



Public Workshop on the Transportation Sector to Inform Development of the 2030 Target Scoping Plan Update

September 14, 2016

Welcome and Opening Remarks

Workshop Outline

- 2030 Target Scoping Plan Overview
- SB 375 and Sustainable Communities
- Land Use Vision and VMT Reduction Strategies
- Lunch
- Vehicle Technology
- Fuels
- Introduction to the Biofuel Supply Module
- Open Discussion Period

2030 Target Scoping Plan Overview

California Air Resources Board

CALIFORNIA CLIMATE STRATEGY

An Integrated Plan for Addressing Climate Change

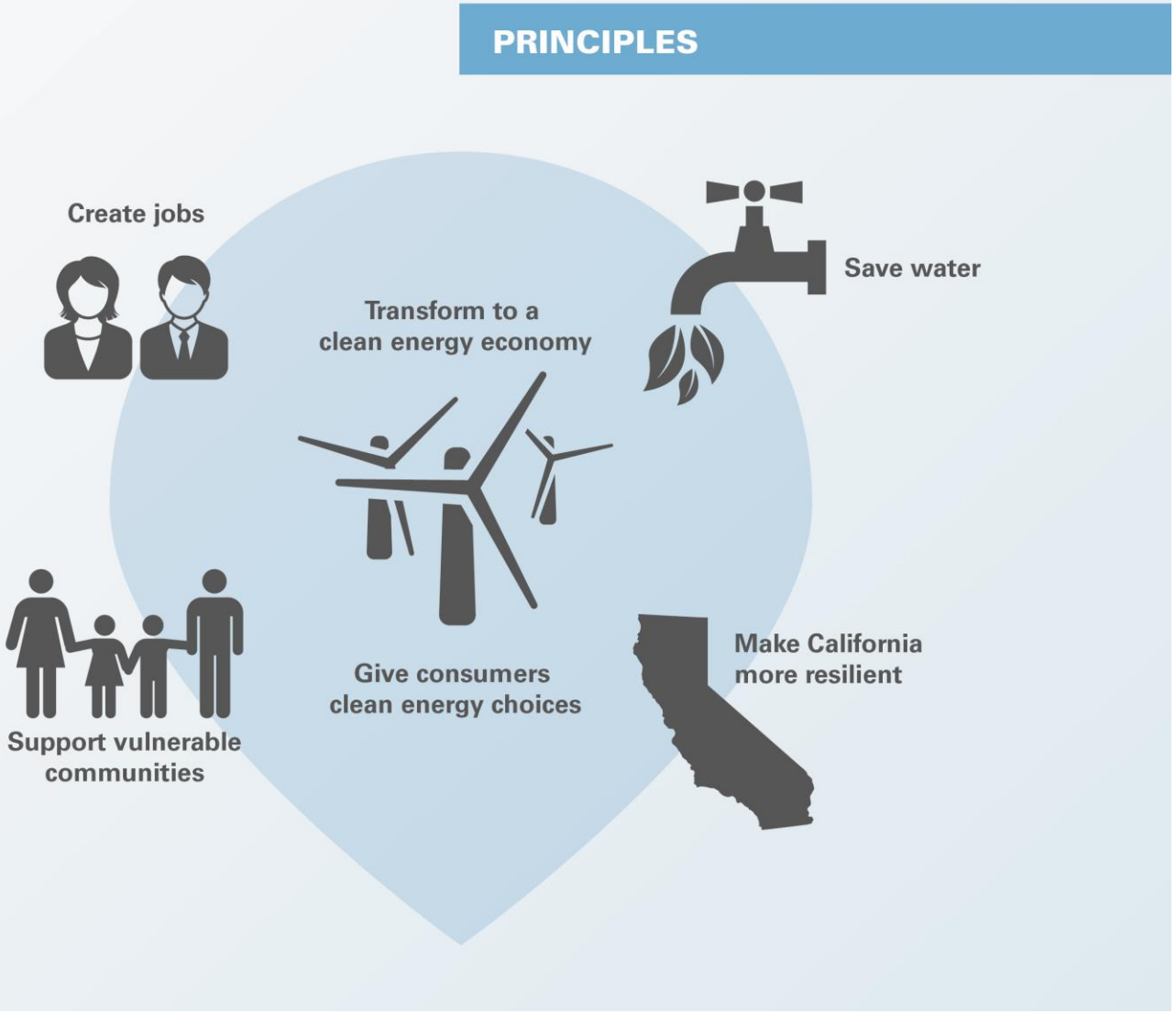
VISION

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

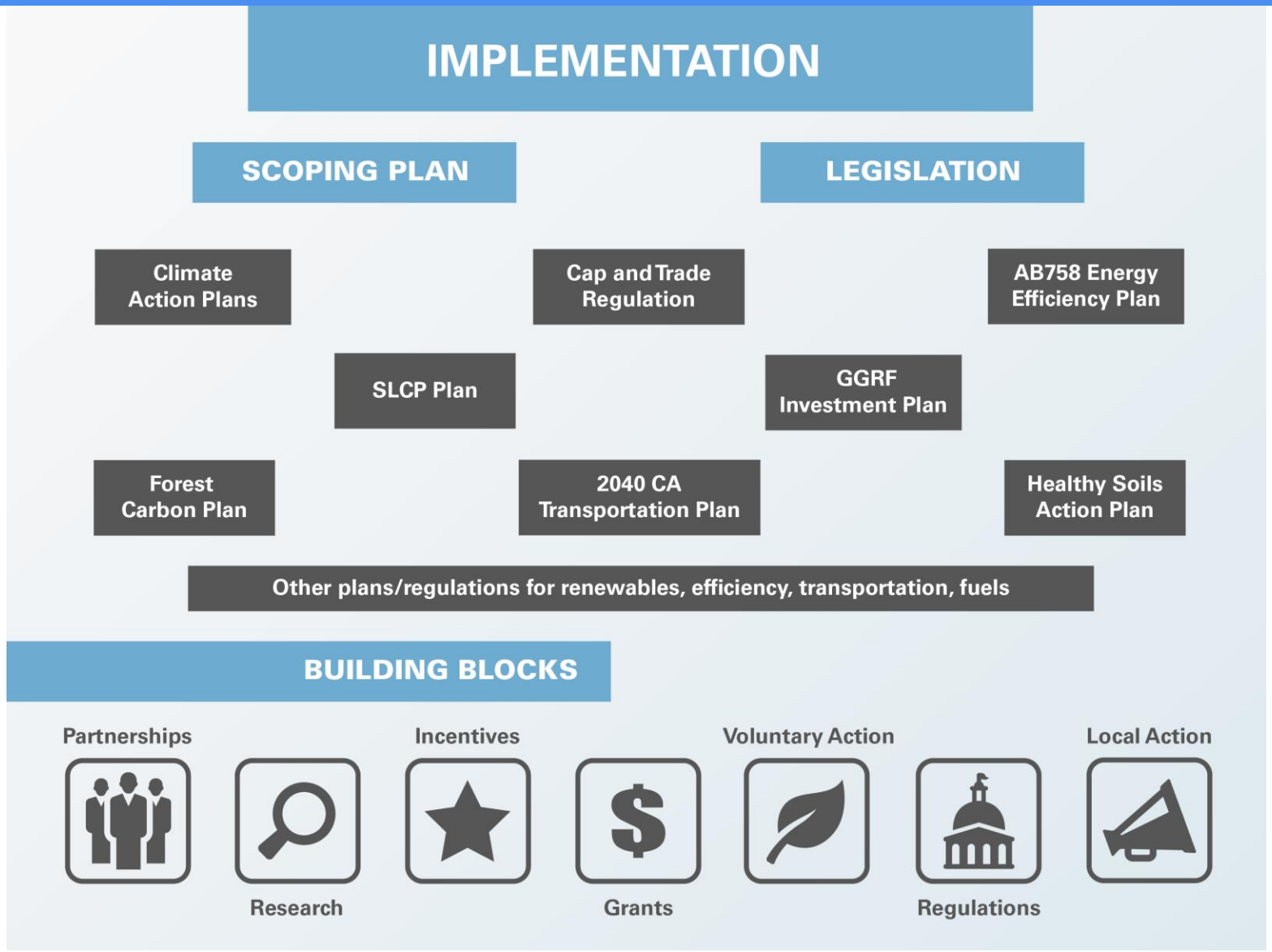
GOALS

- 50% renewable electricity
- 50% reduction in petroleum use in vehicles
- Double energy efficiency savings at existing buildings
- Carbon sequestration in the land base
- Reduce short-lived climate pollutants
- Safeguard California

CALIFORNIA CLIMATE STRATEGY



CALIFORNIA CLIMATE STRATEGY



Scoping Plan Evolution

- First Scoping Plan required by Assembly Bill 32
  - Must be updated at least every 5 years
- Executive Order B-30-15
  - Establishes midterm greenhouse gas (GHG) emissions reduction target of 40% below 1990 levels by 2030
  - Update the AB 32 Scoping Plan to incorporate the 2030 greenhouse gas target
- Senate Bill 32 (SB32) codifies 2030 midterm GHG target

2030 Target Scoping Plan Development

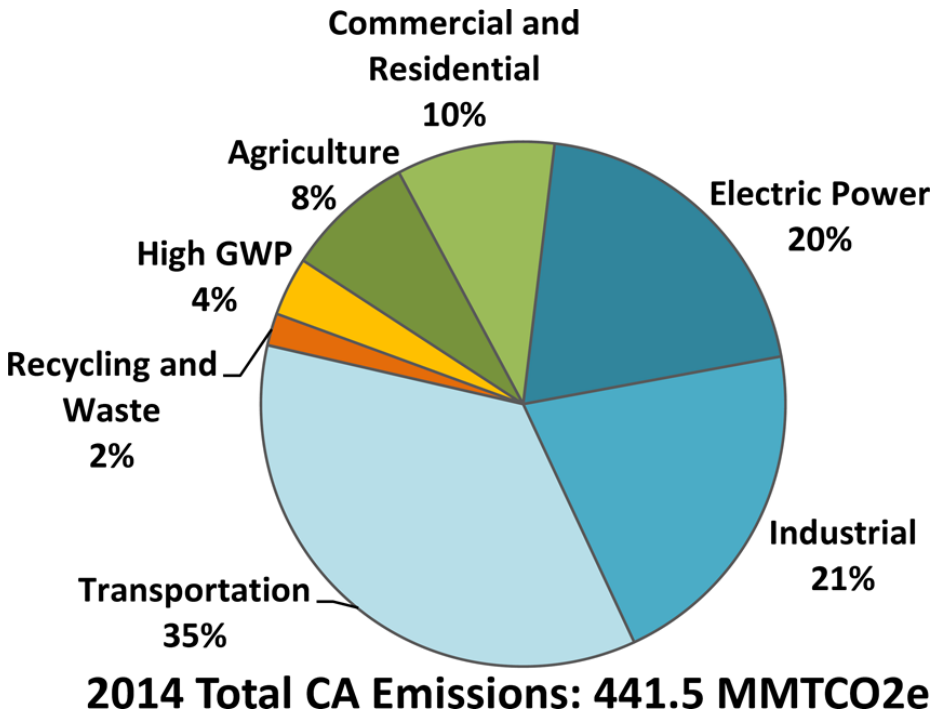
- Collaborate with State Agencies
- Engagement with Legislature
- Coordination with other plans (i.e. 111(d), Cap & Trade, SIP, Freight Strategy, etc.)
- Public Process: Workshops
- Economic Analysis with Expert Reviewers
- Environmental Justice Advisory Committee Engagement
- Environmental Analysis (CEQA)
- Draft Report / Final Report (targeted measures and estimated emission reductions)

Elements of 2030 Strategy

- Focus areas within the pillars framework
  - Energy
  - Green buildings
  - Transportation
  - Water
  - Natural and working lands/Agriculture
  - Waste management
  - Short-lived climate pollutants
  - Industry
- Maximize synergies among sectors

Emissions by Sector

- Consideration of emission sources when identifying opportunities for policies and programs



