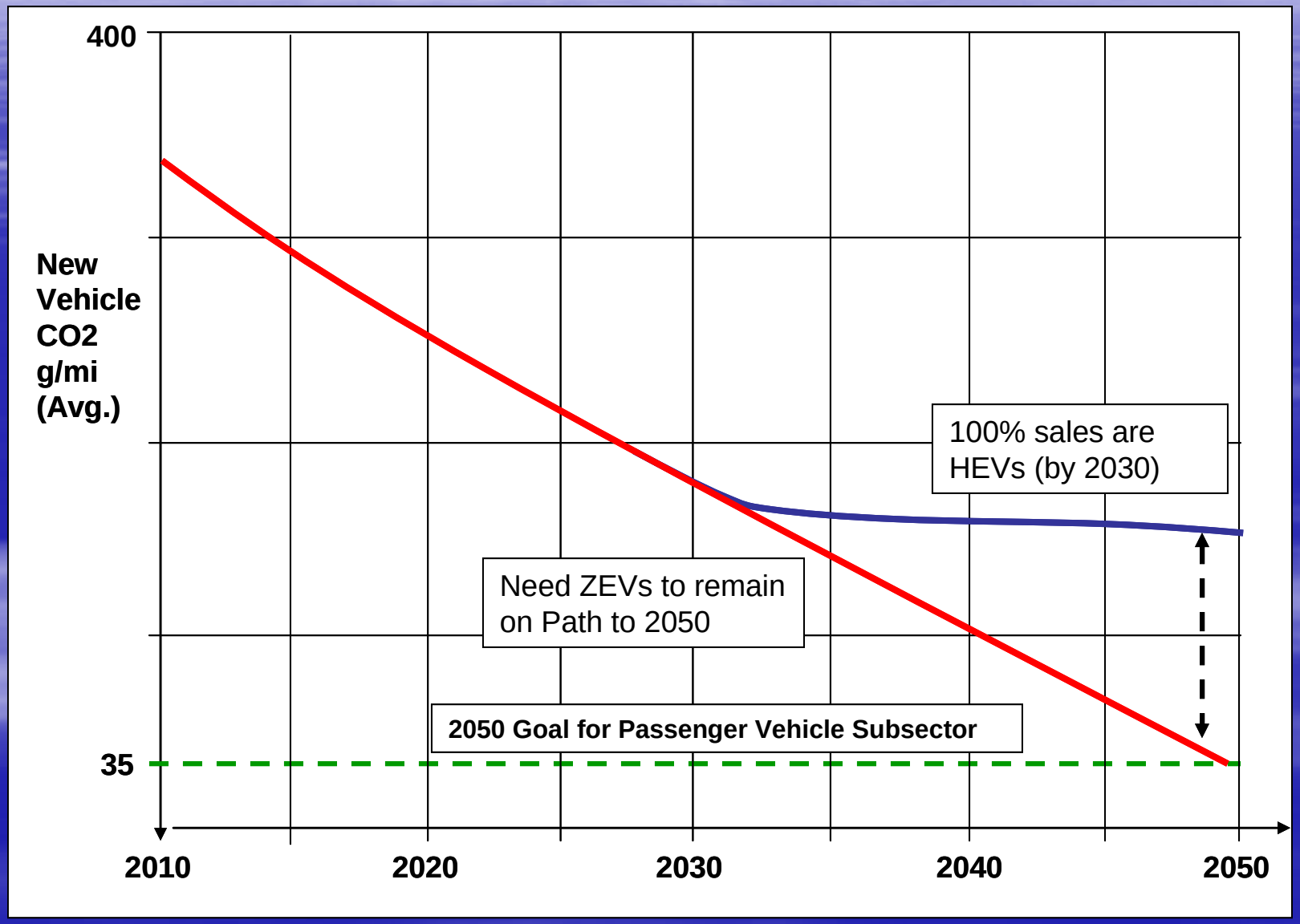


Scenario 1: 100% ZEV sales by 2050, 1 billion gallons gasoline equiv (BGGE) biofuels

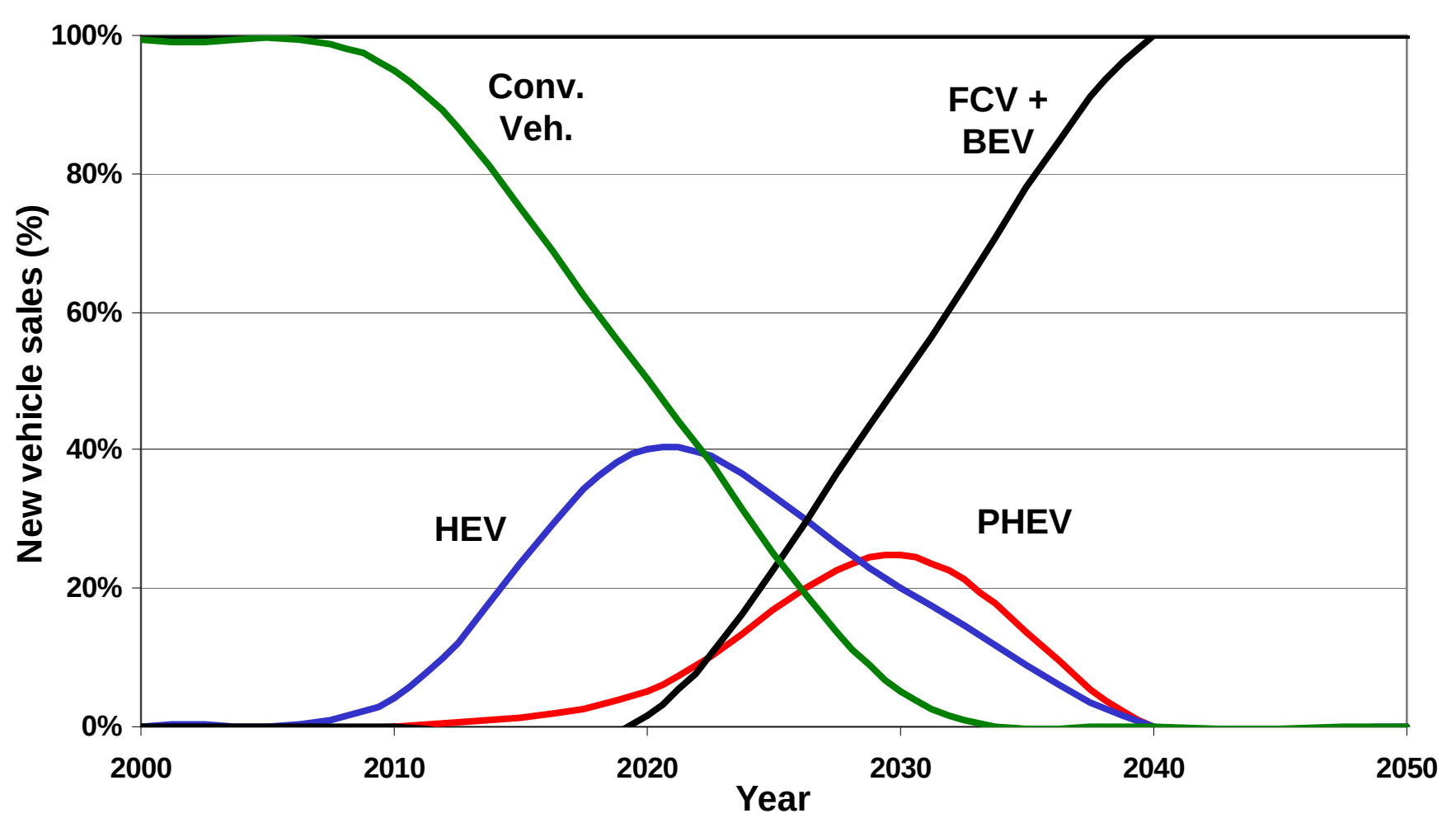
Scenario 2: 100% ZEV sales by 2040, and more biofuels (1.7 BGGE)

* Hypothetical BAU for this analysis only, does not represent ARB projections. Assumes Pavley 1 and LCFS are implemented.

