

California Initiatives Part 1: Air Resources Board

Projecting Transportation Demand for Electricity



CPUC SB 350 Workshop
April 29, 2016

Outline and Panel Members

- Intro: ARB's Mobile Source Electrification Programs
 - Analisa Bevan
- Mobile Source Vision
 - Cody Howard
- Light Duty Vehicle Electrification
 - Analisa Bevan
- Heavy Duty Vehicle Electrification
 - Tony Brasil

CALIFORNIA CLIMATE STRATEGY

An Integrated Plan for Addressing Climate Change



VISION

Reducing Greenhouse Gas Emissions to 40% Below 1990 Levels by 2030

SB 350 → 2030 GHG reductions in transportation sector; Role for electricity

GOALS

50%
reduction
in petroleum
use in vehicles



Carbon
sequestration
in the land base



Safeguard
California



50%
renewable
electricity

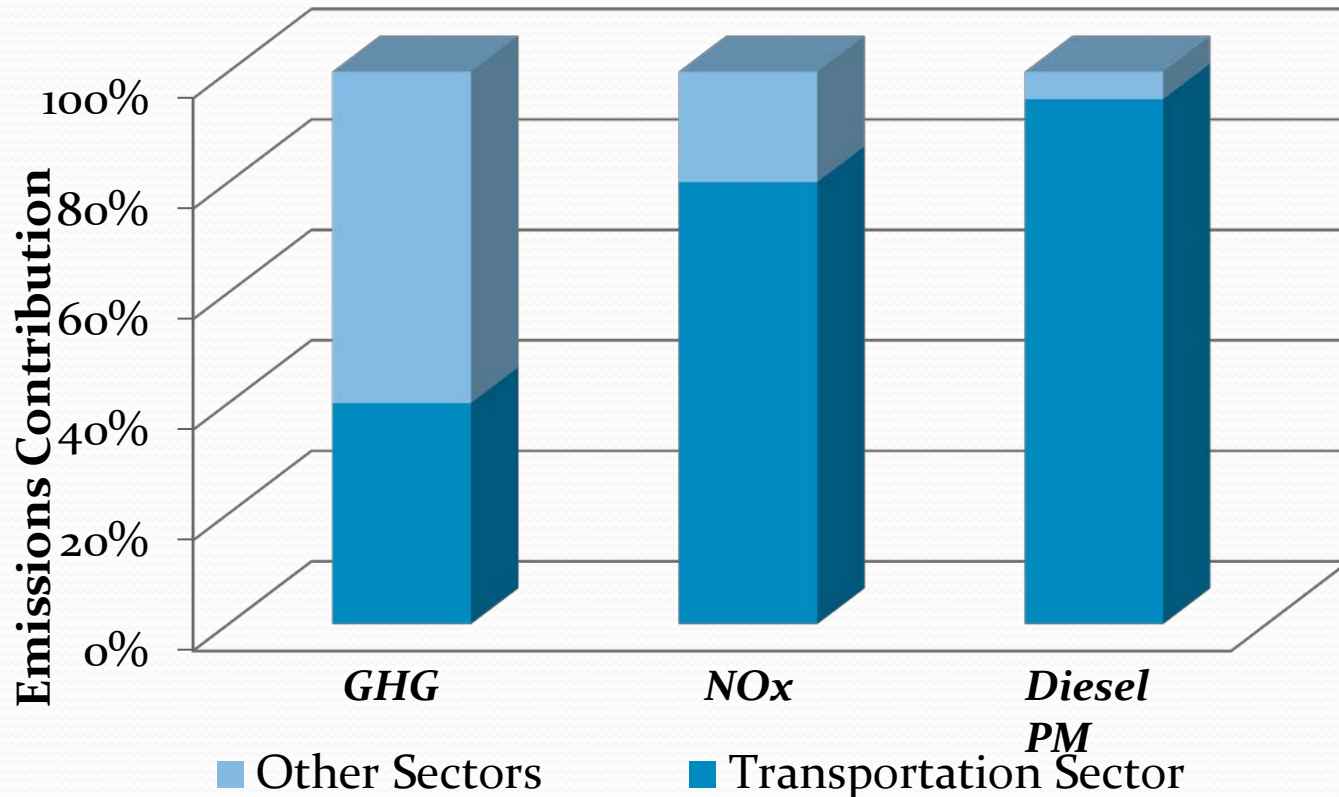
Double energy
efficiency savings
at existing buildings