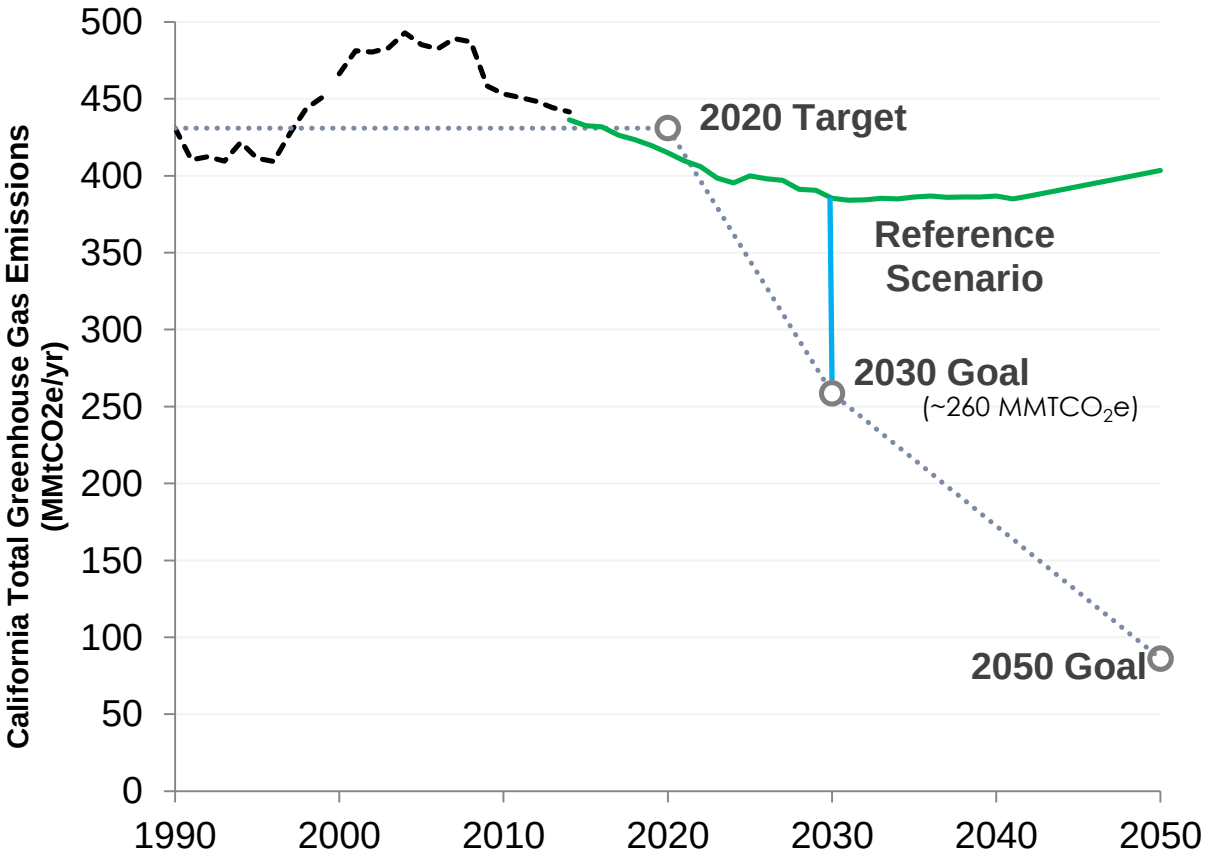
Policy Drivers for GHG Reductions in the Transportation Sector

- Governor's call to reduce petroleum use in cars and trucks by up to 50 percent by 2030
- Mobile Source Strategy
  - Vehicle technology standards and regulation
  - Reductions in Vehicle Miles Travelled (VMT)
  - Achieve criteria pollutant standards
- Sustainable Freight
- SB 350 widespread transportation electrification

Achieving the Target

- Need to understand amount of GHG reductions needed between now and 2030
- Draft reference case ("Business as Usual" or BAU)
  - Potential inputs and models discussed at January 15, 2016 public workshop
  - Presents pre-SB 350 current policies to estimate GHGs in 2030
  - Draft reference scenario modeled

Draft Reference Scenario



Draft Reference Scenario
Assumptions

- Transportation
  - Current Control Programs scenario in Mobile Source Strategy
  - Reflects impact of SB375 on VMT
- Biofuels
  - Meet LCFS by 2020 and beyond: 10% reduction in carbon intensity of transportation fuels

Closing the Gap

- Many policies that will be included in the 2030 Target Scoping Plan are known commitments
- Set of core complementary policies common across all scenarios
  - SB 350
  - Mobile Source Strategy: Cleaner Technologies and Fuels Scenario
  - Implement Draft Short-Lived Climate Pollutant Strategy
  - SB 375 targets
  - Natural & Working Lands targets, etc.

Closing the Gap, cont.

- Even with the known commitments the State does not achieve the 2030 limit
- Need additional reductions to achieve the 2030 limit
- Potential options to fill remaining gap:
  - Enhance and extend existing programs
  - New policies and prescriptive regulations
  - Will be weighed against Scoping Plan objectives

Next Steps: Tentative Schedule

- Technical and Economic Workshop – Fall 2016
  - Economic/environmental analyses
- Draft 2030 Target Scoping Plan – Fall 2016
- Draft 2030 Target Scoping Plan presented to Board – November 2016
- Regional workshops – Winter 2016/Spring 2017
  - Bay Area, Los Angeles, Central Valley
- Final 2030 Target Scoping Plan presented to Board – Spring 2017

Public Comments

- Please provide comments on this workshop by September 28, 2016 at 5:00 p.m.
- Links to submit both written comments and view all comments received can be found at: http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm
- Additional opportunities to comment will be available at subsequent workshops

SB 375 and Sustainable Communities

California Air Resources Board

SB 375 and Sustainable Communities

- Integrated regional planning to reduce passenger vehicle emissions
- Sustainable communities strategies (SCS) explore alternative land use and transportation development patterns
- ARB sets regional greenhouse gas reduction targets for 2020 and 2035
- Result is more compact urban form, transit oriented development, transportation and housing choices

Co-Benefits of Sustainable Development

- Natural resource conservation
- Economic opportunities
- Public Health
- Accessibility
- Social equity
- Lower building energy use, household costs and transportation costs
- Mobility and housing choices

Updating Regional Targets

- In 2017, ARB will update per-capita GHG emission reduction targets for 2020 and 2035
  - New GHG targets will encourage regions to be more ambitious
  - MPOs providing target recommendations by end of year.
  - First workshop on target update early spring.
- Additional actions beyond SB375 targets will be needed to meet the State's climate goals.

Advancing Sustainable, Equitable Communities and Reducing Vehicle Miles of Travel

Louise Bedsworth, **Governor's Office of Planning & Research**
Suzanne Hague, **California Strategic Growth Council**
Kate White, **California Transportation Agency**

Sustainable, Equitable Communities

Existing Conditions (Santa Clara, CA)

Image credit: Urban Advantage

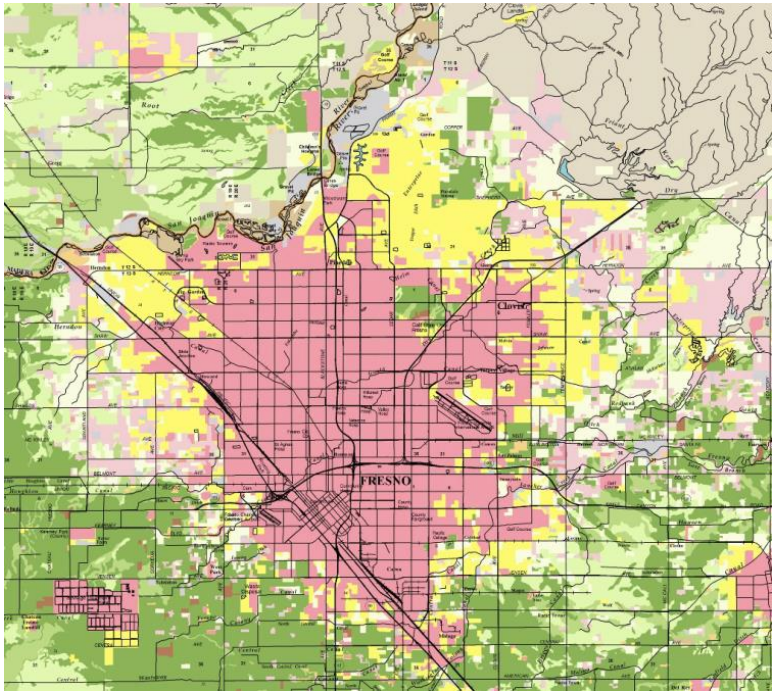
Sustainable, Equitable Communities

Simulation: What is Possible

Image credit: Urban Advantage

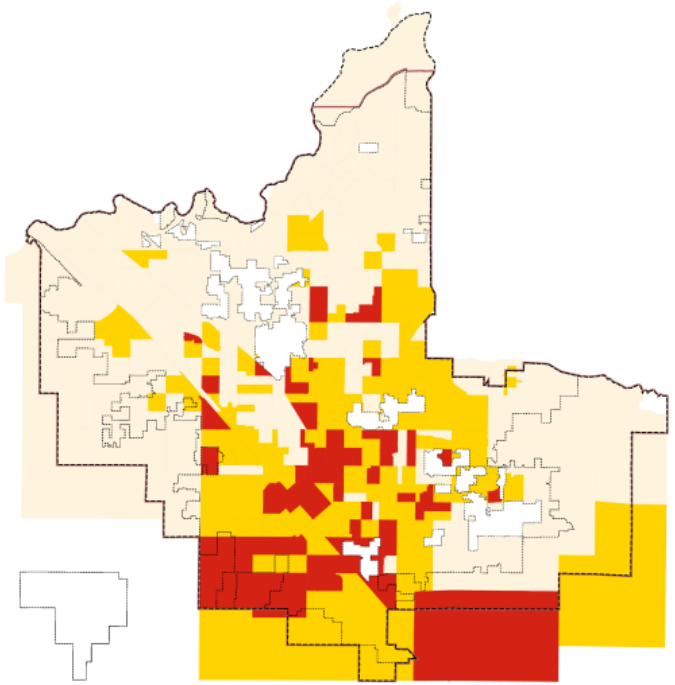
Sustainable, Equitable Communities

Fresno Metro Area Suburban Expansion: 1984 – 2012
(Yellow)



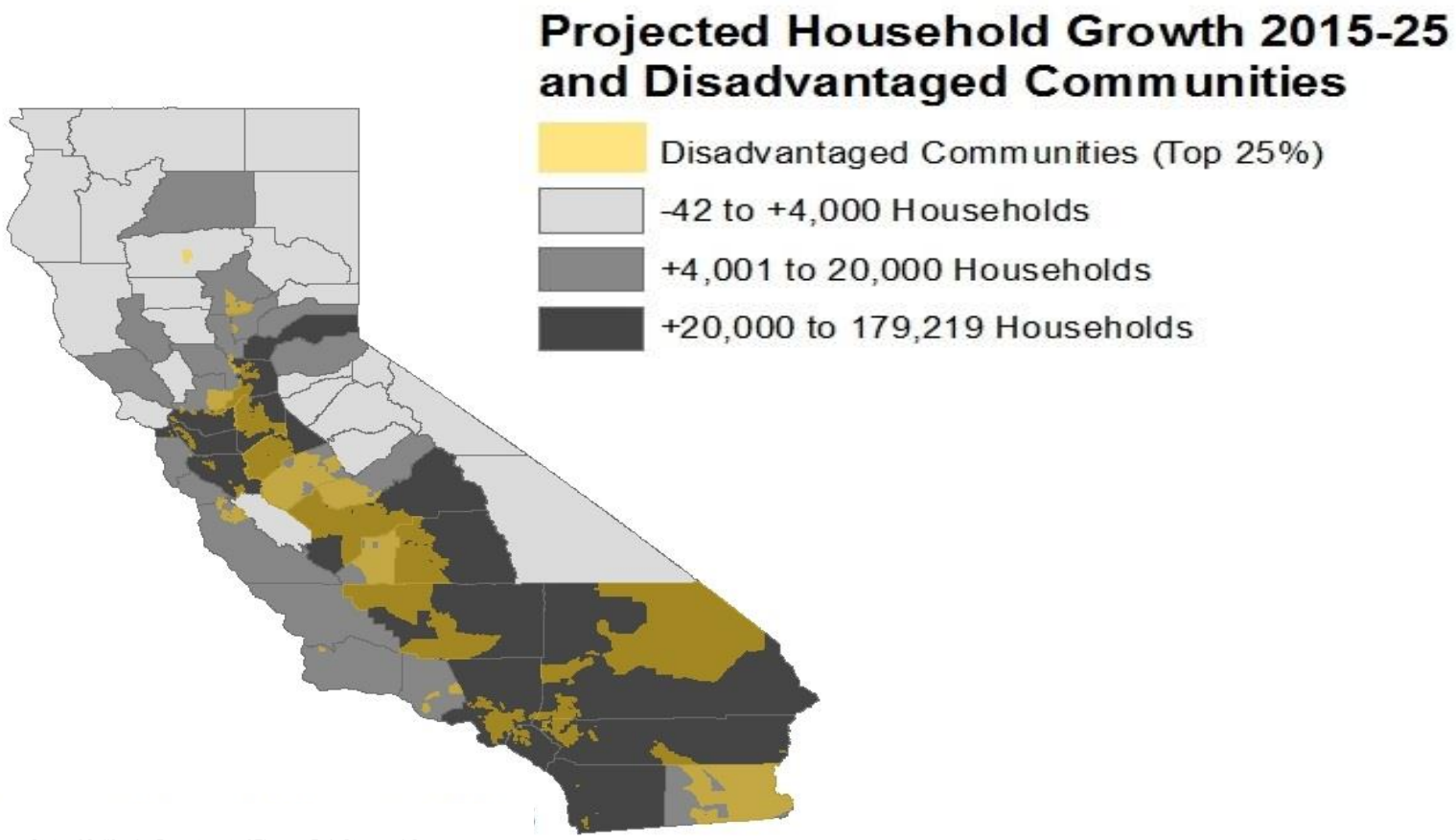
California Department of Conservation. 2015. Farmland Mapping and Monitoring Report.