New Vehicle Emissions



New Passenger Vehicle Sales (Auto only) – Scenario 2



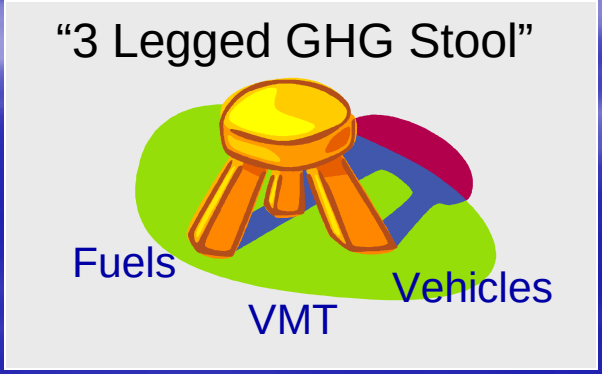
ZEV sales reach 100% by 2040, but on-road fleet is still mixed:
ZEVs are 87% of on-road fleet in 2050

ZEV Sales in 2020 & 2025

Scenario	% ↓ GHG In 2050	Sales in 2020	Sales in 2025
Current ZEV mandate	25%	25,000	30,000
Scenario 1	66%	25,000	250,000
Scenario 2	80%	25,000	425,000

Implications for Policy Development

- Rapid sales growth of ZEVs needed, with high volume production beginning by 2020
  - 10,000s by 2020 (pre-commercialization)
  - 100,000s by 2025 (commercialization)
- Expansion of low-carbon fuel & electricity supply is essential
  - Policies that can influence this include RES, LCFS, SB 1505, AB 118
- VMT per capita reductions are important and have large implications on the other two (vehicles, fuels)



Zero Emission Vehicle Roll Out And Fleet Stratification

- Overall Trends
  - Fuel economy and GHG emission focus
- 2010 to 2015
  - Increased market share of advanced technologies
  - Electrification of light duty vehicle fleet
  - Many companies exploring PHEVs and short-range BEVs
- 2015 and beyond
  - Short to mid-range BEVs, PHEVs with greater all electric range
  - Fuel cell vehicles

Incremental Retail Price of Future Propulsion Technologies [Using MIT Assumptions]

	RETAIL PRICE INCREASE [$2007]
VEHICLE TYPE	
	Cars
2035 Hybrid retail price	$24,100
Incremental relative to 2035 hybrid:	
2035 Plug-in Hybrid (30 mile AER)	$3,400
2035 Battery Electric (100 mile range)	$5,500
2035 Fuel Cell	$2,800

Status of Technology: Fuel Cell Vehicles

- Many technological barriers have been overcome
- Two largest remaining challenges: **cost** and **durability**
- Fuel cell system approximately 2x conventional engine cost (according to U.S. DOE current estimates)
- Cost: $61/kW at high volume (2009 DOE projection)
- Daimler, Ford, GM, Honda, Hyundai/Kia, Toyota and alliance Renault SA and Nissan issue a joint LUA

  "…automakers strongly anticipate that from 2015 onwards a significant number of FCV could be commercialized"
- Pre-commercialization possible with 2015 technology and costs, though continued R&D needed on durability

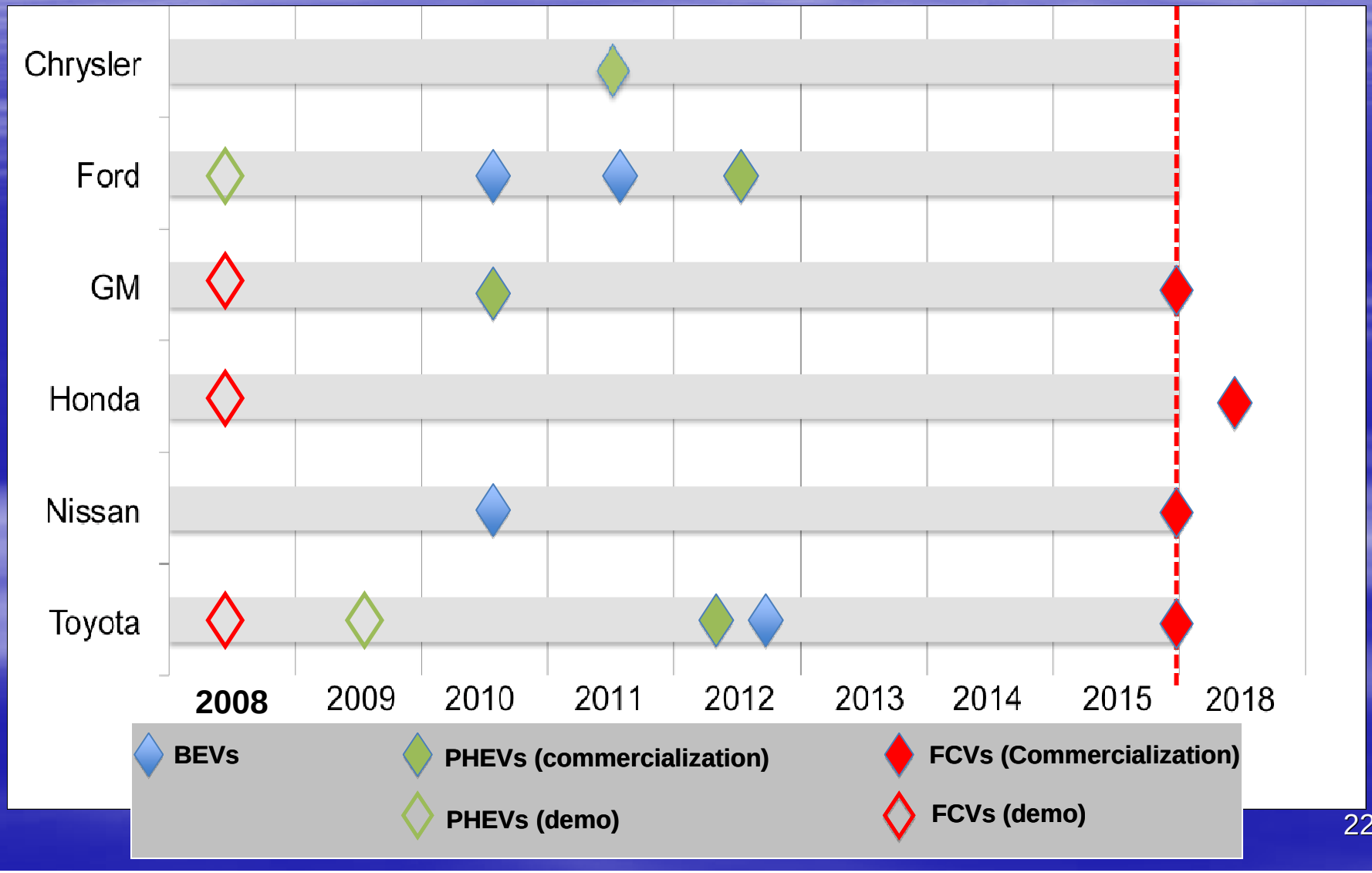
Status of Technology: Batteries

- Li-Ion **durability** and **cost** challenges remain, but have the potential to become commercially viable and profitable within next 10 years
- Cost: $1000/kWh (today), potential for $300/kWh at high volume
- Durability: Challenges remain for hot climates
- Production capacity is “on track” to support the required 2012-2014 pre-commercial BEVs and PHEVs