Reduce
short-lived
climate pollutants



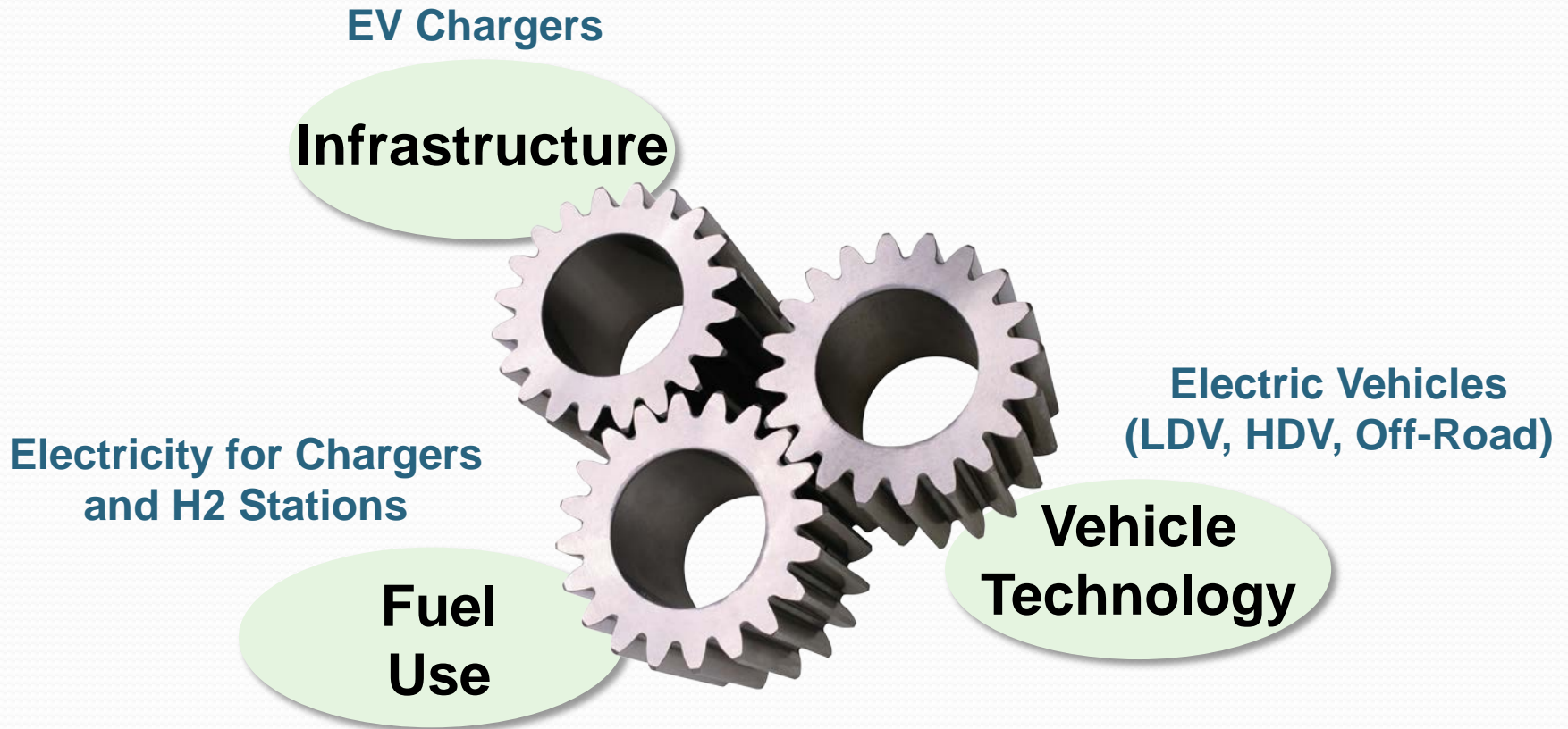
Transportation Sector Key to Meeting Goals



- Meeting goals will require cleaner technology, fuels and increased transportation efficiencies.

The Transportation Sector

An Interwoven Transportation “System”



SB 350 Scope

Existing Transportation Policies for GHG Reductions Through 2020

- LDV: Advanced Clean Cars (LEV GHG, ZEV)
- HDV: Phase 1 vehicle GHG standards
- HDV: Advanced Clean Transit rule
- HDV: Zero emission airport shuttles, last mile delivery
- LDV & HDV Incentive programs, demonstrations, etc
- Marine: Anti-idling at ports

Note – numerous other policy actions enacted to address regional ozone and local pollutants