Households in Poverty:
Yellow: 20-40%
Red: >40%



Courtesy City of Fresno

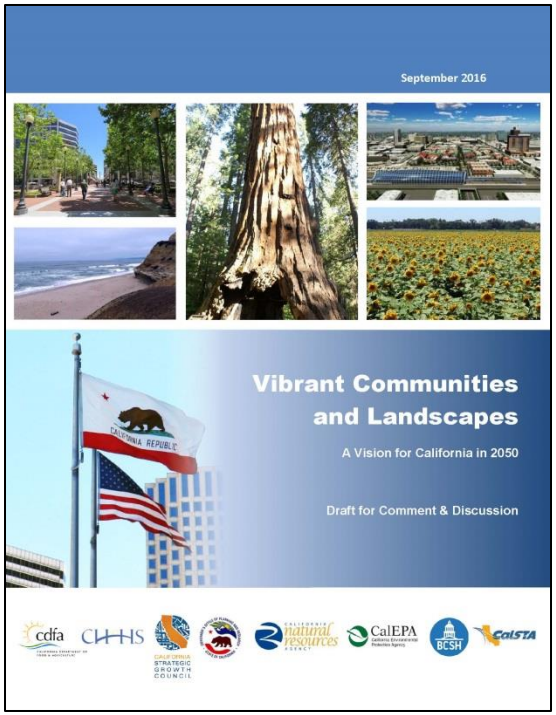
Sustainable, Equitable Communities



Sources: State of California, Department of Finance P-4: State and County Projected Households, Household Population, Group Quarters, and Persons per Household 2010-2030— Based on Baseline 2013 Population Projection Series, 3/10/2015, CalEnviroScreen 2.0, Disadvantaged Communities, Graphic by HCD

Vibrant Communities & Landscapes

- Interagency vision for land use
- Connect strategies for:
  - Conservation of natural and working lands
  - Sustainable, equitable communities
- Intended to inform the many plans and initiatives at the State level that have to do with land use
  - Scoping Plan is just one!
- SEE PUBLIC DISCUSSION PAPER – Posted on ARB Scoping Plan website



Vehicle Miles of Travel (VMT)

- Improved fuel and vehicle technologies **make driving cleaner**;
- Reducing VMT lessens **how much we have to drive in the first place.**
- Even with the most aggressive fuel and vehicle strategies, **we still need to reduce VMT to reach our GHG reduction goals.**

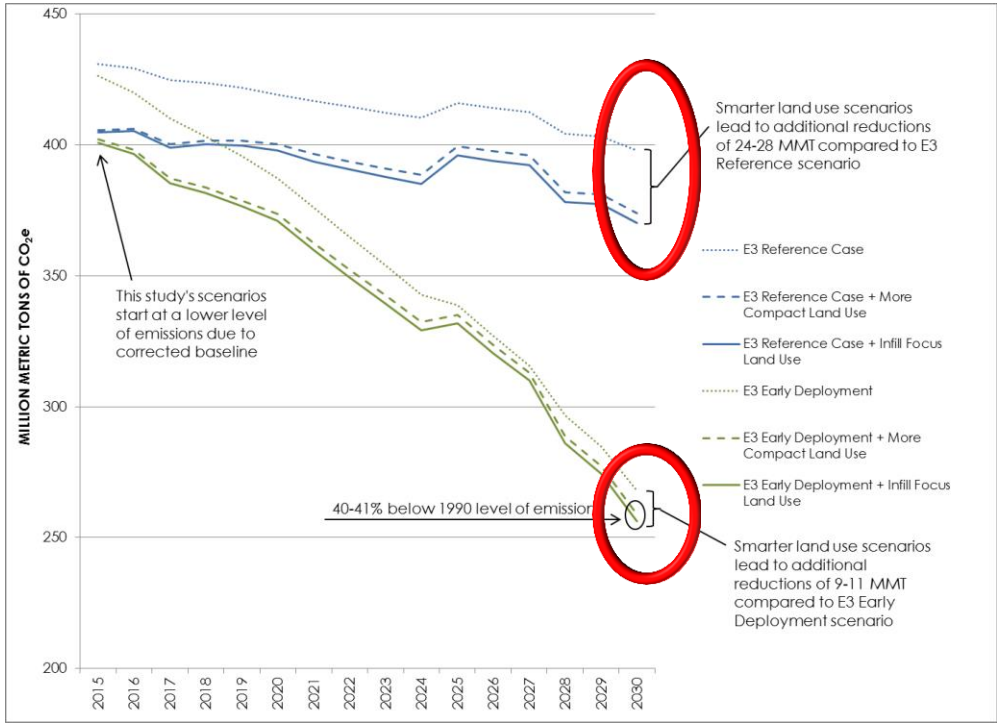


Chart: Busch, Chris, Ericka Lew and Joe DiStefano. *Moving California Forward: How Smart Growth Can Help California Reach its 2030 Climate Target While Creating Economic and Environmental Co-Benefits.* Energy Innovation. 2016. http://energyinnovation.org/wp-content/uploads/2015/11/Moving-California-Forward-Full-Report.pdf

Current State Initiatives

Adopted / In Implementation:

- SB 375
- CA Transportation Plan (CTP 2040)
- Caltrans Management Plan
- High-Speed Rail Business Plan
- Road User Pilot Program

In progress:

- SB 743
- CTP, Regional Transportation Plan Guidelines Update
- Caltrans Rail Plan
- Caltrans Bike-Ped Plan
- Infrastructure Planning

Potential Additional Strategies for Discussion

- **Encourage more efficient, equitable development:** Promote development in existing communities to bring destinations closer together so we don't have to travel as far.

Potential Additional Strategies for Discussion

- **Encourage more efficient, equitable development:**

The State could further explore….*

- Encouraging Transfer of Development Rights programs
- Promoting regional TOD funds
- Rebates for low-VMT housing
- Multi-station financing districts
- Residential property tax abatement for property improvement
- Reduced parking for infill development where transportation alternatives are present
- Promoting urban growth boundaries

*See posted discussion draft/handout for more details!

Potential Additional Strategies for Discussion

- **Expand transportation choices:** Promote a range of viable and attractive clean mobility options.

Potential Additional Strategies for Discussion

- **Expand transportation choices:**

The State could further explore….*

  - Expanding & improving transit and active transportation systems
  - Transit pass subsidies/fare reduction
  - Expanding shared mobility (bike share, car share, carpools)
  - Green construction practices for transportation projects
  - Other location-efficiency considerations for State infrastructure siting

*See posted discussion draft/handout for more details!

Potential Additional Strategies for Discussion

- **Pricing:** Make the cost of using infrastructure proportional to the amount it is used

- Voluntary programs, e.g. mileage-based insurance and road user charge can save households money.
- Revenues can be used to expand transportation alternatives and/or offset burdens for low-income users.

Potential Additional Strategies for Discussion

- **Pricing:**

The State could further explore….*

- Additional HOV lanes
- Expanding mileage-based road pricing and insurance options
- Cordon pricing zones in urban areas where transportation alternatives are present
- Low-Emission Zones for specified heavy-duty vehicles in specified sensitive areas
- Demand-based parking pricing

*See posted discussion draft/handout for more details!

Potential Additional Strategies for Discussion

- **Transportation System Efficiency:** Relieve congestion; encourage commuting alternatives; and reducing the need to travel at all.

Potential Additional Strategies for Discussion

- **Transportation Systems Efficiency:**

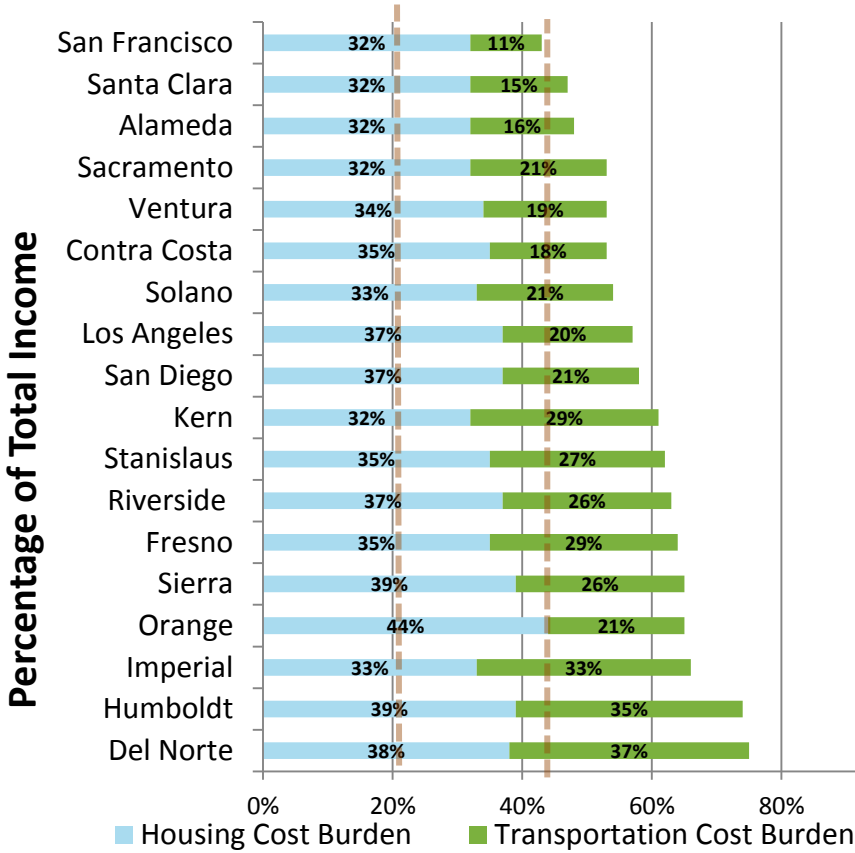
The State could further explore….*

- Commute trip reduction programs
- Eco-driving education
- Transportation management technology to decrease congestions
- Low-Emission Zones for specified heavy-duty vehicles
- Demand-based parking pricing

*See posted discussion draft/handout for more details!

"Co-benefits" of Advancing Sustainable, Equitable Communities & Reducing VMT

- Expand consumer options
- Reduce household cost burdens
- Improve health outcomes & safety
- Reduce time sitting in traffic
- Respond to increased market demand for walkable neighborhoods
- Reinvest in existing communities
- Create communities that attract and retain talent
- Reduce energy and water use



Source: Center for Neighborhood Technology, Housing and Transportation Index, Average Percent of Income Spent on Housing and Transportation for Selected Counties. Graphic by HCD.

Ensuring Equity

- Work collaboratively with communities as potential strategies are further explored and developed.
- Prioritize investments and benefits to existing communities and residents, low-income and disadvantaged communities.
- Integrate policies to prevent displacement.
- Use revenues to further equitable outcomes, e.g. service expansion, incentives, and/or cost offsets for low-income populations.

Public Discussion

Environmental Justice Advisory Committee

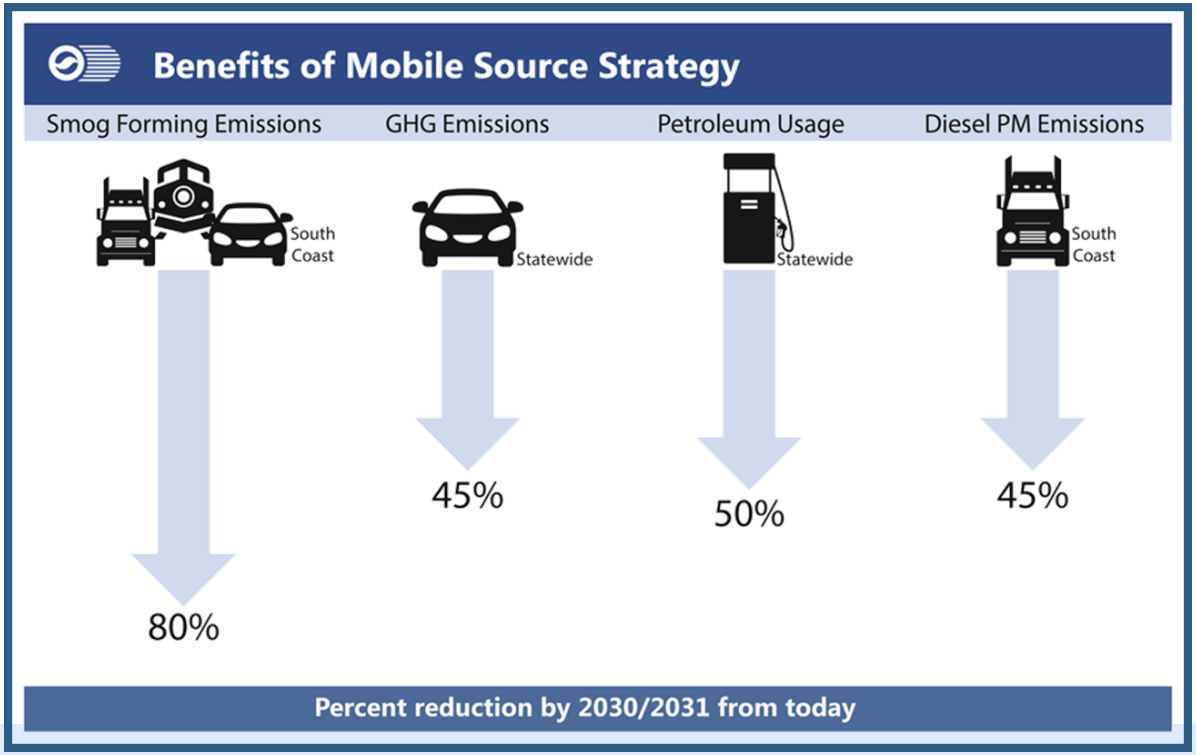
Lunch

Vehicle Technology
Mobile Source Strategy

California Air Resources Board

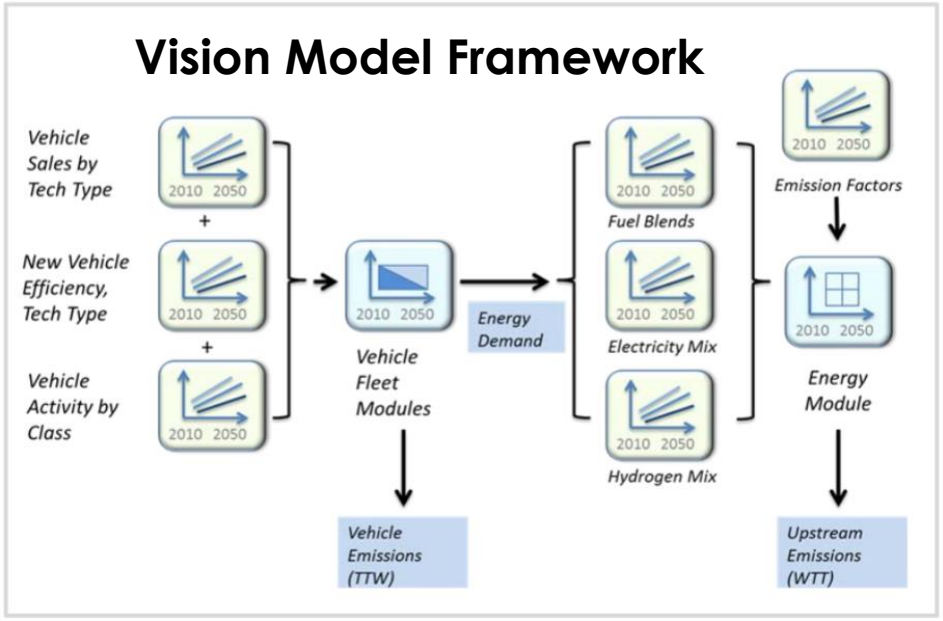
Mobile Source Strategy

- Reflects integrated strategy for mobile sources to meet air quality and climate goals.
- Updated Mobile Source Strategy published in May