Market Projections: BEVs, FCVs and PHEVs

- All major OEMs believe technology portfolio approach necessary.
- Most OEMs committed to BEV and PHEVs pre-commercialization meeting regulatory requirements.
- Several OEMs are prepared to commit to FCVs provided fueling infrastructure is available.
- Several manufacturers plan over compliance
  - Two manufacturers plan to significantly exceed the ZEV production requirements of the regulation

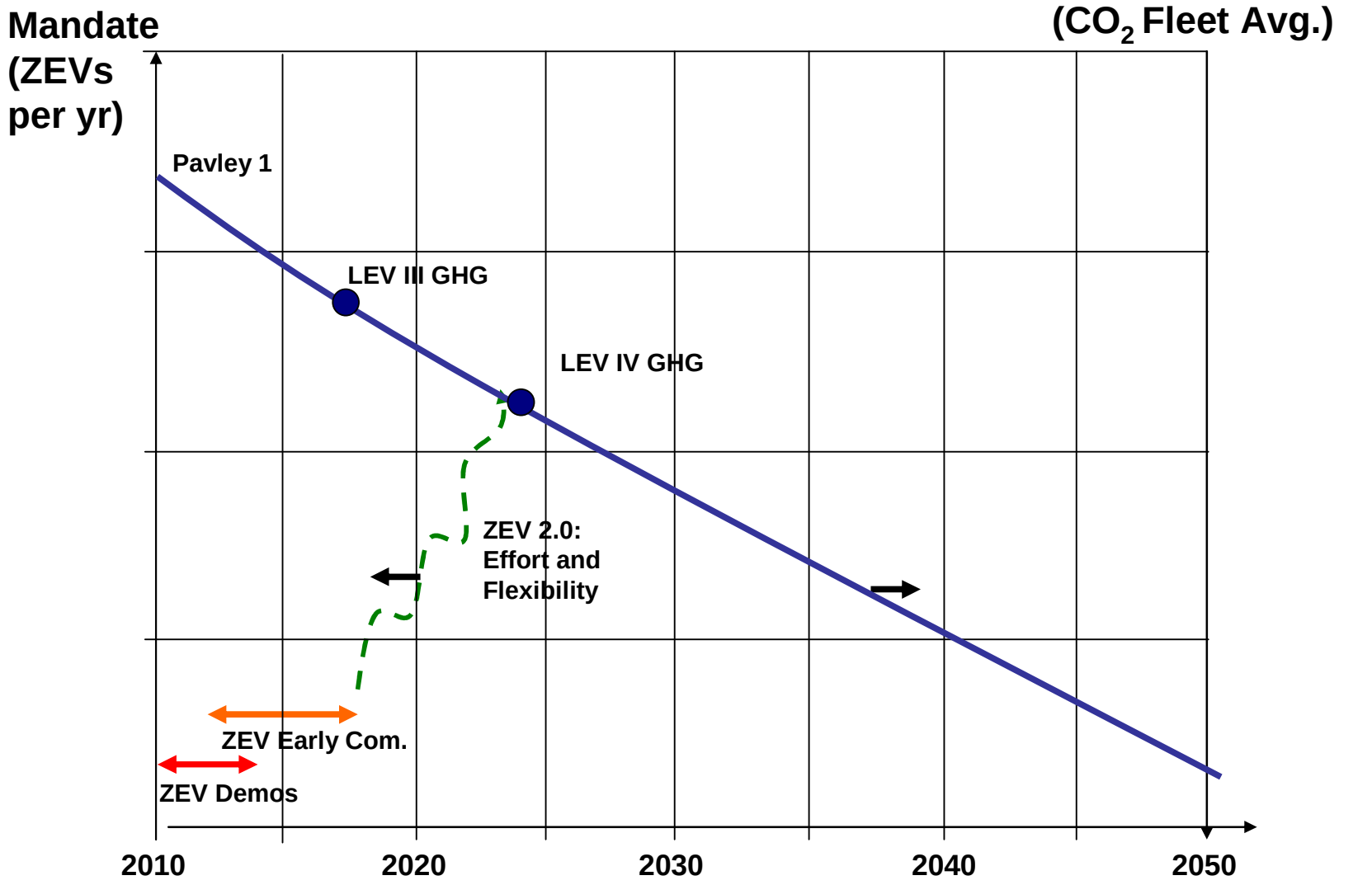
Zero Emission Vehicle Demo/Production Start Years



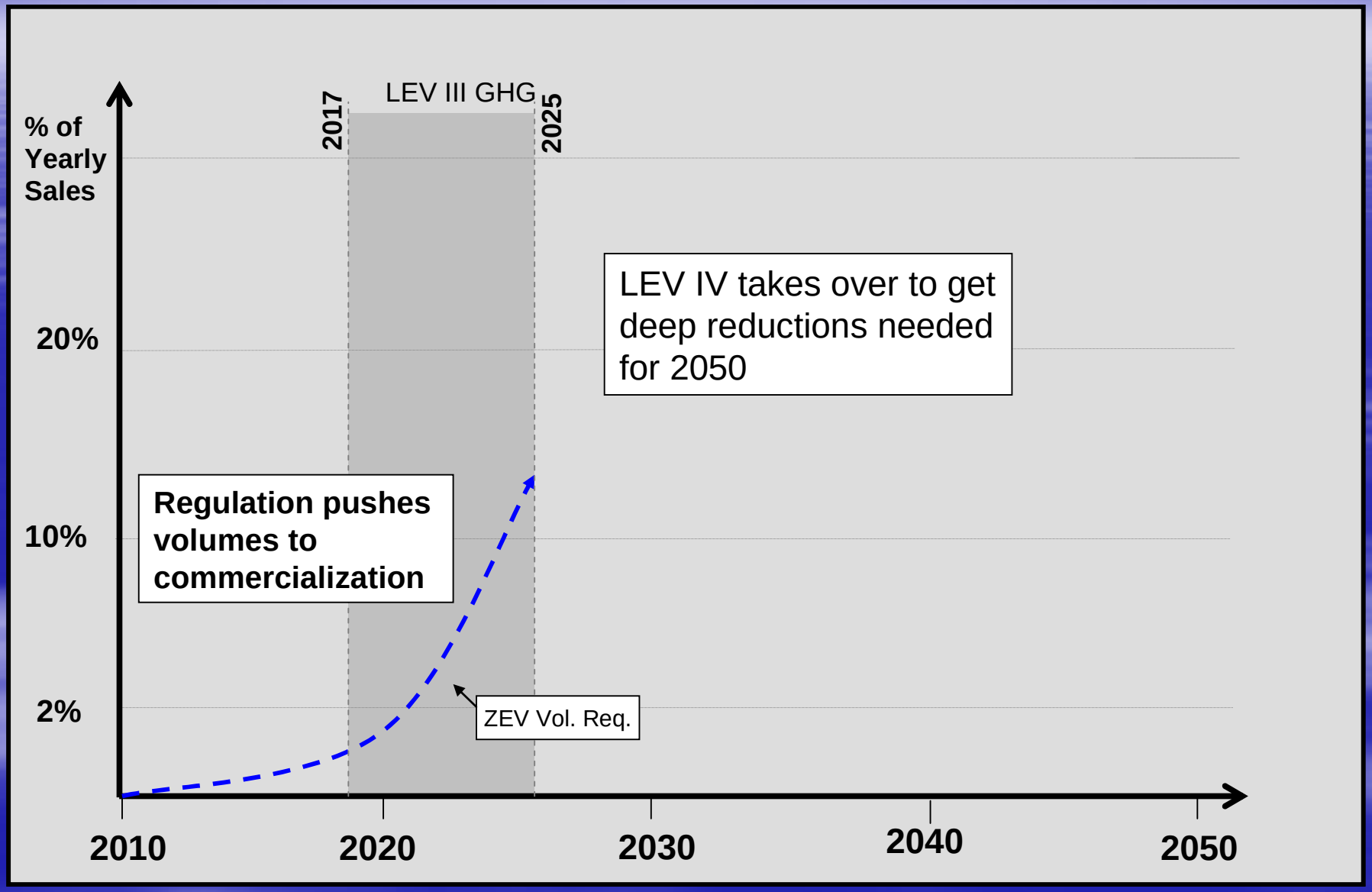
ZEV Mandate is Needed

- Guarantees CA remains on path to 2050
- Market forces along will not sufficiently bring ZEVs to commercialization
- Specific regulatory mechanisms needed for ZEVs
  - ZEVs require slower transition
- Mandate appropriate for 2015-25 to ensure ZEV vol, reduces risk of early market failure
  - Emission benefits not substantial enough at low volumes to guarantee ZEV development
- Once model and technology variety established, performance std. will take fleet to 2050