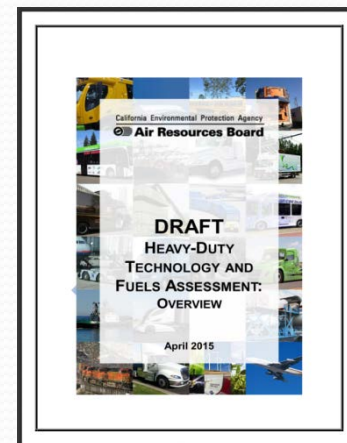


Mobile Source Emission and Electricity Projections

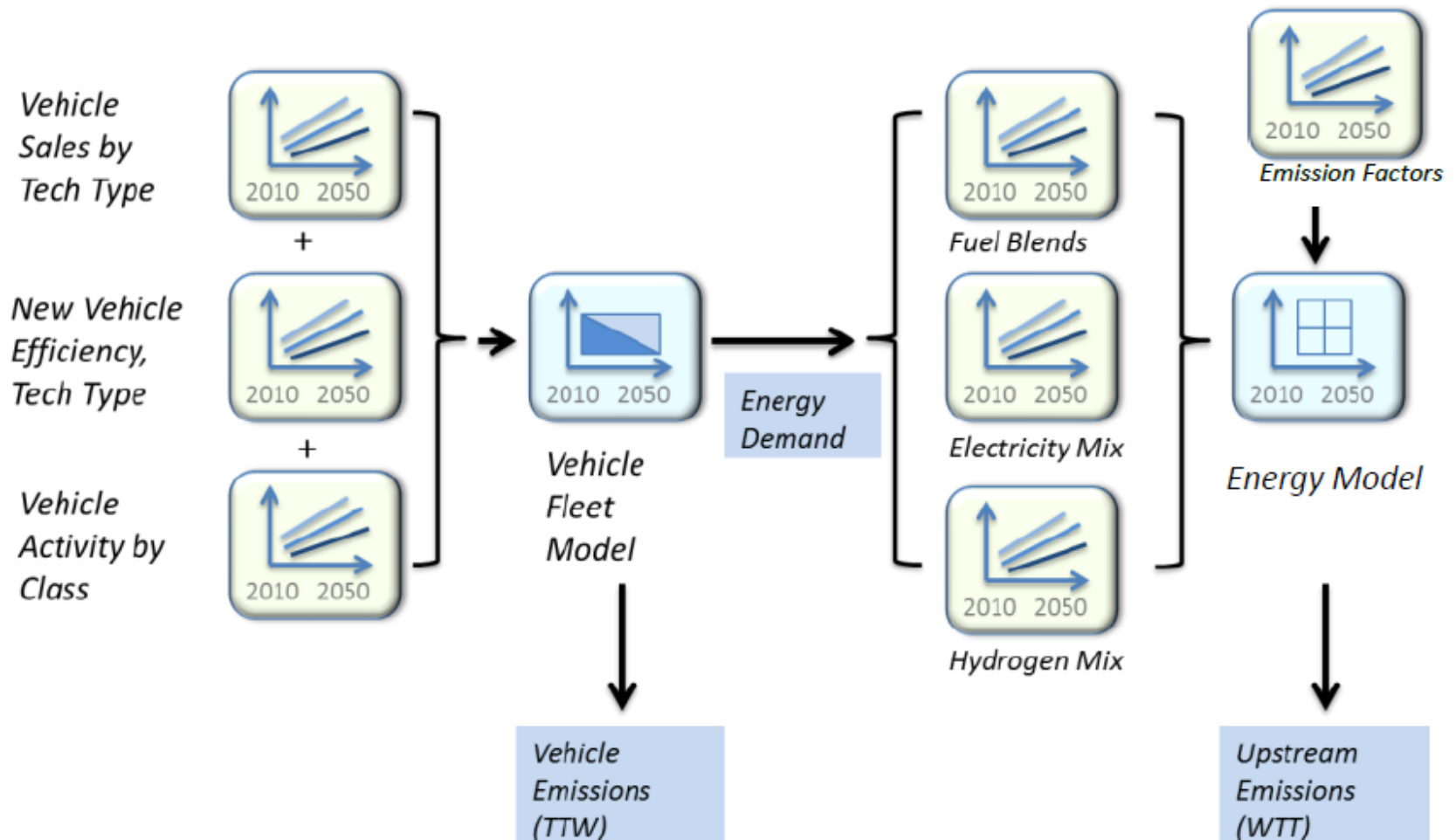
Cody Howard

Building a Strategic Vision

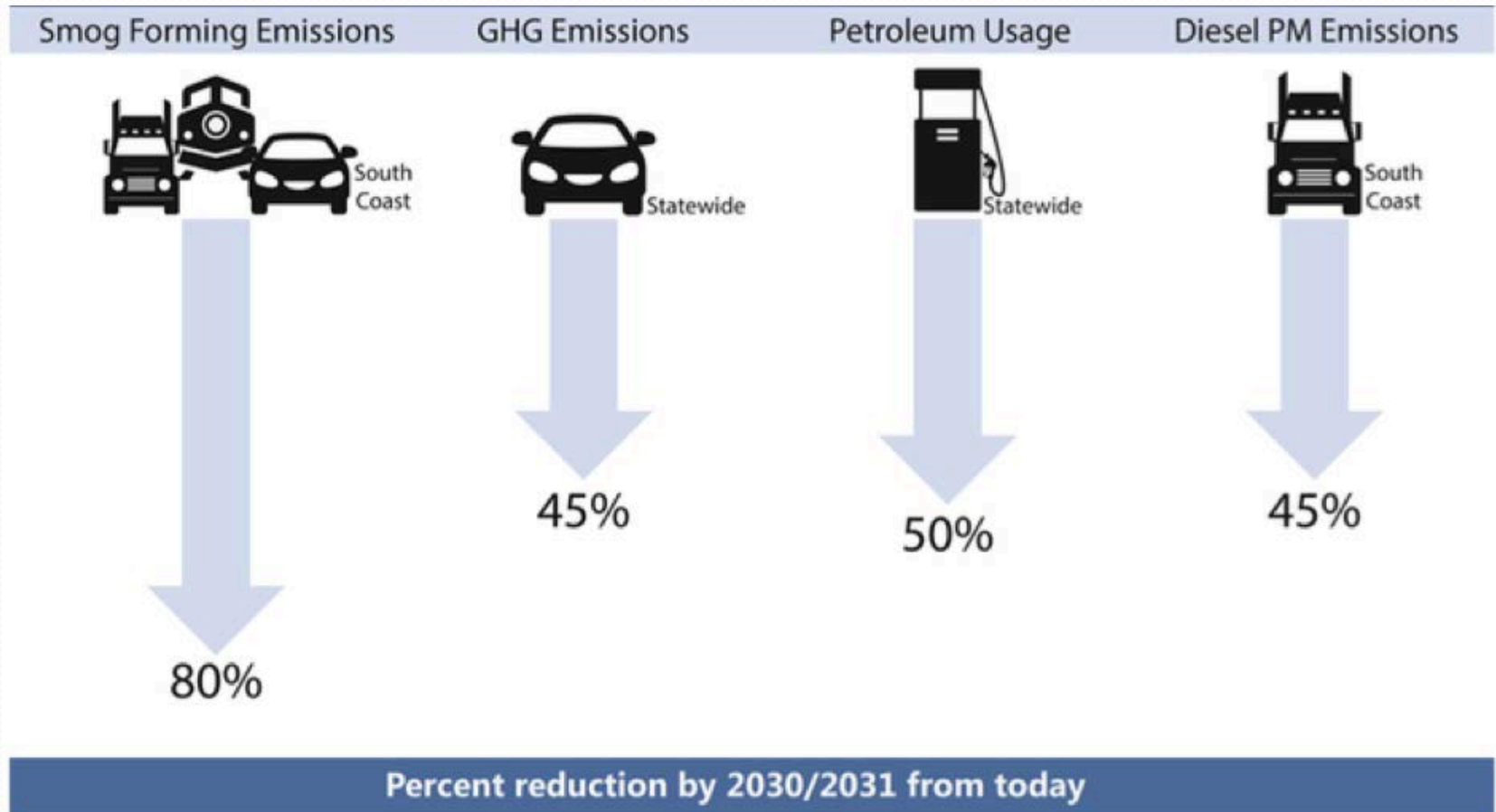
- Current program successes provide a blueprint for future policies.
- Technology assessments that identify technology performance, market readiness and costs form foundation of this analysis.
- Scenario analysis explores the scope and timing of technology, fuels, and transportation efficiencies necessary to meet goals.
- Results helped inform development of the SIP measure concepts