Building Blocks for Strategy Development

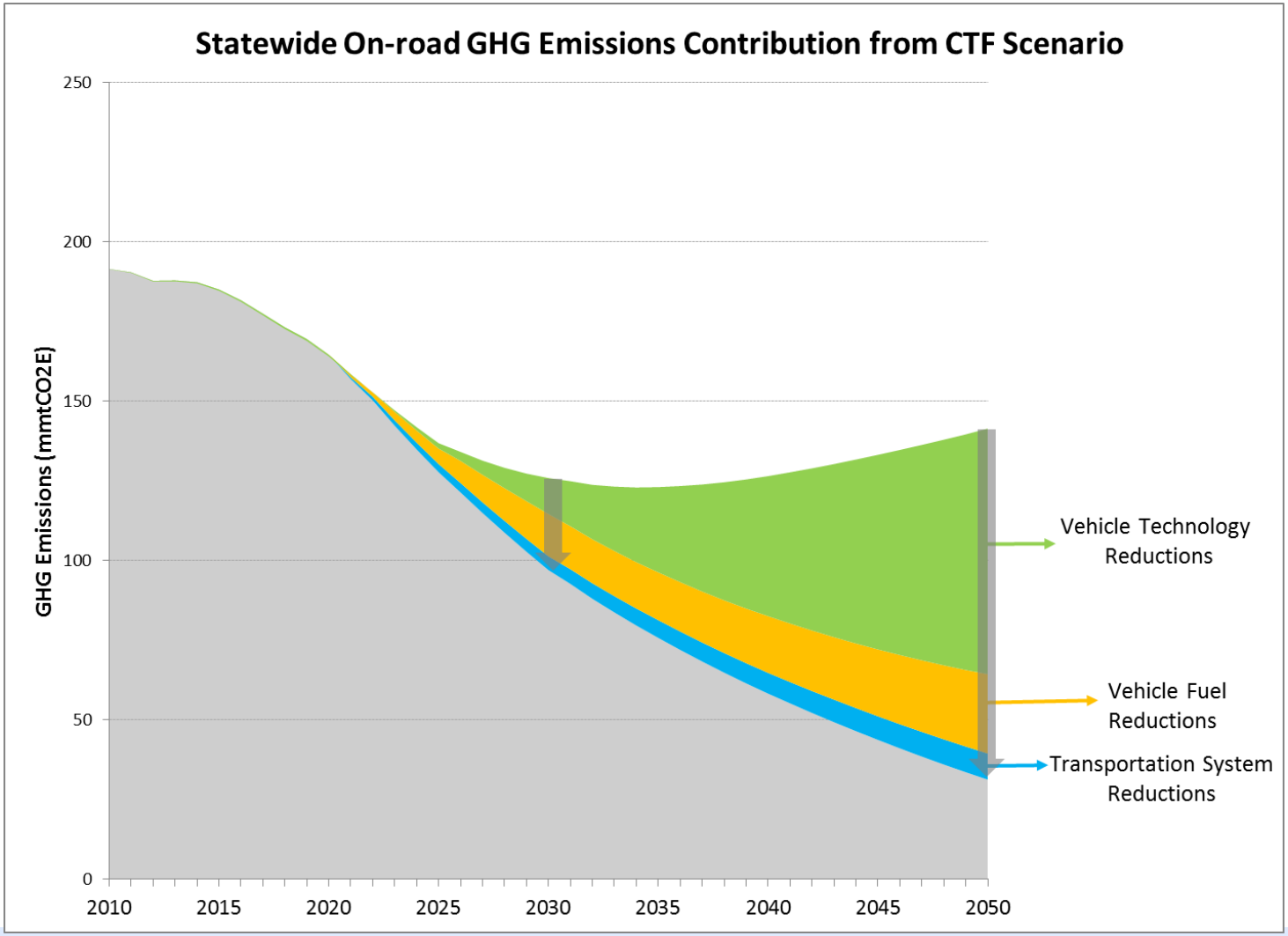
- Current programs provide blueprint for successful strategies
- Technology assessments identify status of advanced technologies and fuels
- Scenario analysis provides framework to assesses interplay between pollutants and strategies
- Identifies scope and timing of needed deployment of technologies, fuels, and efficiency measures



Key Strategy Actions

- Establish more stringent engine performance standards for cleaner combustion technologies
- Increase penetration of ZEV technology
- Slow growth in vehicle miles travelled
- Ensure durability of emission control systems
- Expand use of cleaner renewable fuels
- Conduct pilot studies to demonstrate new technologies
- Incentivize deployment of cleanest technologies


Mobile Source Strategy – Scenario Results



Scope of Mobile Source Strategy Scenario

	Today		2030
Passenger Fleet	~200k	ZEV/PHEV population	4.2 Million
	27%	Renewable energy generation	50%
	24 mpg	Fuel Efficiency	49 mpg
	11%	Improved system to reduce VMT growth (VMT growth between today and 2030)	5%
Truck Fleet	Demos	Low-NOx truck population	900,000
	~ 300	ZEV last-mile delivery truck population	23,000
	8%	Renewable Fuels	50%
	6.5 mpg	Fuel Efficiency*	8.9 mpg

*Fuel efficiency for class 8 trucks

Next Steps

- Strategy provides framework for ongoing planning efforts:
  - State Implementation Plans
  - Scoping Plan Update
  - California Freight Action Plan
  - Short Lived Climate Pollutant Plan
- Proposed Short Lived Climate Pollutant Plan published in April.
- Freight Plan published in July.
- Board will consider approval of the State SIP Strategy in January.

Vehicle Technology
Light Duty Vehicles

California Air Resources Board

Joshua Cunningham

Chief, Advanced Clean Cars Branch

Emissions Compliance, Automotive Regulations and Science (ECARS) Division

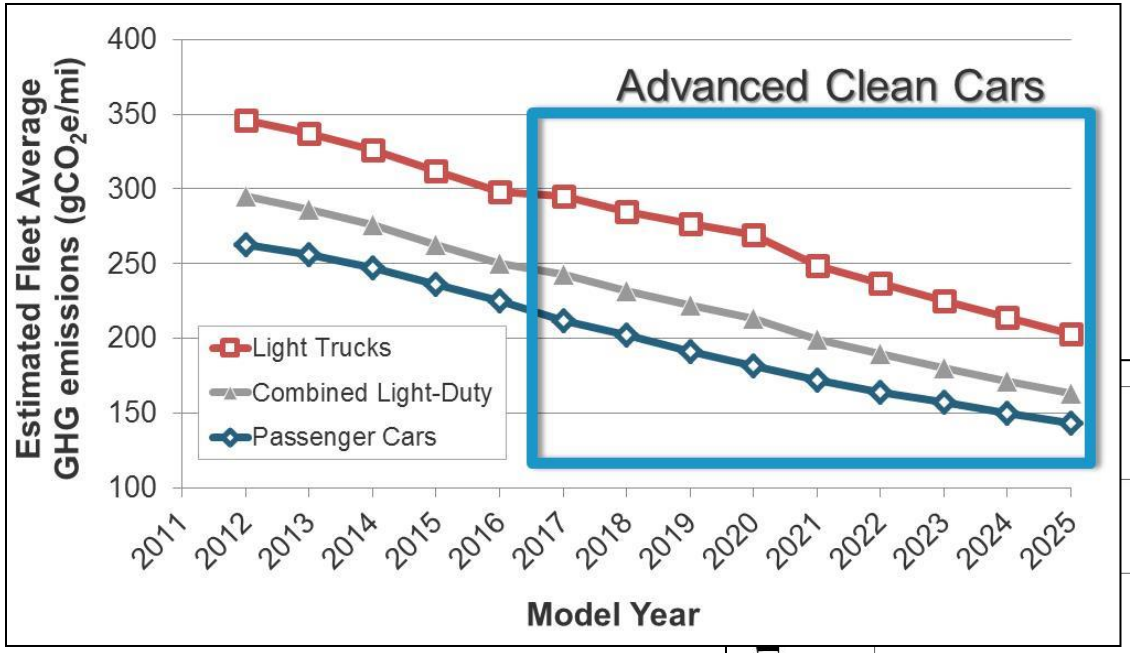
Overview of Presentation

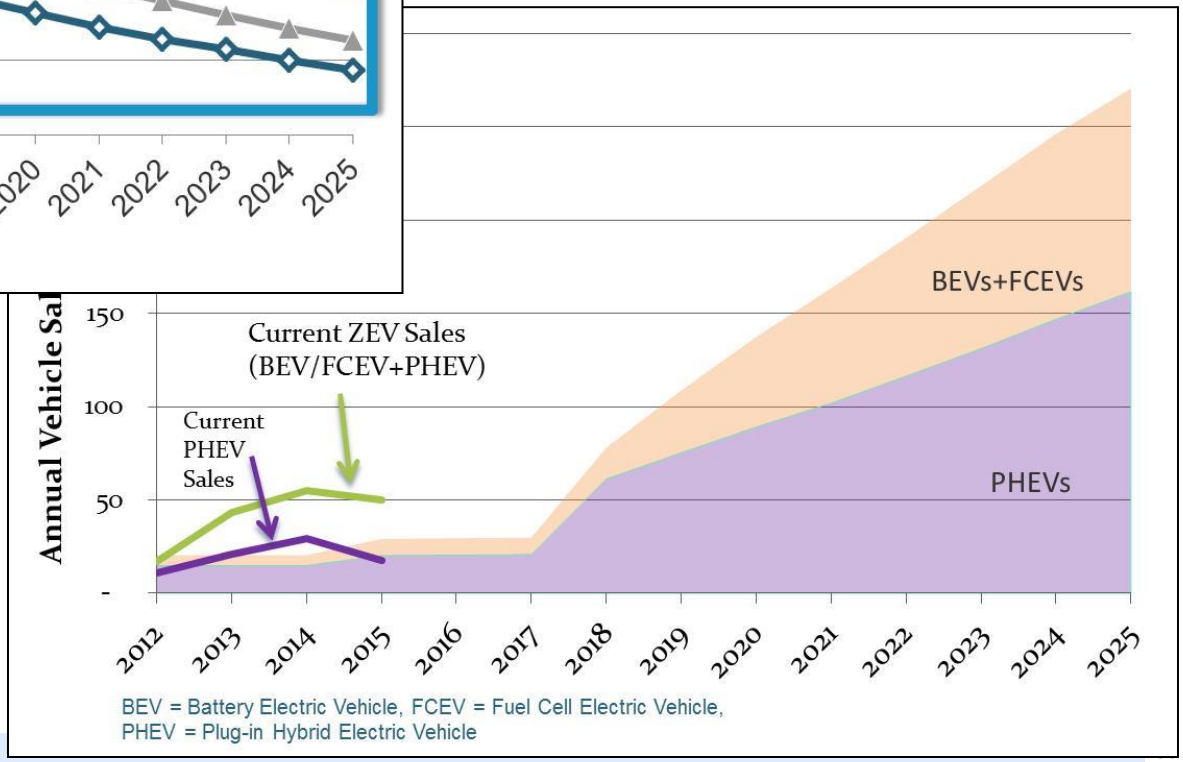
- Background: Existing light-duty vehicle programs
- Vehicle technology today; Near term projections
- Achieving post-2025 targets