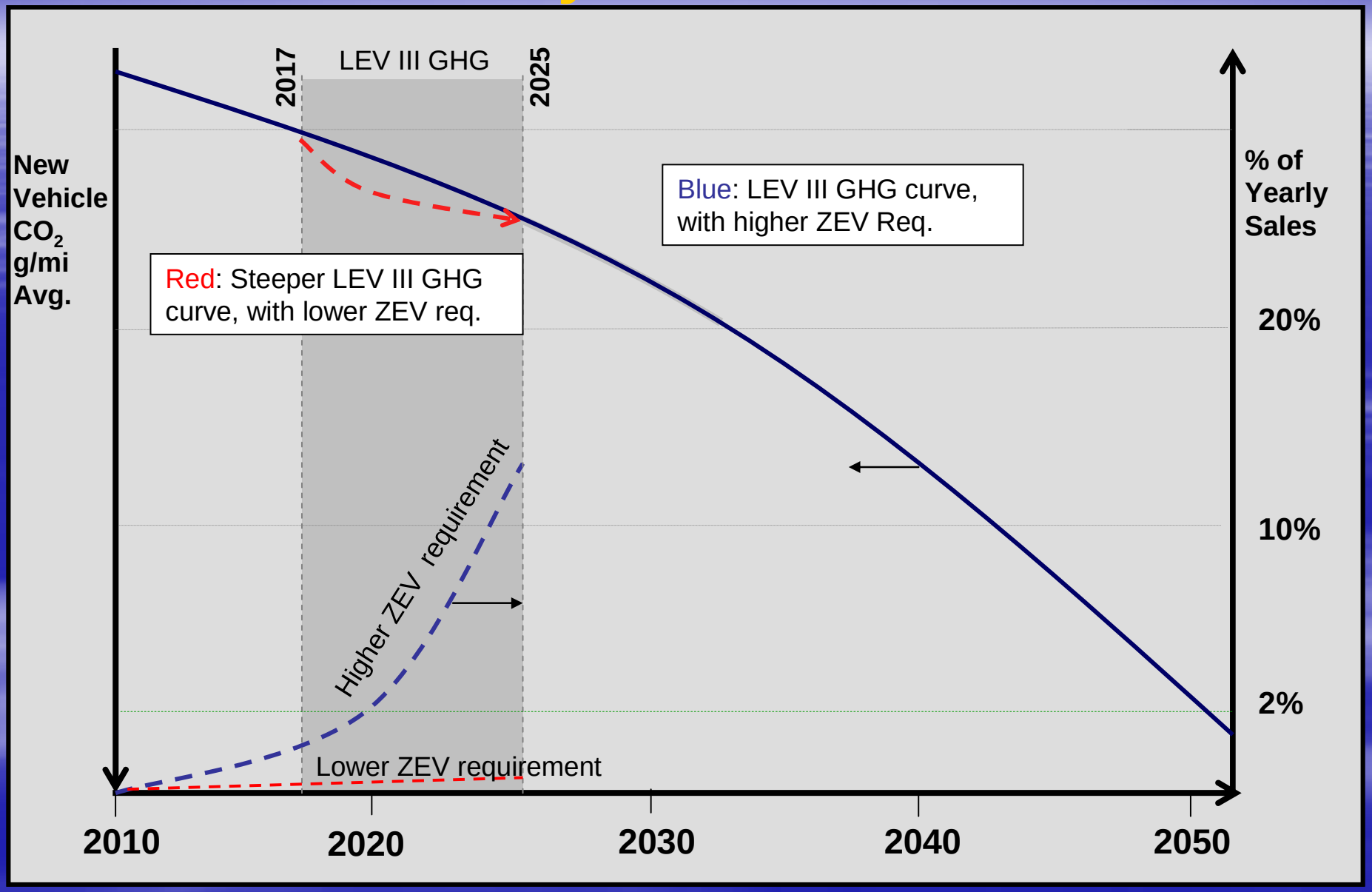
ZEV Policy Future



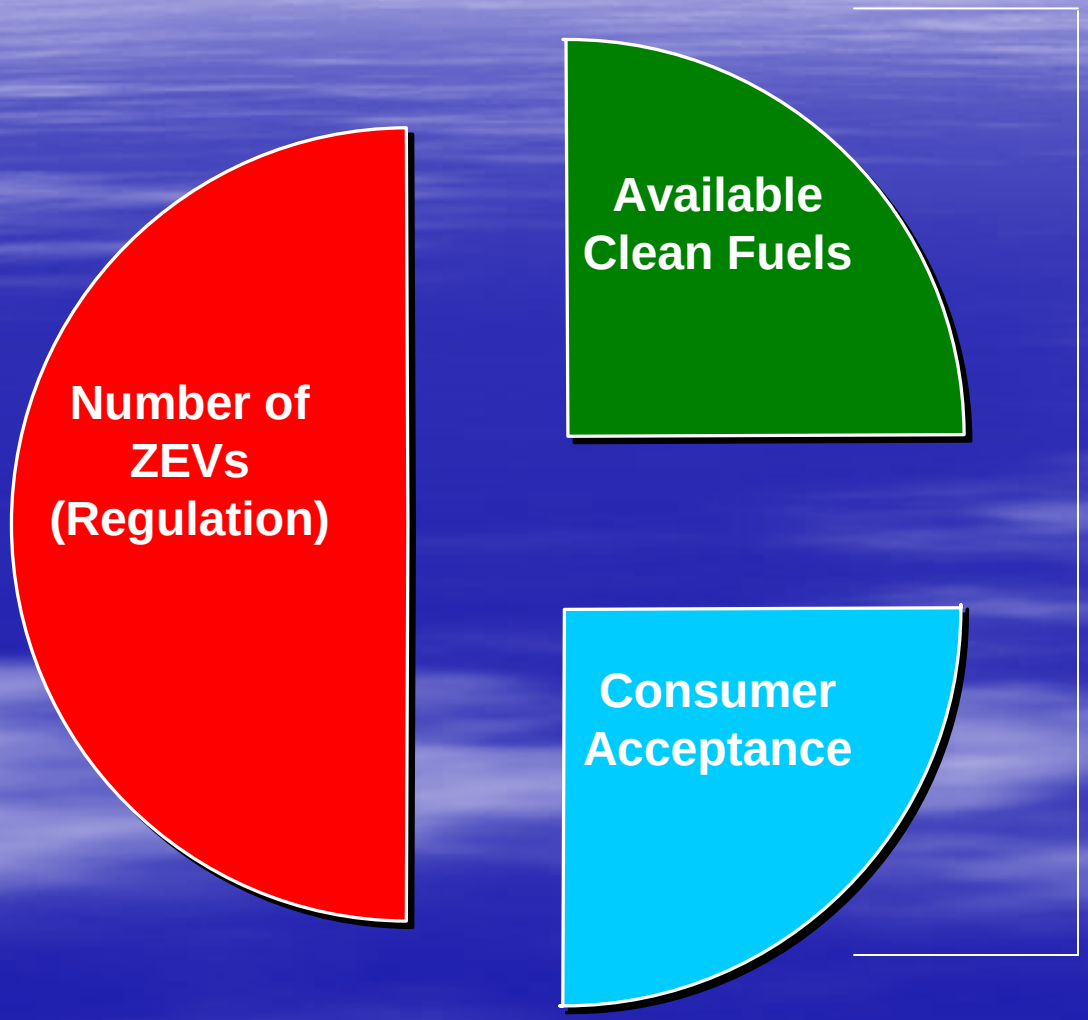
Policy Alternative 1



Policy Alternative 2



Complementary Policies



To ensure ZEV markets emerge, additional "complementary" policies needed in next 10 years