Vision Model Framework for Scenario Analysis

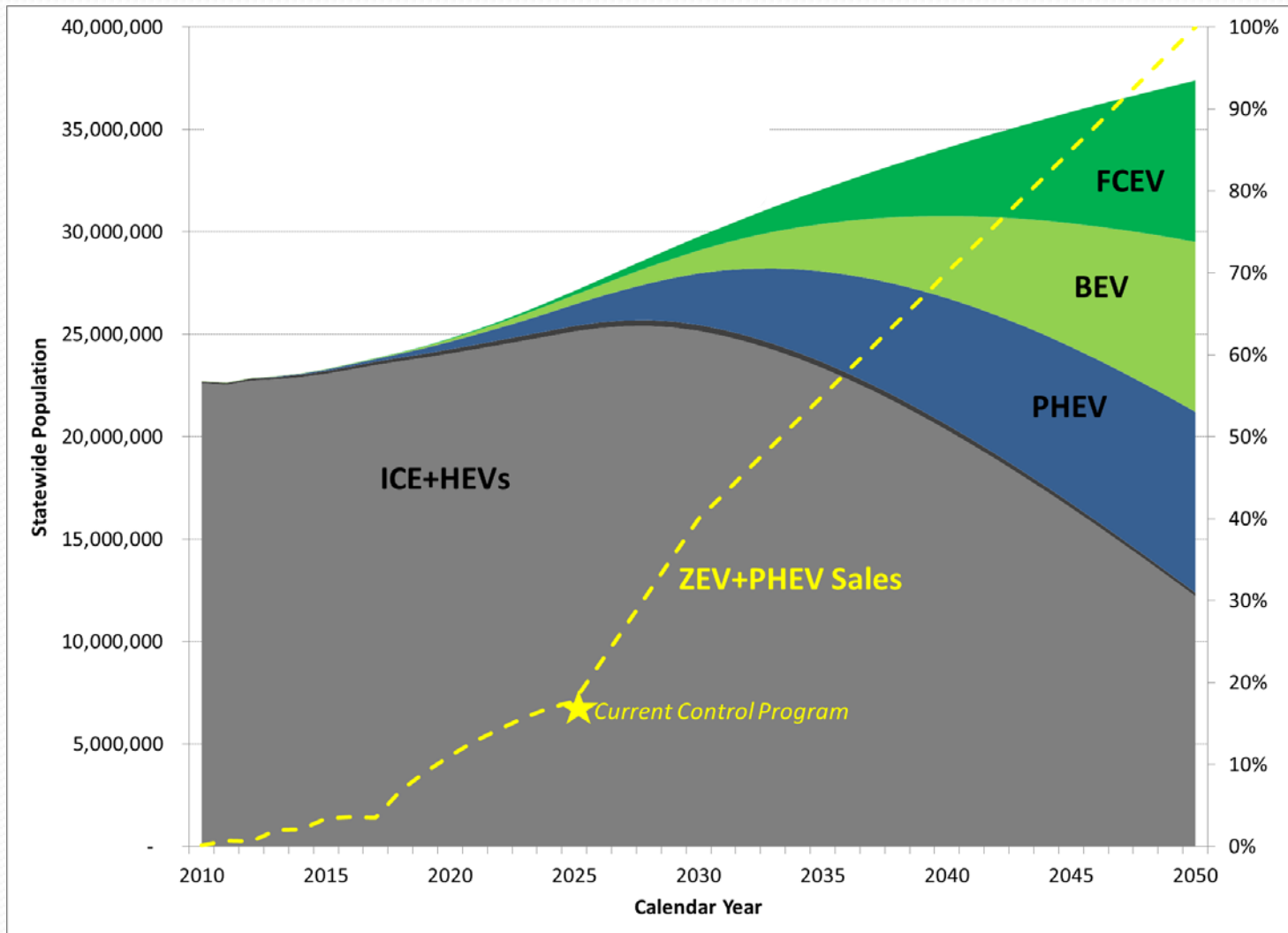


2030 Benefits from ARB Mobile Source Strategy CTF Scenario *



* <http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm>

Passenger Vehicle Transformation



Transformation of Passenger Vehicle Fleet

Technology/Fuel/System	Today	2030	2050
Population of ZEVs/PHEVs/FCEV	200k	4.3 million	24 million
Fuel Economy	24 mpg	49 mpg	121 mpg
Renewable Energy Generation	27%	50%	75%





Light Duty Vehicle Electrification

Analisa Bevan

Existing ARB Light Duty Vehicle Electrification Programs

Regulations: *Advanced Clean Cars Rules to 2025*

- Criteria Emission Fleet Standards: 70% reduction in NO_x *
- GHG Emission Fleet Standards: 25% reduction in GHG *
- Zero Emission Vehicle (ZEV) Mandate: ~15% New Sales

Incentives and Consumer Education:

- DriveClean- Consumer Buying Guide
- Vehicle Purchase Rebates
- Pilot Projects in Disadvantaged Communities

Partnerships:

- California, Multi-State, International Activities
- Public-Private Partnerships for Market Acceleration