Existing Light Duty Vehicle Programs

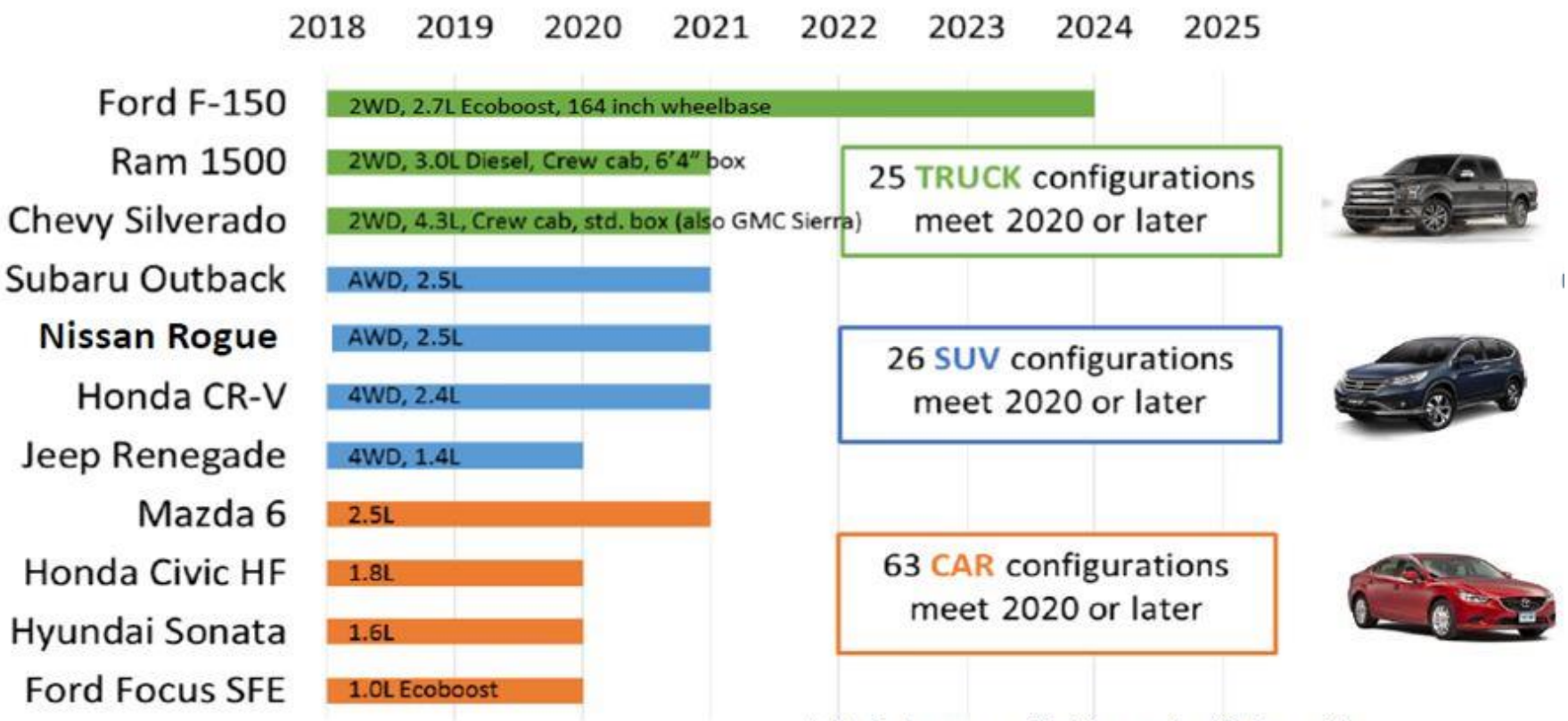
- **Regulations**: *Advanced Clean Cars rules to 2025*
  - LEV III GHG Emission Fleet Standards
  - ZEV Regulation
  - LEV III Criteria Emission Fleet Standards
- **Incentives**: *Low Carbon Transportation Funds*
- **Regional Planning**: *Market Support Actions*
  - H2/EV station siting; Consumer awareness; etc
- **Partnerships**: *Collaboratively addressing barriers*
  - CA Fuel Cell Partnership (CaFCP); CA Plug-in Electric Vehicle Collaborative (PEVC)
  - GO ZEV Action Plan (multi-agency partnerships)
  - Multi-state ZEV MOU
  - International ZEV Alliance

GHG & ZEV Compliance Projections





GHG Regulation:
Many of Today's Top Sellers Meet Future Standard



** Variants are specified for each vehicle model*
***Assumes addition of air conditioning credits phasing in per EPA rule projections, up to 18.8 g/mi for cars and 24.4 g/mi for trucks in 2021-2025*

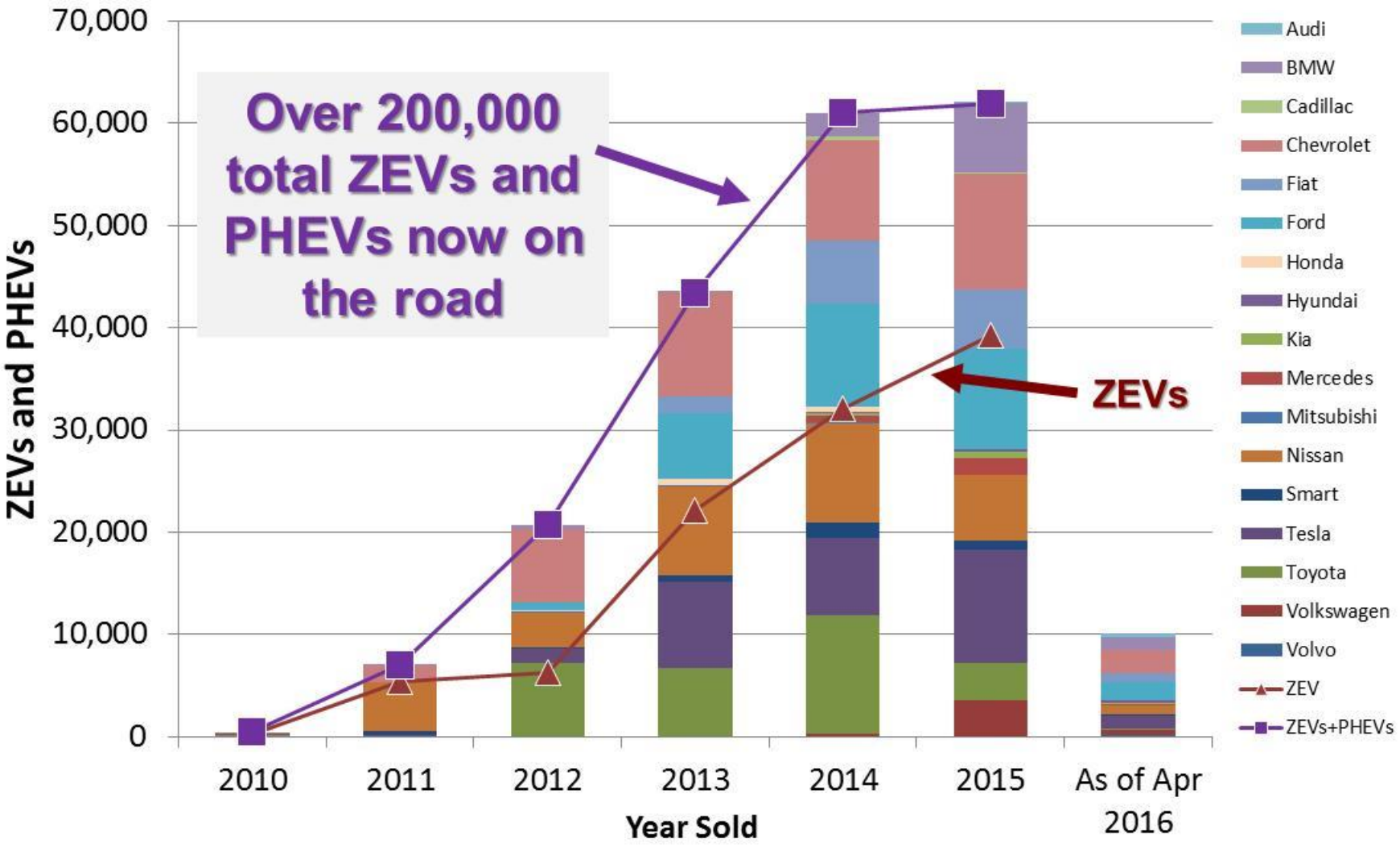
8

Technical Assessment Report (TAR) Key Findings for GHG Rule

- 2025 GHG standards can be met cost effectively predominantly with advanced gasoline engines and transmissions
- In addition, light-weighting, improved aerodynamics and better tires also key technologies
- Nationwide, minimal reliance on ZEVs needed to meet GHG standards

2025 Model Year Vehicle Technologies	
Conventional Technologies	54%
Stop-Start	20%
Mild Hybrid (48 Volt)	18%
Strong Hybrid	3%
Plug-in Hybrid Electric Vehicle	**2%**
Battery Electric Vehicle	**3%**

ZEV Regulation:
ZEV Market Strong & Growing



Source: CA DMV Registration Records, April 2016

ZEVs either on the market now or coming very soon

24 Models today in CA; 68 models projected by 2021

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

Strategies to Achieve Post-2025 Emission Reductions

- **ZEV+LEV Scenario shows substantial GHG & petroleum reductions ***
- **SULEV+ Scenario shows NOx reductions increase beyond 2031**

Figure 3-5: On-Road GHG Emission Reductions

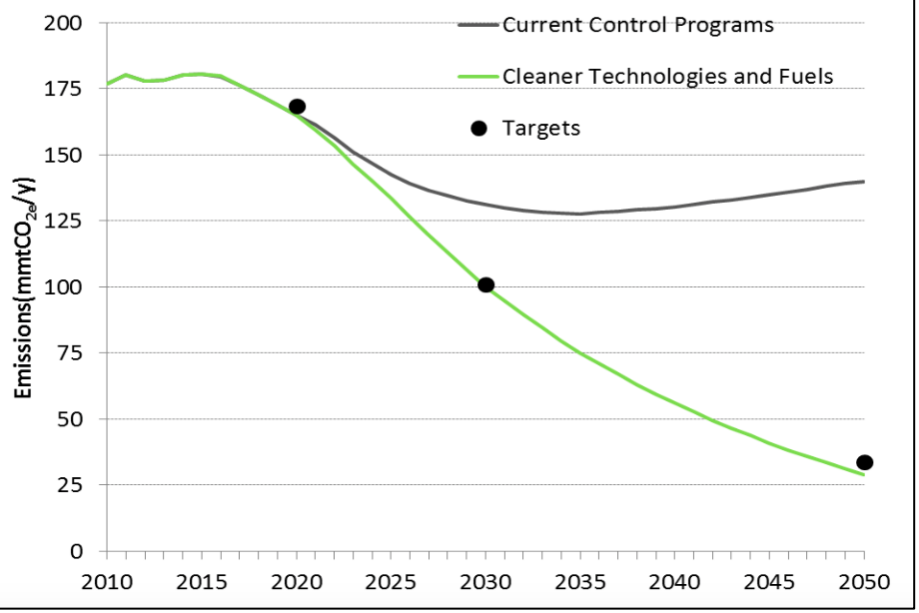
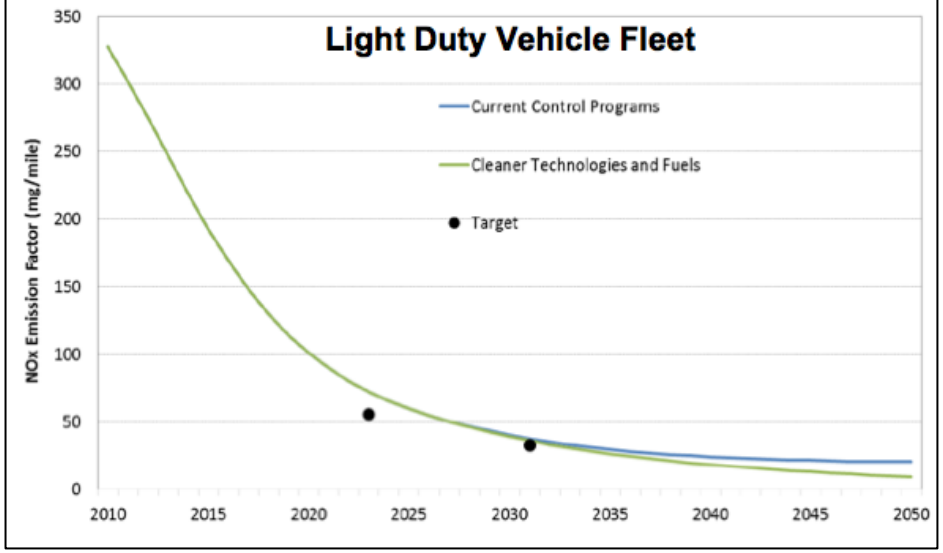
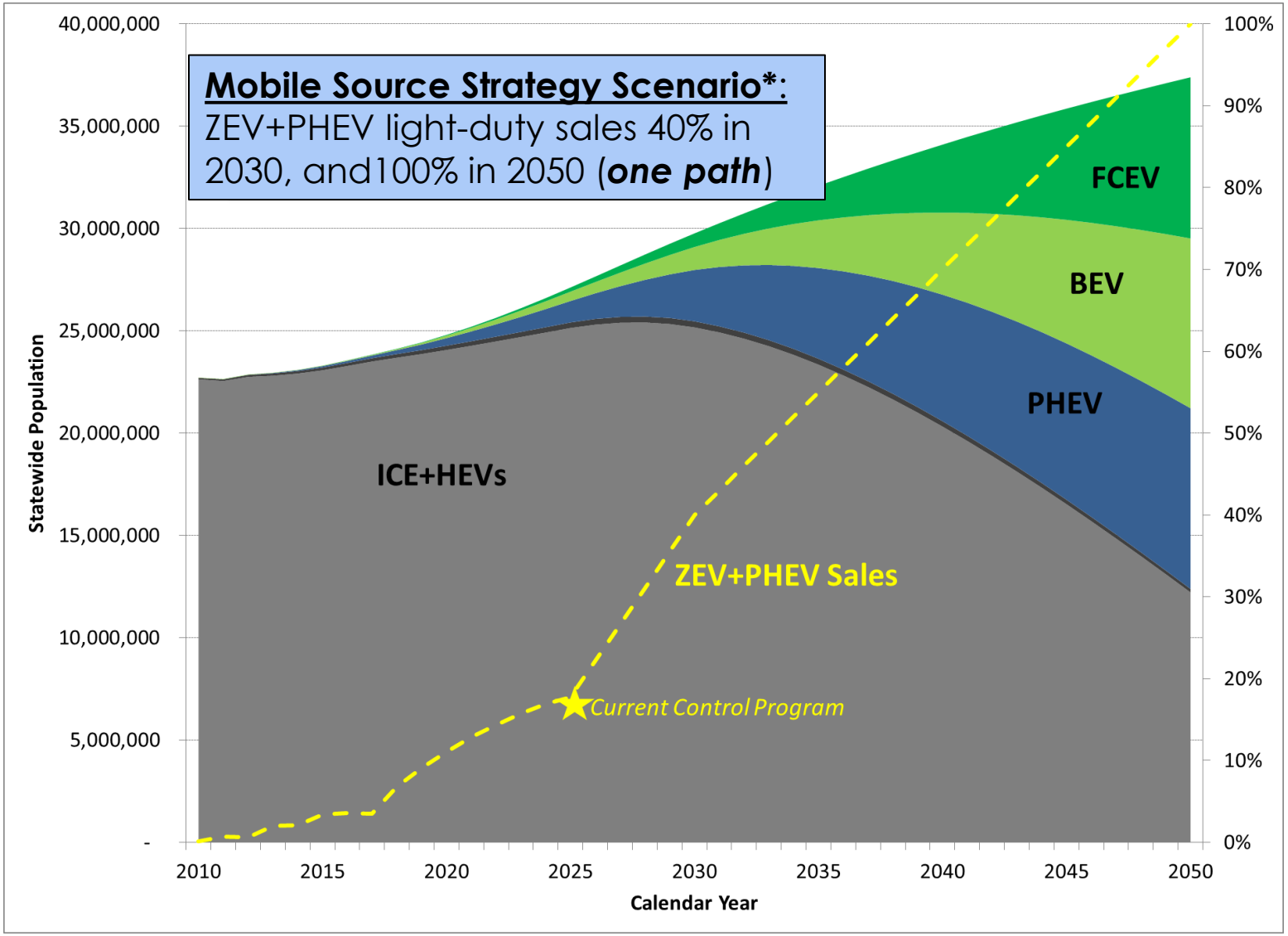