Electric Charging Infrastructure

- Current infrastructure minimal with limited compatibility among different vehicles and chargers
- Near-term: home charging is key
- CPUC Rulemaking 09-08-009
- ARB review of electric infrastructure policies and submit plan to board in 2010

Hydrogen Infrastructure

Year	2009	2010	2011	2012-14	2015-17
Total FCVs[1]	193	370	712	4,307	49,600
H2 Stations[2]	6	10	13	19-31	tbd

1. Source: Aggregated OEM projections from CaFCP 2008 action plan
2. Does not include bus infrastructure

Options to infrastructure: Three Prong Approach

1. Financial incentives
2. Fuel performance regulations
3. Alternative fuel infrastructure regulation

1. Infrastructure Incentives

Financial incentives

- Hydrogen Highway funding - ARB
  - $14.9M to date - Seven stations funded
  - SB 1505 requirements met for emissions and renewables
  - Funding from this source discontinued
- AB 118 funding - administered through CEC

2. Fuel Performance Regulation

LCFS credit incentives

- Focused on fuels with long-term potential and larger market barriers
- Internal evaluation of the benefits and challenges
- Workshops with stakeholders
- Maintain LCFS primary goals

3. Revised Clean Fuels Mandate

13CCR Section 2300 et seq.

- Focus on vehicle/fuel technologies that align near term infrastructure growth with 2050 low carbon fuel needs
- Energy providers match fuels and outlets to OEM deployments
- Align stations placements with vehicle placements
- Shift compliance burden to suppliers

Conclusions

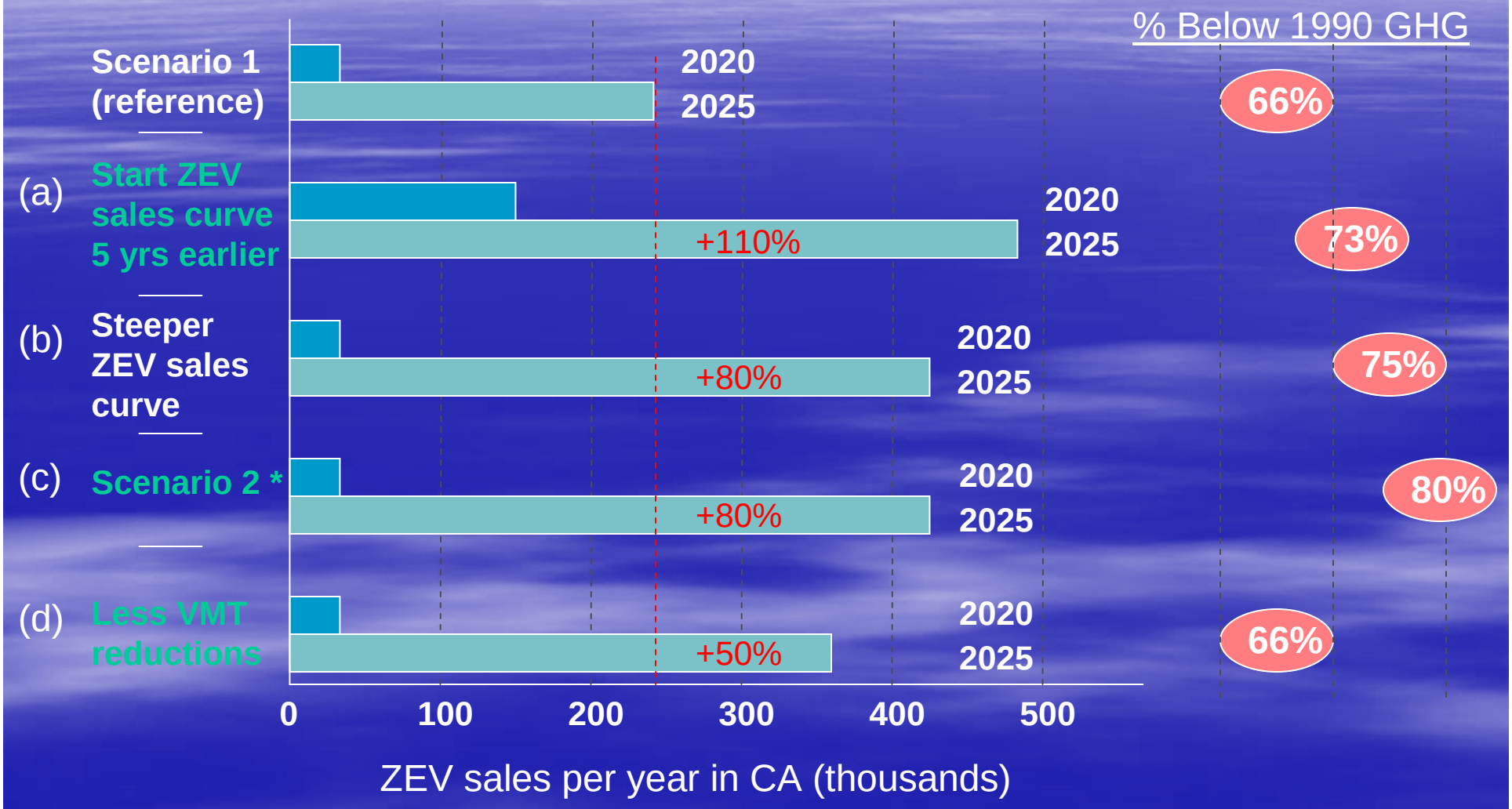
- ZEV regulation has helped introduce vehicle technologies with very low smog-forming emissions
- Regulation can be modified to also be an effective tool to address GHG emissions:
  - a large increase in the number of ZEVs on the roads
  - All ZEV technologies are encouraged for the future
- Complementary policies needed to encourage the purchase and use of ZEVs during near term commercialization

Timeline

- Q1 2010: LEV and ZEV public workshops
- Q2 2010: Update to the Board on electric infrastructure
- Q2 or 3 2010: LEV III ISOR and Hearing
- Q4 2010: ZEV ISOR and Hearing