Currently Available ZEVs

FCEV

Fuel
Cell
Electric
Vehicle



BEV

Battery
Electric
Vehicle



Range: ~ 100 miles



Range: ~ 200 miles



Range: ~ 250 miles

PHEV

Plug-in
Hybrid
Electric
Vehicles



Car

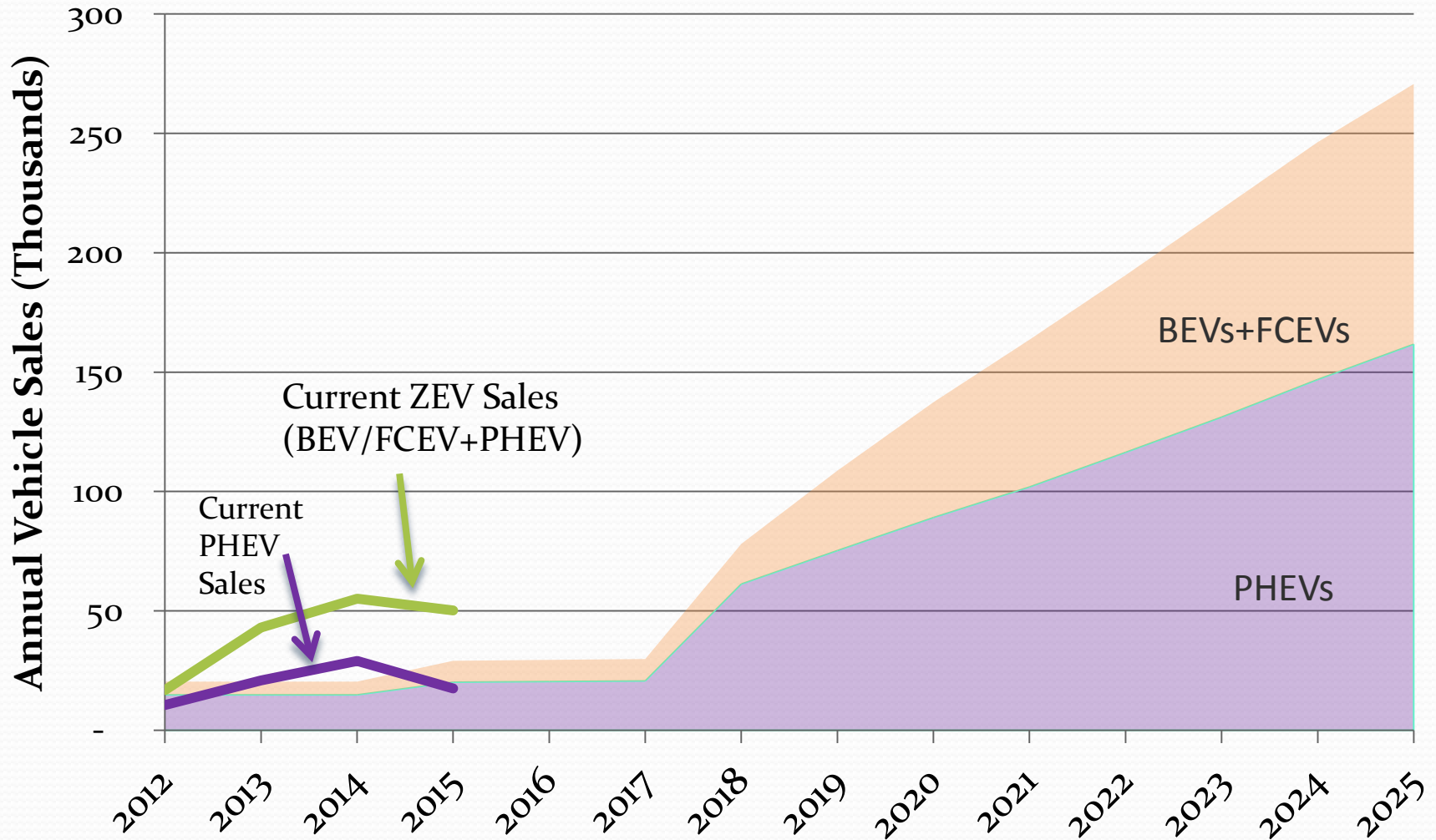


SUV



Minivan

ARB ZEV Regulation Likely Compliance Scenario and Current Sales in CA



BEV = Battery Electric Vehicle, FCEV = Fuel Cell Electric Vehicle,
PHEV = Plug-in Hybrid Electric Vehicle

ARB Vehicle Regulation ZEV Mid-Term Review

Technology

Update technical and cost assumptions for ZEV technologies

Emissions/Driving Behavior

Analyze vehicle manufacturer provided trip and charging data

In-house PHEV testing

Household vehicle usage and charging study

Consumers