Figure 3-4: Projected In-Use Fleet Average NOx Emission Rate* Trends
under *Cleaner Technologies and Fuels* Scenario



** ARB Mobile Source Strategy, CTF Scenario, May 2016*

Transforming the Fleet to ZEVs is Needed to Meet Emission Reductions



** ARB Mobile Source Strategy, CTF Scenario, May 2016*

Advanced Clean Cars 2 Measure Concept

- **Increase stringency**
  - Evaluate appropriate policy mechanism (ZEV mandate and fleet standards)
  - Ensure ZEVs continue to expand in the market
  - Regulation may include further reductions below current SULEV criteria emission standard, and GHG standard
- **Timeframe:**
  - Build upon Mid-term Review Board item in Dec 2016
  - Board adoption in 2020-2021
  - Implementation 2026 – 2035 (preliminary)

Contact Details

Joshua Cunningham

E-mail: Joshua.Cunningham@arb.ca.gov

ZEV Program:
http://www.arb.ca.gov/msprog/zevprog/zevprog.htm

Drive Clean:

http://www.driveclean.ca.gov/

ARB Mobile Source Strategies for On-Road and Off-Road Heavy Duty Equipment

ARB Scoping Plan Transportation Workshop

September 14, 2016

Outline

- Current heavy-duty programs reducing greenhouse gases
- Technology assessments
- On-road strategy and measures
- Off-road strategy and measures

Current Programs

- Proposed measure from the 2008 Scoping Plan
  - California Tractor Trailer GHG regulation and Phase 1 GHG Emission Standards (as adopted in California) are expected to result in GHG reductions of:
    - ✓ 3.6 MMTCO2e in 2020
    - ✓ 7.6 MMTCO2e in 2035

Results of Heavy-Duty Sector Technology Assessments

- Renewable fuels can provide significant GHG and petroleum reductions
- Heavy-duty zero emission technologies are currently being developed.
  - Airport ground support equipment available now
  - Battery electric and fuel cell buses are in the early commercialization phase
  - Battery costs dropping rapidly
  - Zero emission drayage and delivery truck demonstrations
- Technology Assessment reports available at www.arb.ca.gov/msprog/tech/report.htm

On-Road Heavy-Duty Sector Strategy

- Establish more stringent criteria and greenhouse gas emission standards
- Establish requirements to ensure durability of HDVs
- Deploy zero emission technologies in focused heavy-duty applications
- Offer incentive funding for the cleanest engine technologies
- Increase use of renewable fuels
- Increase freight transport system efficiencies and use of intelligent transportation systems

Heavy-Duty GHG Phase 2

- **Goal**: Establish next generation of Heavy-Duty Truck GHG standards building upon Phase 1 standards
  - 32 % reduction in CO2 (tractor-trailers) compared to Phase 1
  - Federal Phase 2 scheduled finalized August 2016
  - California Phase 2 scheduled for adoption in Summer 2017
- **Type of Action**: U.S. EPA Regulation/ARB Regulation
- **Timeframe**:
  - U.S. EPA adoption date (Federal Phase 2): August 2016
  - ARB Board adoption date (CA Phase 2): 2017
  - Implementation schedule: 2018-2027

Advanced Clean Transit (ACT)

- **Goal**: Increase penetration of clean engine technologies and zero emission buses into transit bus fleets by developing ACT rule amendments
  - Phase-in advanced technology buses
  - Require renewable fuel/cleanest engines for conventional buses
  - Develop flexibility provisions
  - Promote innovative methods of transportation
- **Type of Action**: ARB Regulation
- **Timeframe**:
  - ARB Board Hearing date: 2017
  - Implementation schedule: 2018 - 2040

Last Mile Delivery

- **Goal:** Increase the penetration of zero emission class 3-7 trucks used for last mile delivery
  - Phase in zero emission last mile delivery trucks from 2020 through 2030
  - Work with stakeholders to explore mechanisms
  - Update Board next spring
- **Type of Action:** ARB Regulation
- **Timeframe:**
  - ARB Board Hearing date: 2018
  - Implementation schedule: 2020 - 2050

Zero Emission Airport Shuttle Buses

- **Goal**: Promote deployment of zero emission airport shuttle buses
  - Encourage early introduction of zero emission buses
  - Establish future phase-in requirements
- **Type of Action**: ARB Regulation/Incentives/MOU
- **Timeframe**:
  - ARB Board Hearing date: 2018
  - Implementation schedule: 2023

Innovative Technology Certification Flexibility

- **Goal:** Provide certification flexibility for advanced truck and bus technologies needed to meet AQ and climate goals
  - Targets new heavy-duty low-NOx, low-CO2, and hybrid engines, plus medium- and heavy-duty hybrid conversions
  - Mostly provides OBD compliance flexibility
- **Type of Action**: ARB Regulation
- **Timeframe**:
  - ARB Board Hearing date: 2016
  - Implementation schedule: 2017-2027
- Proposed regulation and staff report available at: https://www.arb.ca.gov/msprog/itr/itr.htm

Incentive Funding to Achieve Further Emission Reductions from On-Road Heavy-Duty Vehicles

- **Goal:** Provide incentive funding to accelerate the penetration of zero and near-zero equipment beyond the rate of turnover achieved through implementation of other measures
  - ARB's Low Carbon Transportation funds and AQIP (~$7 million per year for low-NOx trucks using renewable fuels (2015-2020)); $150M approved by legislature for 2016/2017 fiscal year (pending Governor's signature)
  - District's AB 923 and Carl Moyer (~$28 million per year for cleaner trucks (2015-2020))
  - ARB's Proposition 1B: Goods Movement Emission Reduction Program funds (~$165 million for cleaner trucks (2016-2018))
- **Type of Action**: Funding programs
- **Timeframe**:
  - ARB Board adoption date: 2016 and annually thereafter
  - Implementation schedule: 2016 - 2023

Off-Road Equipment Category Strategy

- Focus deployment of zero emission technologies where commercially available
- Demonstrate ZE technology in heavier equipment and duty-cycles
- Integrate worksite efficiencies, vehicle automation, and fleet management technologies
- Continue to assess the expansion of zero emission technologies throughout the off-road equipment sector
- Investigate need even cleaner new off-road compression ignition engine standards and related requirements

Zero Emission Off-Road Forklift Regulation Phase 1

- **Goal**: Accelerate deployment of zero emission forklifts with a lift capacity ≤ 8,000 lbs
  - Forklifts primed for increased zero emission technology deployment
  - Provide pathway for technology to transfer to heavier equipment and other applications
  - Encourage growth of zero emission infrastructure at work sites
- **Type of Action:** ARB Regulation
- **Timeframe**:
  - ARB Hearing Date: 2020
  - Implementation: 2023-2035

Zero Emission Airport Ground Support Equipment

- **Goal**: Accelerate deployment of ZE technology in Ground Support Equipment
- GSE already moving towards electric
- Possible Strategies
  - Incentives for Demonstrations
  - Conservative Approach: Natural turnover + incentives
  - Aggressive Approach: MOU or regulatory program
- Pathway to transition ZE to heavier applications
- **Type of Action**: Incentives and/or Regulation
- **Timeframe**:
  - ARB Hearing Date: 2018
  - Implementation: 2023

Zero Emission Off-Road Emission Reduction Assessment

- **Goal**: Evaluate the state of zero and near-zero emission off-road technologies
  - Identify opportunities to expand use of zero and near-zero emission technologies to larger, higher power-demand applications
  - Inform future measures
  - Follows *Zero Emission Forklift* and *Airport Ground Support* regulations
- **Type of Action:** Technology Review
- **Timeframe**: Board Date: 2025+

Small Off-Road Engines (SORE)

- **Goals**:
  - Reduce emissions from small off-road engines
  - Enhance enforcement of current emission standards
  - Tighten exhaust and evaporative emission standards
  - Increase penetration of zero emission technology
- **Type of Action**: ARB Regulation
- **Timeframe**:
  - Board Date: 2018
  - Implementation schedule: 2022 - 2030

Transport Refrigeration Units for Cold Storage

- **Goal**: Advance zero and near-zero emission technology and support the needed infrastructure developments
- **Type of Action:** ARB Regulation
- **Timeframe**:
  - Board Date: 2017-2018
  - Implementation: 2020 +

Emission Reduction Assessment: Off-Road Worksite Efficiency

- **Goal**: Evaluate worksite efficiency technologies
  - Autonomous equipment and connected worksite technologies
  - Potential metrics for quantifying benefits
  - Estimate emission reductions and cost effectiveness
  - Recommend ways to encourage deployment (e.g., through financial incentives or regulatory credit)
- **Type of Action**: Technology Review
- **Timeframe**: TBD

Contact Details

Bruce Tuter

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btuter@arb.ca.gov

Vehicle Technology
Sustainable Freight

California Air Resources Board

Overview

- Freight Transport System Overview
- Sustainable Freight Pathways
- Governor's Executive Order
- California Sustainable Freight Action Plan

Freight Transport System









Modes & Facilities

Need to Accelerate Progress

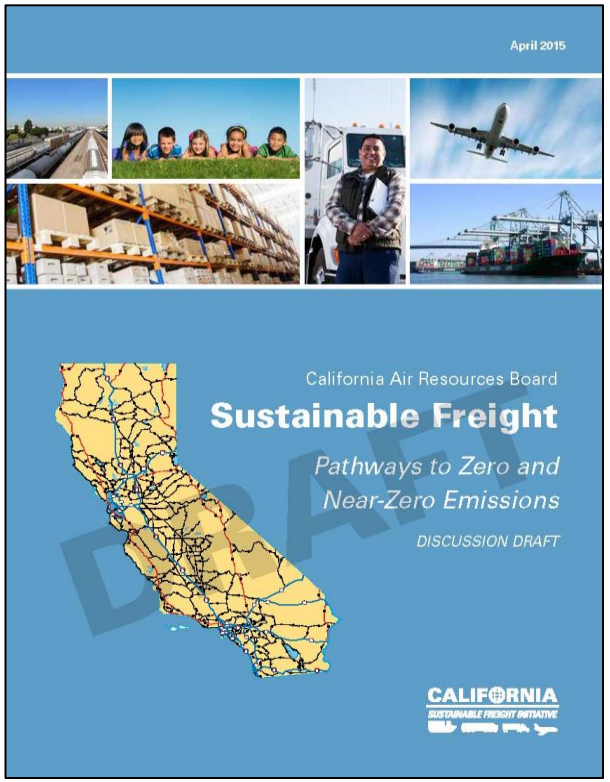
Current ARB Freight Strategies

Trucks	Ships	Locomotives	Harbor Craft	Cargo Loading Equipment
• Idling limits • International truck requirements • Transport refrigeration unit upgrades • Drayage truck modernization • Statewide truck and bus rule • GHG reductions for new tractor-trailers • Optional low-NOx standards	• Lower sulfur fuel for auxiliary and main engines, plus boilers • Shore power/at dock reductions • Ship incineration ban	• Low sulfur diesel fuel use for intrastate locomotives • Fleet average NOx limits for South Coast • Diesel PM risk reduction at 18 major rail yards --inventories -- risk assessments -- reduced idling	• Low sulfur diesel fuel required • In-use harbor craft upgrades – tugs, tows, etc.	• Low sulfur diesel fuel use required • In-use diesel equipment upgrades • In-use gas forklift upgrades • In-use airport ground support equipment upgrades

ARB Pathways to Zero and Near-Zero Emissions Document

- Immediate ARB actions (2015/16)
- Near-term ARB measures (2016 +)
- Longer term approach (~2050)

http://www.arb.ca.gov/gmp/sfti/sfti.htm



ARB Strategies for Cleaner Combustion: Locomotives

Petition US EPA to promulgate updated standards for all locomotives, including a Tier 5 standard for newly manufactured locomotives that requires zero-emission track mile capability, and tighter requirements for remanufactured locomotives.