BACKGROUND SLIDES

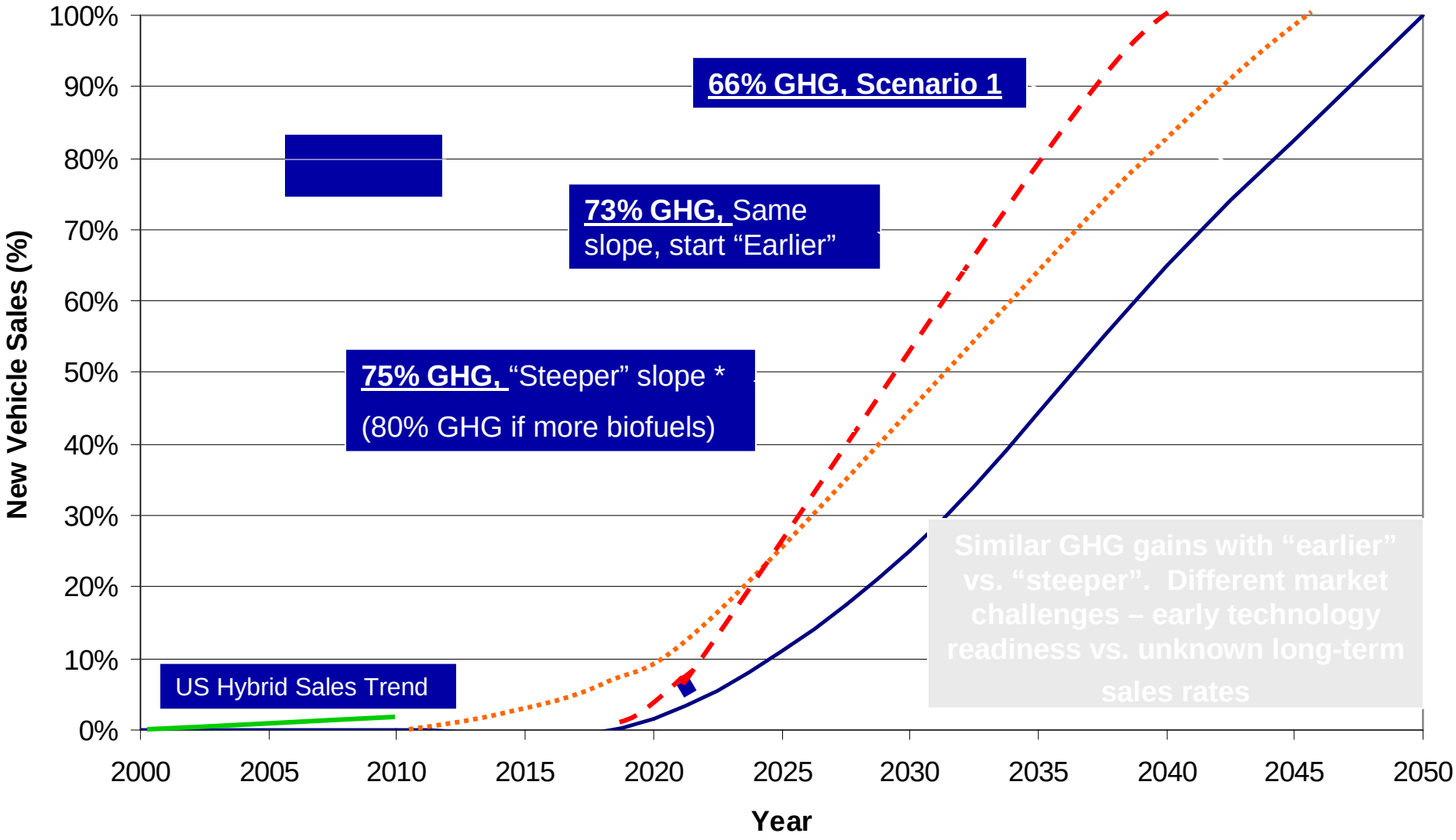
Sensitivity Study – Key Factors that Change ZEV Sales



** Includes ZEV sales from (b) and an increase in biofuel usage (1.7 BGGE instead of 1 BGGE in Scenario 1)*

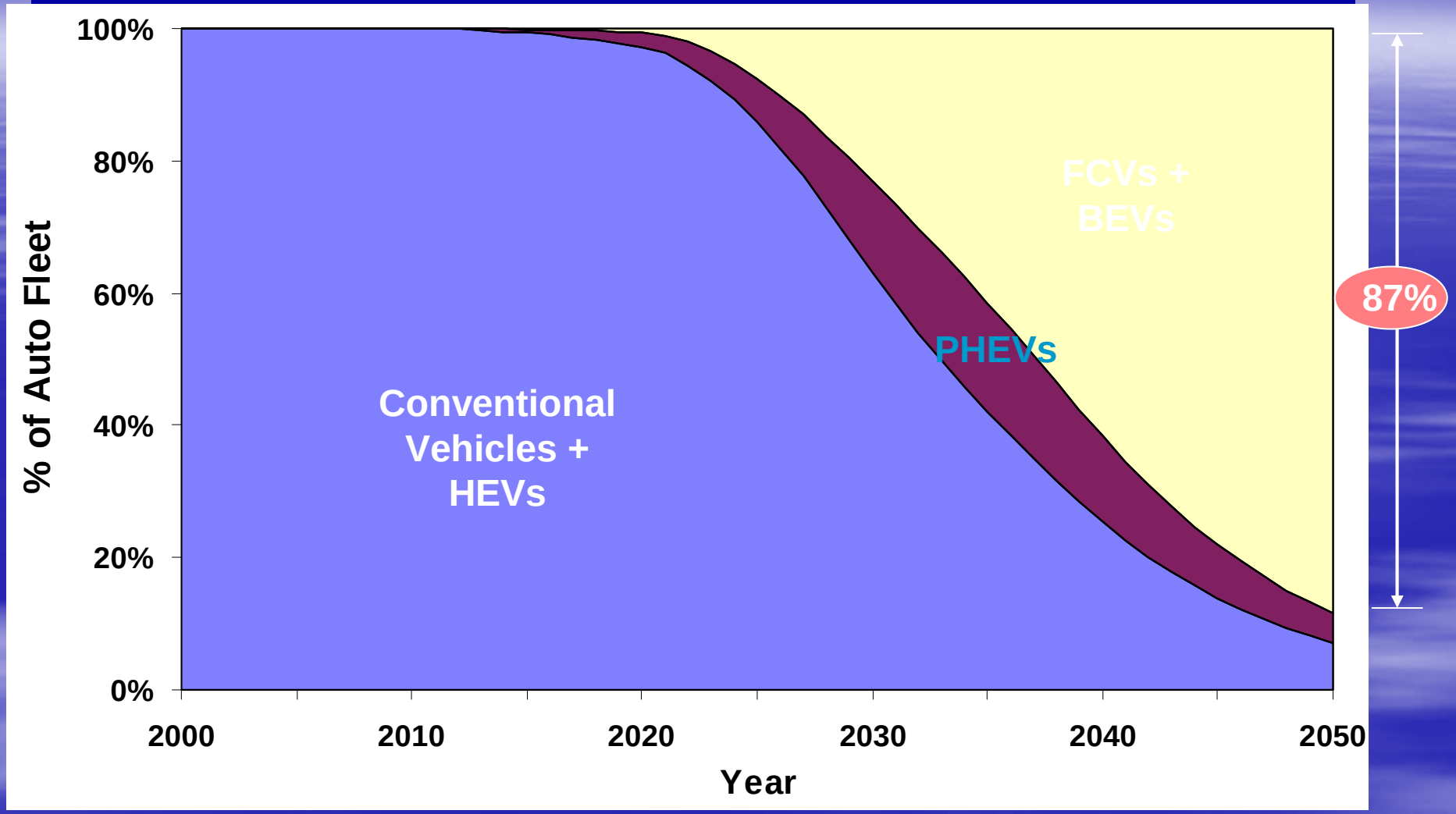
3 ZEV Sales Scenarios

Path to 2050



** Scenario 2 includes this "steeper" ZEV sales trajectory and an increase in biofuel usage (1.7 BGGE instead of 1 BGGE in Scenario 1)*