New car buyer surveys

Examining California's ZEV market factors

Used ZEV market and buyer study

Sales Trends

Continued analysis of various data sources for California and multi-state MOU partner States

Infrastructure

Evaluation of existing and projected needs for ZEV technologies in California

EV Infrastructure Usage



Charging Patterns today:

Dominated by home base, then workplace, with small amount at public locations (including DCFC)

Will this change?

- How many apartments will have charging?
- Longer trips in “200 mi” BEVs: More DCFC?
- Less charging at work when “not free”?
- Will longer AER PHEVs use workplace charging more or less?

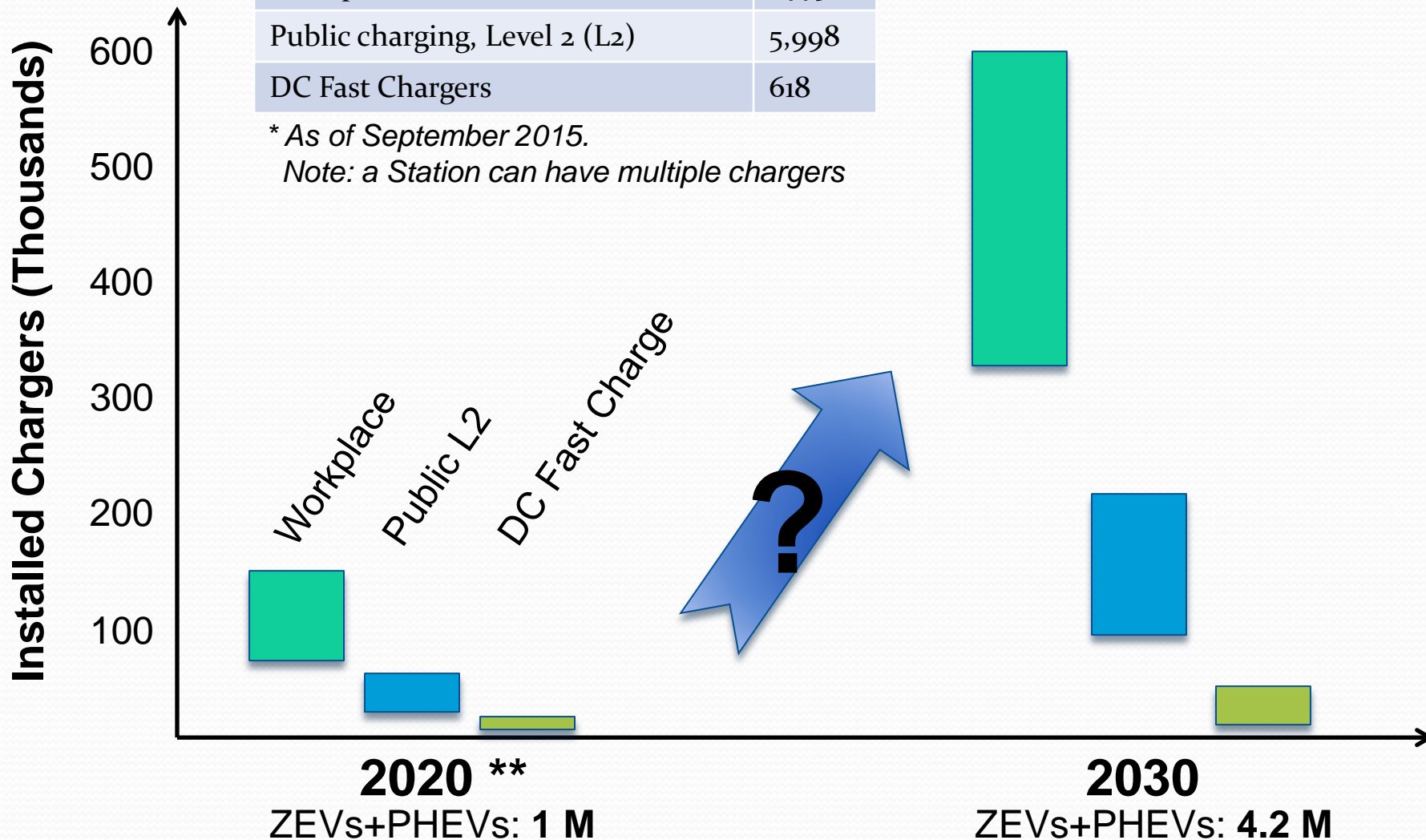
Source: Argonne National Laboratory, 2013