ARB Strategies for Cleaner Combustion: Ships

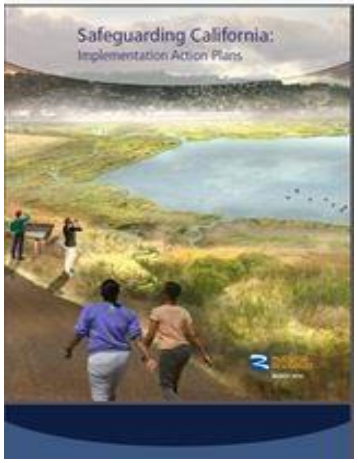
1. Advocate with international partners to the International Maritime Organization for stricter marine vessel emission and efficiency standards
2. Develop incentive programs in cooperation with ports and other stakeholders to bring low-emission, efficient vessels to California ports
3. Amend ARB's At-Berth Regulation to address implementation issues and expand benefits

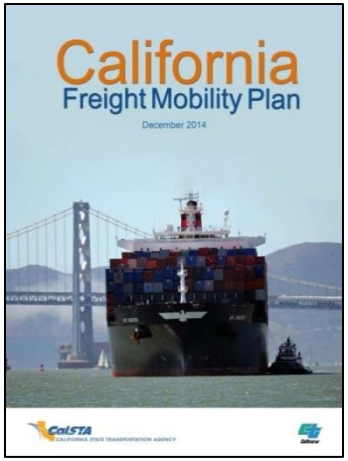
Governor's Executive Order B-32-15

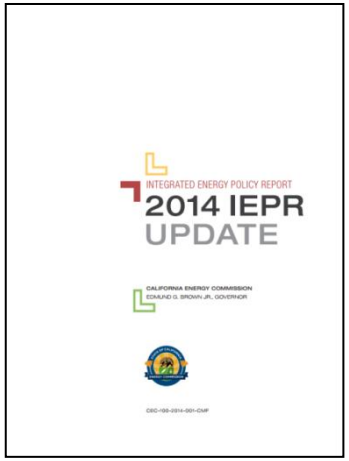
Multi-decade, iterative process needed to transform California's freight system. State agencies, in consultation with stakeholders, to develop plan by July 2016 to:

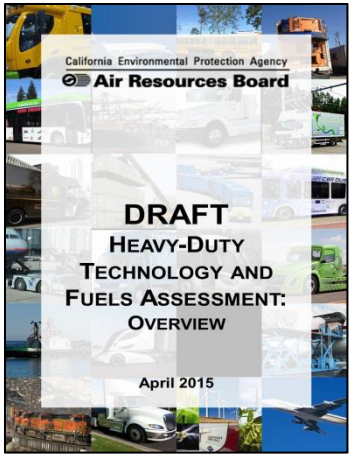
- Improve freight efficiency
- Transition to zero emission technologies
- Increase competitiveness

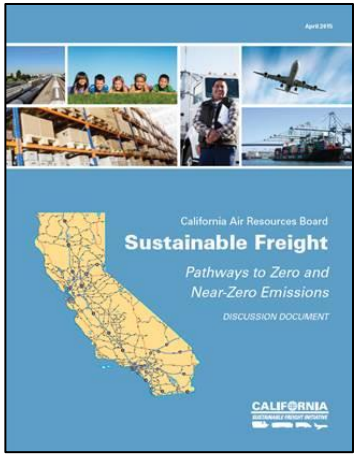
Foundations for Action Plan

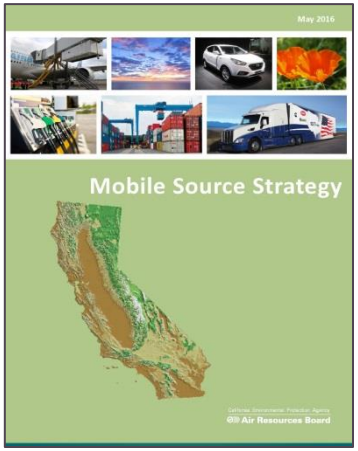


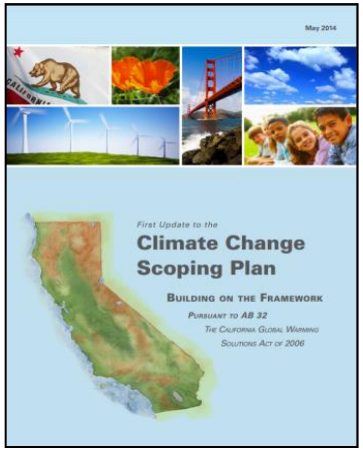


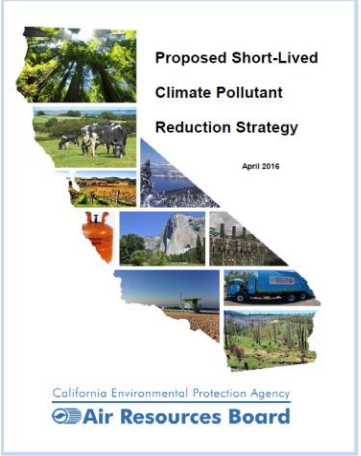








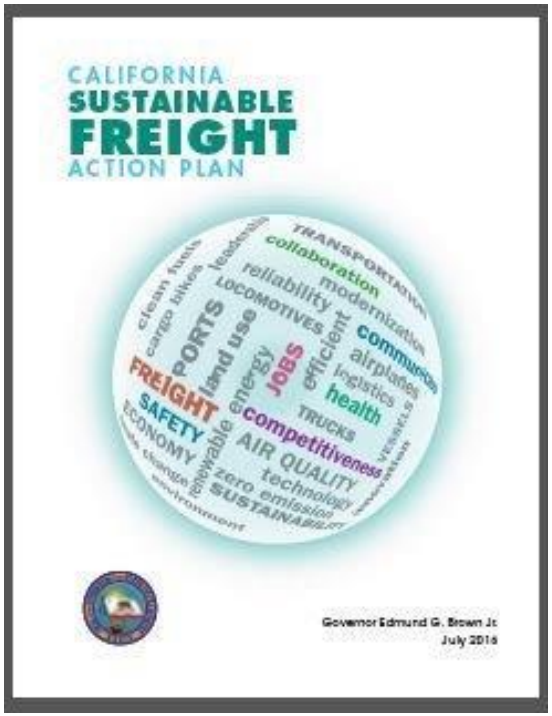




Framework of Action Plan

Released in July 2016, includes:

- **2050 Freight System Vision**
- **Guiding Principles**
- **2030 Statewide Targets**
- **Freight Funding Approach**
- **State Agency Actions**
- **Pilot Projects**
- **Discussion Concepts**



Vision for a Sustainable Freight Transport System

Utilize a partnership of federal, State, regional, local, community, and industry stakeholders to move freight in California on a modern, safe, integrated, and resilient system that continues to support California's economy, jobs, and healthy, livable communities. Transporting freight reliability and efficiently by zero emission equipment everywhere feasible, and near-zero emission equipment powered by clean, low-carbon renewable fuels everywhere else.




2030 Statewide Targets

- **System Efficiency:** Improve 25 percent
- **Technology:** Deploy over 100,000 vehicles and equipment capable of zero-emission operation, and maximize near-zero equipment with low carbon fuels
- **Economy:** Foster future economic growth within the freight and goods movement industry




Freight Funding Approach

- Fixing America's Surface Transportation (FAST) Act
- Explore Trade Corridor Improvement Fund/Goods Movement Emission Reduction Program Phase II
- Further explore matching grants, financing assistance, and bulk purchasing power
- Develop integrated, statewide freight funding strategy

State Agency Actions

1. Work with Legislature on a freight transport funding package
2. Work with California Transportation Commission on updated guidelines for distribution of federal FAST Act funds (per new legislation)
3. Plan and invest in infrastructure to modernize freight corridors
4. Accelerate use of advanced technologies and renewable fuels

State Agency Actions (cont'd)

5. Establish a sustainable freight think tank
6. Develop strategies, tools, and data that consider commercial viability and promote competitiveness
7. Continue the freight efficiency working group
8. Implement steps to meet existing and future workforce needs
9. Identify process improvements to expedite delivery of projects

Implementation Steps for Actions

- **Transportation and Fueling Infrastructure**
  - Highway, Rail, and Waterway Network Planning and Development
  - Charging and Hydrogen Fueling Network Planning and Incentives
  - Freight Handbook
- **Advanced Technologies**
  - Vehicle and Equipment Regulatory and Incentive Concepts
  - Renewable Fuels Concepts

Implementation Steps for Actions

- **Competitiveness**
  - Cost and Benefit Data, Tools, and Metrics Development
- **System Efficiency**
  - Freight Truck Platooning, Route Designation, and Signal Priority
  - Intelligent Transportation Systems Enhancements
  - Off-Hour Delivery/Pick Up Strategy
- **Workforce Development**
  - Upskilling Programs and Job Training Models

Freight Efficiency Working Group

Chaired by Dr. Sperling
and
Convened by Caltrans

- **Participants:** Freight industry, academics, advocates, and government
- **Developed a series of white papers:**
  - Funding for Freight Infrastructure and Clean Equipment
  - Strategies to Maximize Asset Utilization
  - Planning and Policy
  - Operational Modernization at Distribution Nodes
  - Information Technology

Pilot Projects

- **Dairy Biogas for Freight Vehicles**
  San Joaquin Valley

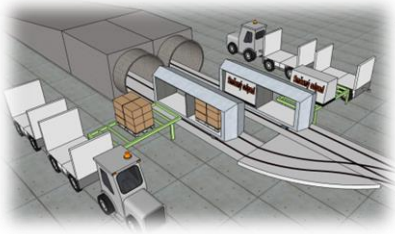
- **Advanced Technology for Truck Corridors**
  Southern California

- **Advanced Technology Corridors at Border Ports of Entry**
  California-Mexico Border



Discussion Concepts

- **Inland marine corridors**
- **Non-traditional transport methodologies**
- **Packaging optimization**
- **Supply chain consolidation in the agricultural industry**
- **System efficiency strategies**
- **Transportation projects**
  - Interstate 710 Corridor
  - State Route 11 Otay Mesa East Port of Entry



Next steps

- Continued work with stakeholders to refine and prioritize the strategies outlined in the Action Plan
- Create or continue stakeholder working groups on competitiveness, system efficiency, workforce development, and regulatory and permitting process improvements
- Establish work plans for chosen pilot projects