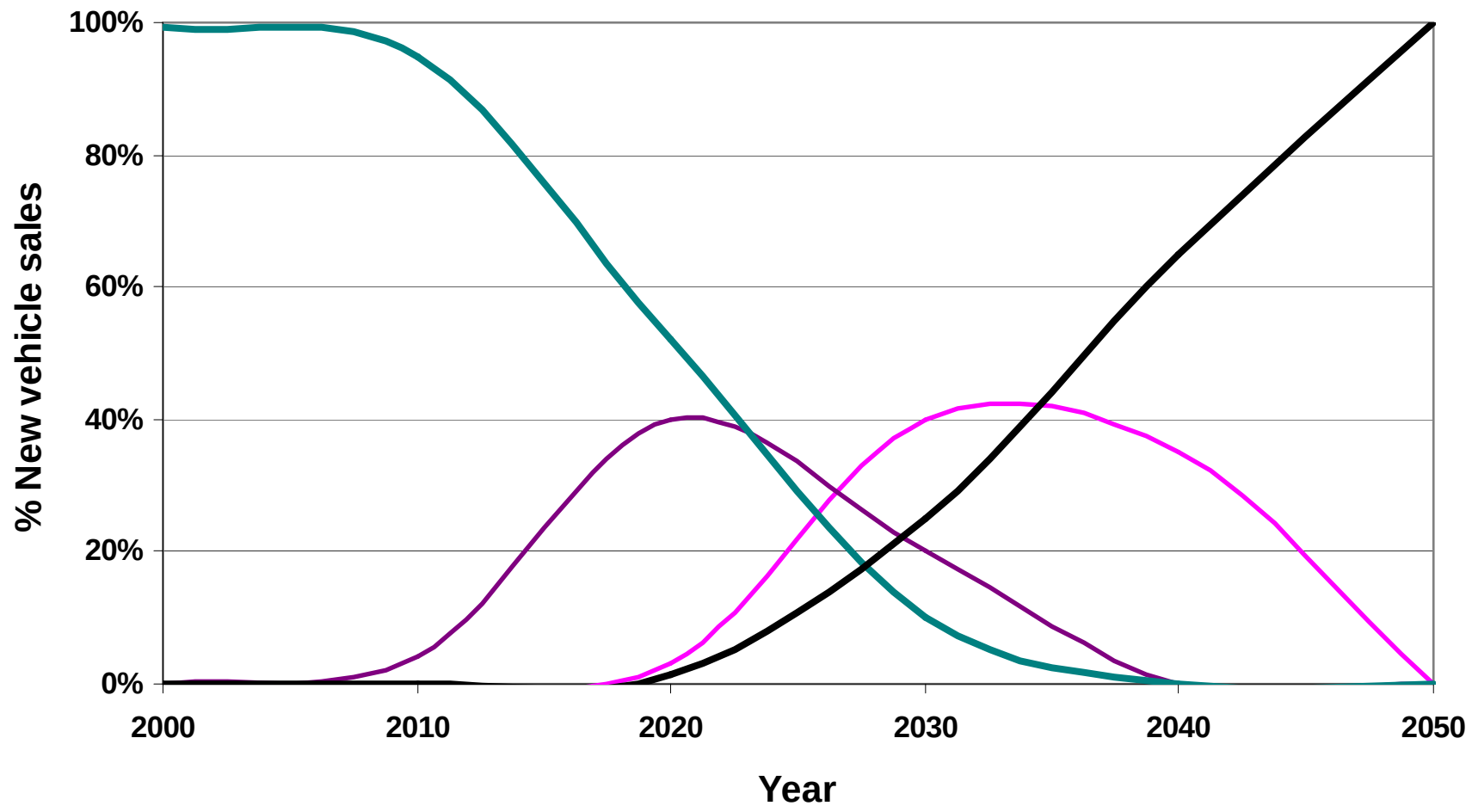
Passenger Vehicle On-Road Fleet – Scenario 2



- Fleet turn-over takes time, 100% sales in 2040 → 87% Fleet (2050)
- ZEV fleet in this scenario: 120,000 (2020), 1.4 million (2025) *

** Combined cars and trucks (Passenger Vehicle Sector)*

LDV New Vehicle Sales (Auto only) – Scenario 1

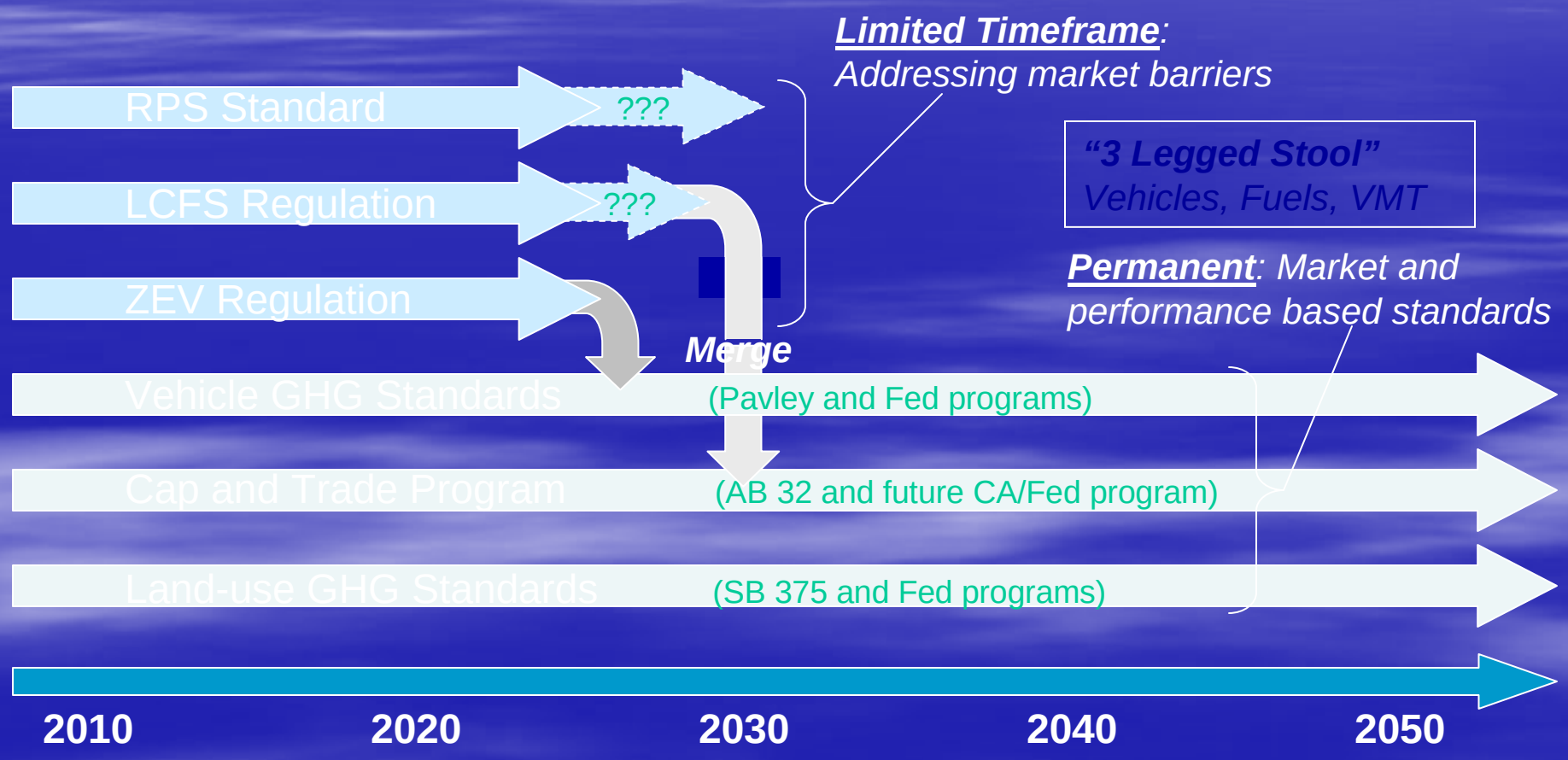


- All advanced vehicle technologies necessary
- ZEV sales in this scenario: 25,000 (2020), 230,000 (2025) *