Non-Home EV Charger Installations

Currently Installed Stations *	
Workplace, Level 2 (L2)	1,775
Public charging, Level 2 (L2)	5,998
DC Fast Chargers	618

* As of September 2015.

Note: a Station can have multiple chargers



** Low and high range from NREL/CEC #600-2014-003

State Agency Actions Help Close the Charger Gap

- **PUC Actions with Electric Utility Investments (SB 350) and NRG Settlement**
- CEC Actions with public infrastructure grants and loan loss reserve
- Supporting private investments by charging companies, automotive manufacturers, and NEDO
- BSC/ARB Actions requiring infrastructure in new building construction



Heavy Duty Vehicle Electrification

Tony Brasil

Long-term Transformation for Mobile Sources

- Zero emission equipment everywhere feasible, and near-zero emission equipment powered by clean low-carbon renewable fuels everywhere else.
 - Freight movement
 - Off-road equipment
 - Passenger transportation



Near Term Focus on Zero Emissions Heavy Duty Vehicles

- Advanced Clean Transit
- Last mile delivery
- Airport shuttles and equipment
- Other

Advanced Clean Transit

A New Approach

- Achieve additional NOx and GHG emission reductions
- Encourage zero emission bus purchases
 - Full transformation from 2018 to 2040
- Flexibility for regional collaboration between metropolitan planning organizations and transit fleets
- Opportunity to recognize greater efficiencies and zero-emission modes of moving passengers

Coordination Efforts

- Collaborating with transit and regional agencies
- Working closely with funding programs and partners
- Monitoring fueling/charging standards development
- Engagement with technology and bus manufacturers
- Coordination with utilities (SB 350)
- Coordination with other programs
 - Sustainable Communities Strategies (SB 375)
 - Sustainable Freight Strategies
 - Low Carbon Fuel Standard

Transit Fleet Electrification Characteristics

- Large utility customers
 - Subject to demand charges
- Distributed fast charging (500 kW) or
- Fueling/charging at central yards or depots
- Predictable charging patterns
- Directly claim Low Carbon Fuel Standard Credits

Fuel Cell Electric Buses

- Fueled at night like conventional buses
- Performance, range, and availability same as conventional
- Hydrogen can be produced on site
 - Electrolysis
 - Steam methane reformation
- Hydrogen stored on site



Battery Electric Bus

Slow Charge

- Fully charge in 4 to 5 hours
 - Plug in overnight at bus depot (80 kW)
 - Can plug in mid-day for commuter routes or peak service
- About 120 to 190 miles per charge
- Extend range with inductive charging at strategic locations



Battery Electric Bus

Fast Charge

- Charge on route for about 3 to 10 minutes
 - 500 kW charger
- Charge multiple times during day
- Unlimited range
- Chargers distributed at various locations
- Up to 6 buses per charger



First Utility/Transit Workgroup Meeting

- Held on April 8, 2016 at ARB
- Supports Advanced Clean Transit program
- Presented idea to CPUC on how to promote heavy duty transportation electrification
- Discussed barriers, challenges, and opportunities
- Improve communication between transits and utilities to further deployment of zero emission buses

Meeting summary and materials <http://www.arb.ca.gov/msprog/bus/actmeetings.htm>

Outreach and Communication

- Opportunities to improve information sharing among ARB, utilities and fleet owners
- Transit agencies would like a dedicated liaison at the utility who understands transit electrification
- ARB willing to facilitate information sharing between fleets and utilities
- Plan to continue transportation electrification workgroup meetings

Electricity Rate Structure

- Long term zero emission bus deployment strategies influenced by electricity price signals
- Need statewide policies ensuring clarity and predictability for electricity cost
- Temporary rates without demand charges are useful for transit fleets to get familiar with electric bus operation
- Existing rates have uncertainty with 5 minute demand charge option for electric vehicles
 - Issue for fast charging strategies

Third Party Energy Storage

- Can reduce demand charges
- Could be managed by transit fleet
 - Optimize for avoiding demand charges
 - Adds financing and operational complexity
- Potential for utility ownership and/or operation
 - Gain ability to manage daily grid fluctuations
 - Peak shaving and excess renewable
 - Could share cost benefits with transit fleet
 - Could result in benefits rate payers
 - More zero emission vehicles and air quality benefits

Other Comments

- Clarify that hydrogen production and compression is in scope of transportation electrification efforts
- Streamline and simplify review process for cap-and-trade consignment auction proceeds for zero emission transit buses and infrastructure
- Explore opportunities for utilities to own and operate charging or hydrogen infrastructure

Thank you



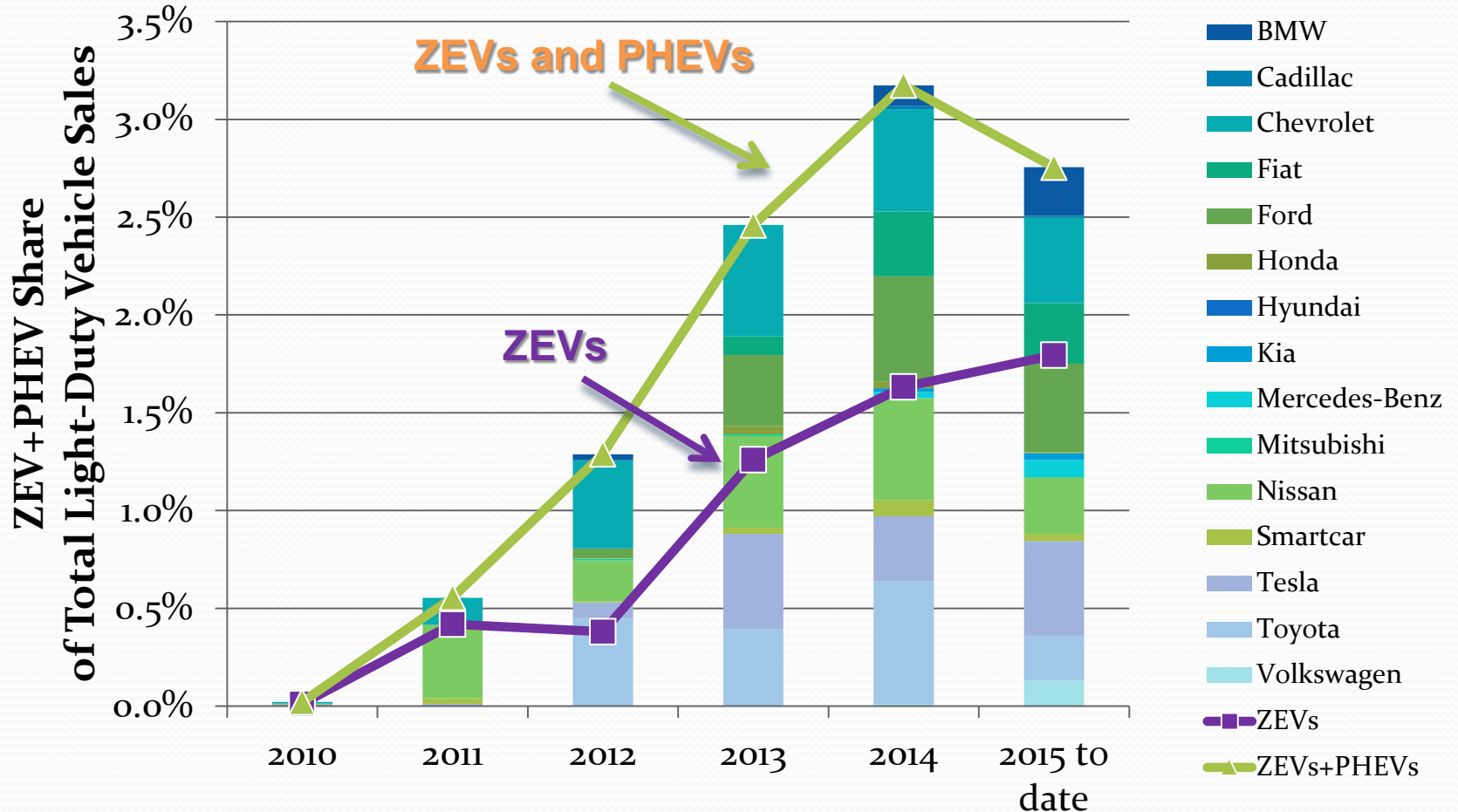
BACKGROUND MATERIAL

Significant Benefits from Advanced Clean Cars

- Reduce Urban Air Pollution
- Reduce GHG Emissions
- Commercialize ZEVs
 - Battery, plug-in hybrid, and fuel cell vehicles
 - Significant well-to-wheel emission benefits
 - Will lower cost of ZEVs for all consumers
- Benefits to Consumers
 - Lower cost of operation than current vehicles
 - Net benefit to economy

2015 ZEV Market Growth

Outpacing PHEVs



Source: IHS Automotive, Polk new vehicle registrations for CY2010-2015 as of August 2015.

Aligning State Agencies: California ZEV Action Plan

- Coordination Across Government Agencies
 - *Consumer Awareness*
 - *Enable Infrastructure*
 - *Transform Fleets*
 - *Grow Jobs and Investment*
- 2016 Action Plan Currently in Final Review
 - *Promote Broad Access*
 - *Expand Use in Rail, Freight, HD*
 - *Support National and International Deployment*