** Combined cars and trucks (full LDV)*

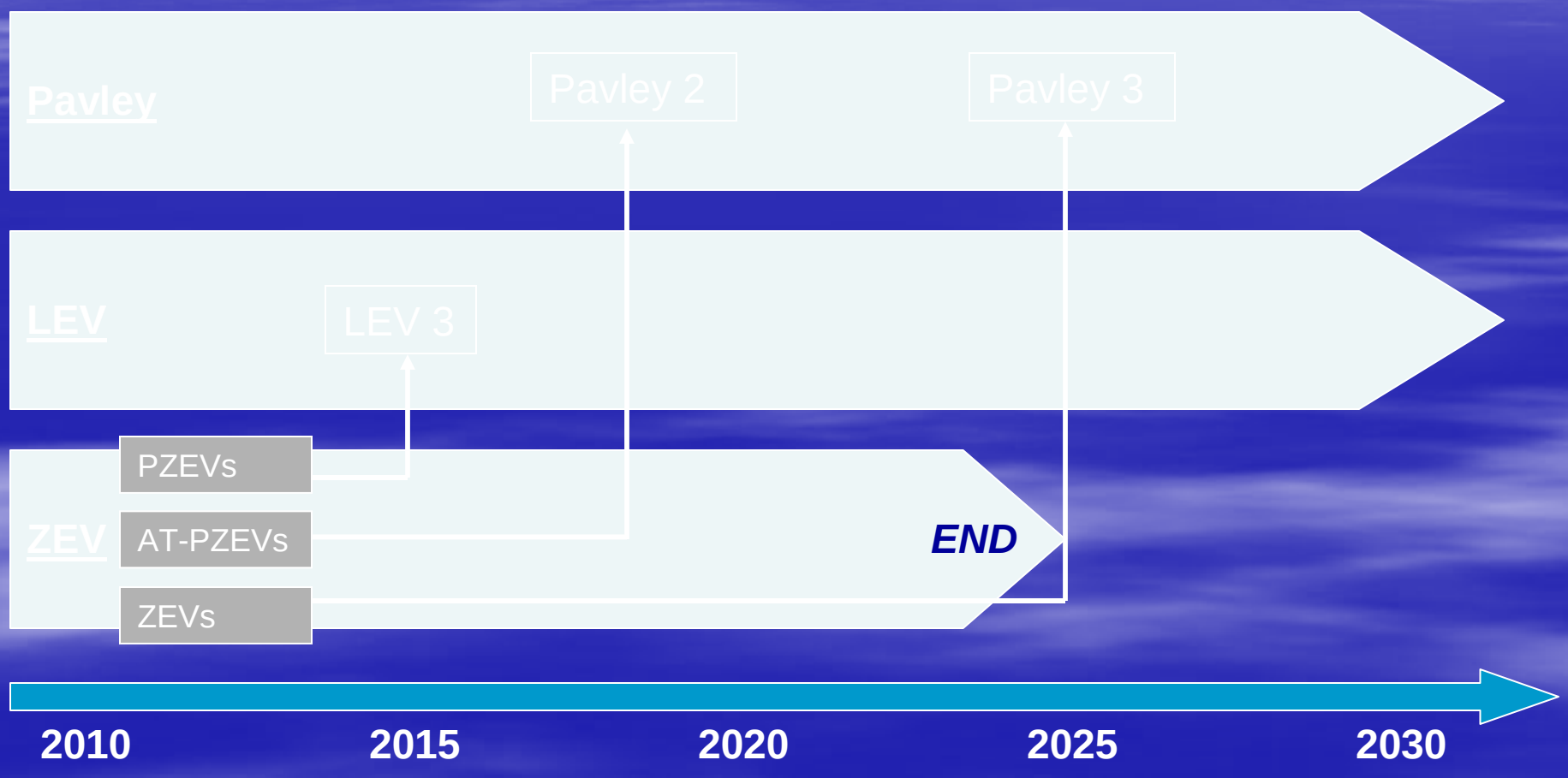
Broad Policy Context

Comprehensive, multi-policy approach for trans GHG, ZEV Regulation ultimately phase out, merges with Pavley



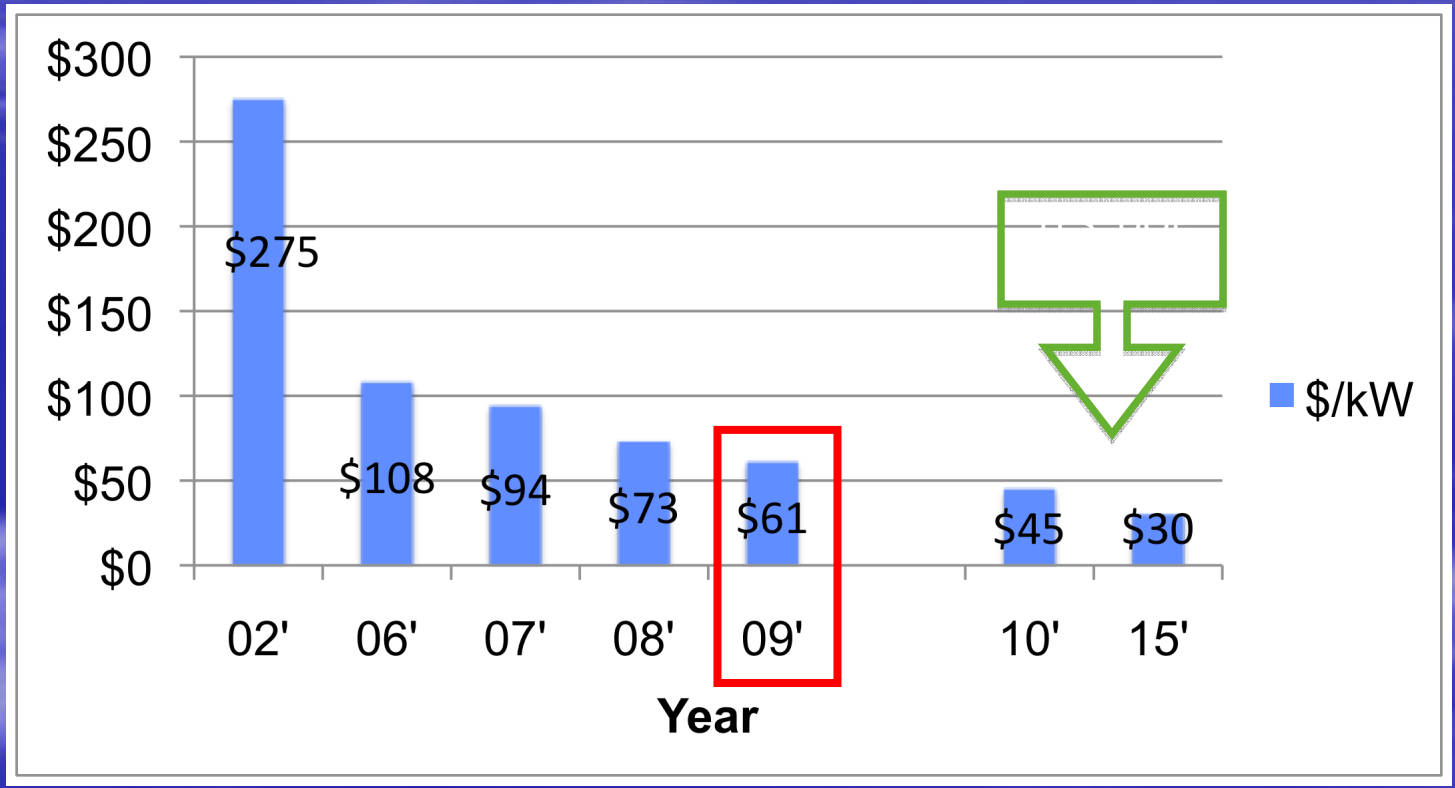
ZEV 2.0 Simplifications

Harmonizing Vehicle Regulations



U.S. DOE Fuel Cell System Cost

2009 fuel cell system cost: $61/kW



Successful ZEV Commercialization