View the Action Plan at:
http://www.casustainablefreight.org/

Current State Agency Efforts
Fuels – Low Carbon Fuel Standard

California Air Resources Board

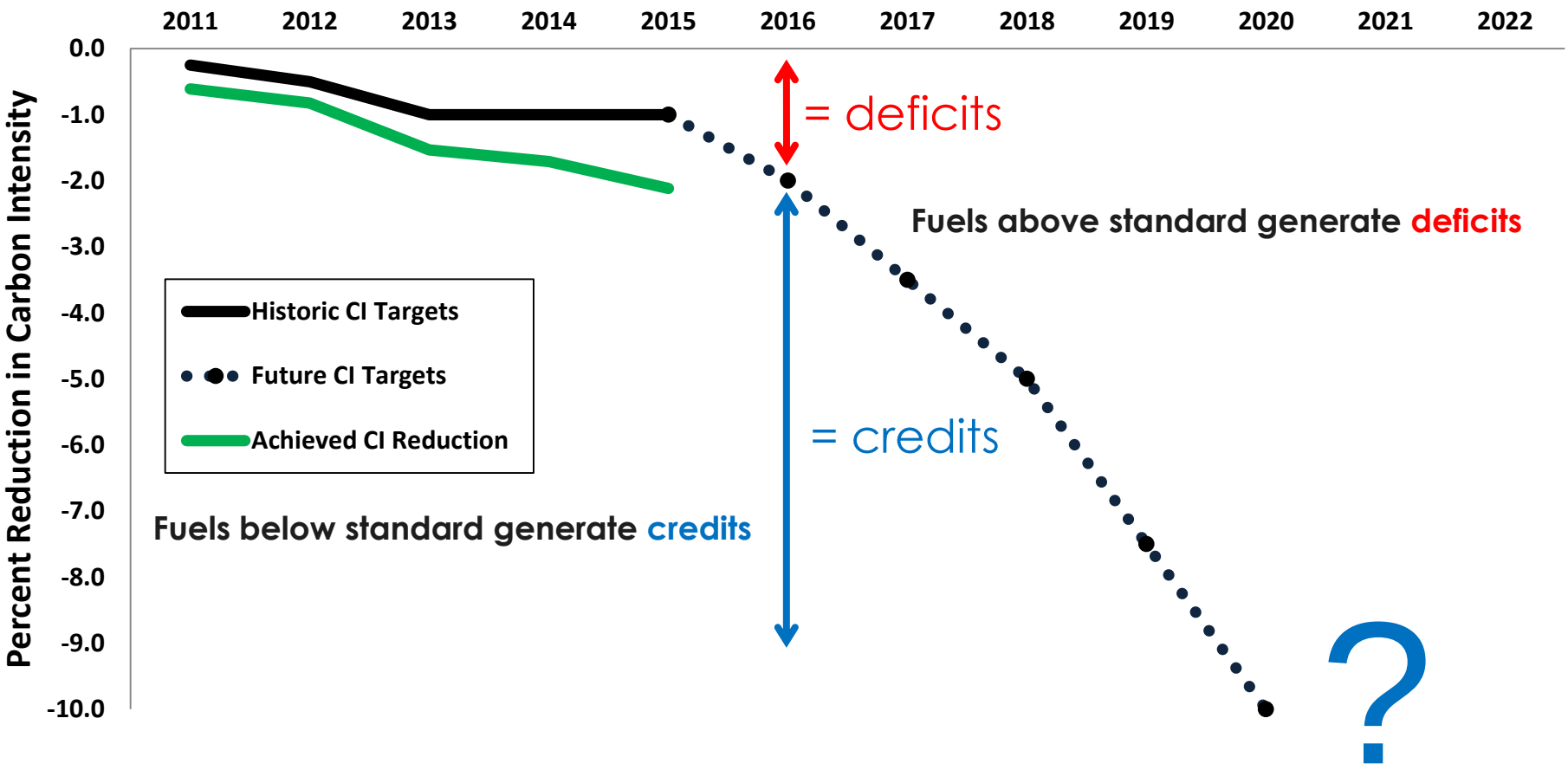
LCFS History

- Original adoption in 2009, amended in 2011, re-adopted in 2015
- Goal: Reduce carbon intensity (CI) of transportation fuel pool by at least 10% by 2020
- Expected benefits:
  - Complement other AB 32 measures
  - Transform and diversify fuel pool
  - Reduce petroleum dependency
  - Reduce emissions of other air pollutants

Basic LCFS Requirements

- Sets annual carbon intensity (CI) standards for gasoline, diesel, and the fuels that replace them
- CI is the measure of GHG emissions associated with producing and consuming a fuel, which is measured in grams of carbon dioxide equivalent per megajoule (gCO_2e/MJ)
- CI based on complete lifecycle analysis

How Does LCFS Work?



Achieving Compliance

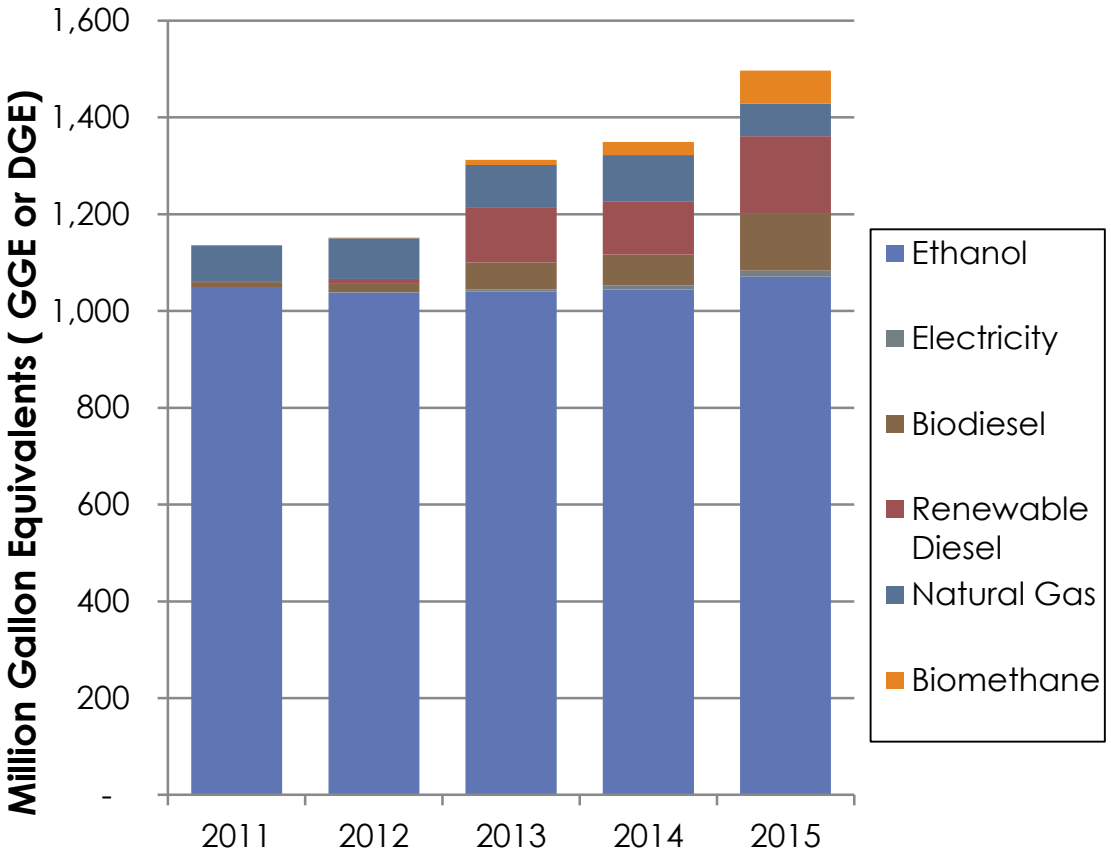
- Producers and importers of deficit generating fuels (e.g. gasoline and diesel) can achieve compliance by:
  - Producing low-CI alternative fuels
  - Purchasing and blending low-CI alternative fuels
  - Purchasing credits from producers of low-CI fuels
  - Lowering emissions of their refining process by investing in refinery projects or using renewably produced hydrogen
  - Using credits banked from over-compliance in previous years

Status of the LCFS

- Low carbon fuel use is increasing
- Regulated parties are engaged in transactions in the credit market
- Data Dashboard contains the current status of the LCFS
  - Volume of fuels and credits generated
  - Percent reduction in carbon intensity
  - Average credit prices and credit volumes transacted

http://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm

Volumes of Low Carbon Fuels Continue to Grow



Before the LCFS, natural gas and ethanol were the only alternative fuels with any market share.

In 2015, we now have 290 million gallons of Bio- and Renewable Diesel, and 69 million gallons of Renewable Natural Gas.

Other Jurisdictions have LCFS in Place: Pacific Coast Collaborative

- Pacific Coast Collaborative is a regional agreement between California, Oregon, Washington, and British Columbia
- Strategically align polices to reduce GHGs and promote clean energy
- CA, OR, and BC: Program in place
- Regional low-carbon fuels market in the future

Current State Agency Efforts
Fuels

California Energy Commission

Alternative and Renewable Fuel and Vehicle Technology Program

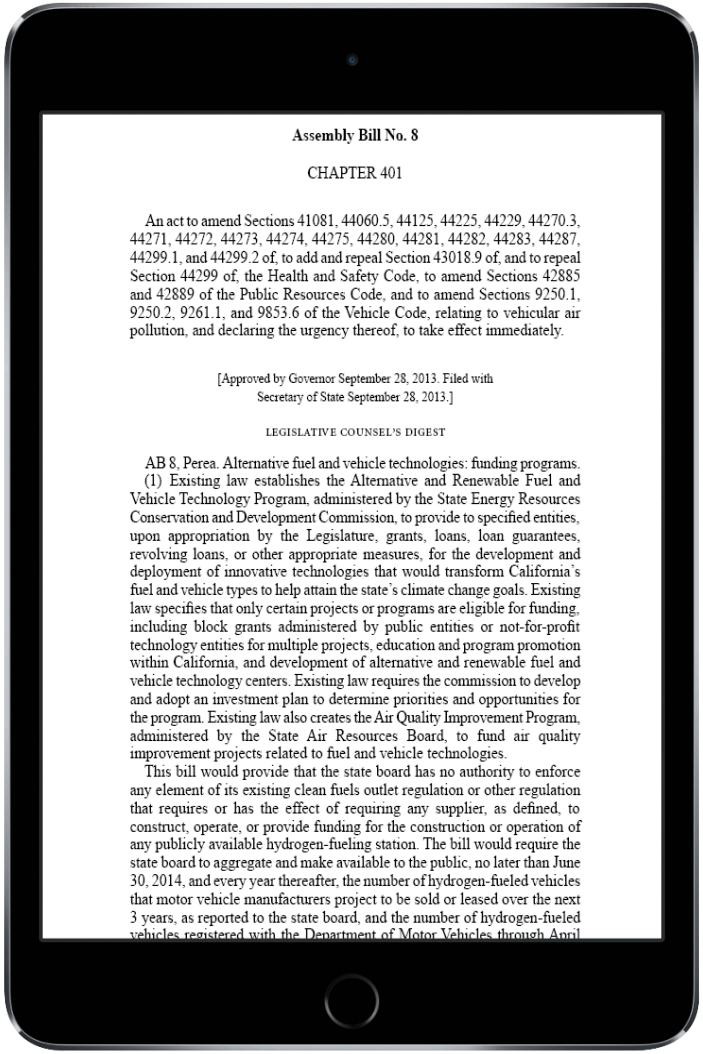
Elizabeth John

Supervisor
California Energy Commission
Fuels and Transportation Division
September 14, 2016

Purpose of the ARFVTP

"…to develop and deploy innovative technologies that transform California's fuel and vehicle types to help attain the state's climate change policies."

Health and Safety Code 44272(a)



Assembly Bill No. 8

CHAPTER 401

An act to amend Sections 41081, 44060.5, 44125, 44225, 44229, 44270.3, 44271, 44272, 44273, 44274, 44275, 44280, 44281, 44282, 44283, 44287, 44299.1, and 44299.2 of, to add and repeal Section 43018.9 of, and to repeal Section 44299 of, the Health and Safety Code, to amend Sections 42885 and 42889 of the Public Resources Code, and to amend Sections 9250.1, 9250.2, 9261.1, and 9853.6 of the Vehicle Code, relating to vehicular air pollution, and declaring the urgency thereof, to take effect immediately.

[Approved by Governor September 28, 2013. Filed with Secretary of State September 28, 2013.]

LEGISLATIVE COUNSEL'S DIGEST

AB 8, Perea. Alternative fuel and vehicle technologies: funding programs.

(1) Existing law establishes the Alternative and Renewable Fuel and Vehicle Technology Program, administered by the State Energy Resources Conservation and Development Commission, to provide to specified entities, upon appropriation by the Legislature, grants, loans, loan guarantees, revolving loans, or other appropriate measures, for the development and deployment of innovative technologies that would transform California's fuel and vehicle types to help attain the state's climate change goals. Existing law specifies that only certain projects or programs are eligible for funding, including block grants administered by public entities or not-for-profit technology entities for multiple projects, education and program promotion within California, and development of alternative and renewable fuel and vehicle technology centers. Existing law requires the commission to develop and adopt an investment plan to determine priorities and opportunities for the program. Existing law also creates the Air Quality Improvement Program, administered by the State Air Resources Board, to fund air quality improvement projects related to fuel and vehicle technologies.

This bill would provide that the state board has no authority to enforce any element of its existing clean fuels outlet regulation or other regulation that requires or has the effect of requiring any supplier, as defined, to construct, operate, or provide funding for the construction or operation of any publicly available hydrogen-fueling station. The bill would require the state board to aggregate and make available to the public, no later than June 30, 2014, and every year thereafter, the number of hydrogen-fueled vehicles that motor vehicle manufacturers project to be sold or leased over the next 3 years, as reported to the state board, and the number of hydrogen-fueled vehicles registered with the Department of Motor Vehicles through April

Complementary state goals

- Improve air quality
- Increase alternative fuel use
- Reduce petroleum dependence
- Promote economic development

Origins of the Statute

Established by Assembly Bill 118 (Nunez, 2007)

Up to $100 million per year

Extended through January 1, 2024 by Assembly Bill 8 (Perea, 2013)

Investment Areas

Alternative Fuel Production

- Biofuel Production and Supply

Alternative Fuel Infrastructure

- Electric Charging Infrastructure
- Hydrogen Refueling Infrastructure
- Natural Gas Fueling Infrastructure

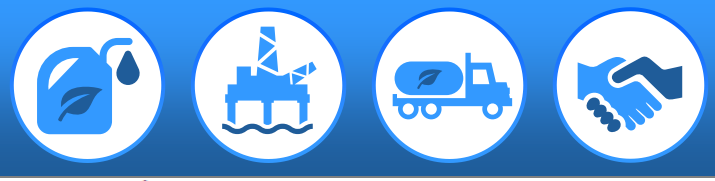
Alternative Fuel and Advanced Technology Vehicles

- Natural Gas Vehicle Incentives
- Med and Hvy-Duty Advanced Vehicle Technology Demo and Scale-Up

Related Needs and Opportunities

- Emerging Opportunities
- Workforce Training and Development
- Regional Readiness

ARFVTP Awards
(as of December 31, 2015)



Category	Funded Activity	Cumulative Awards to Date (in millions)*	# of Projects or Units
Alternative Fuel Production	Biomethane Production	$50.9	16 Projects
	Gasoline Substitutes Production	$27.2	14 Projects
	Diesel Substitutes Production	$57.4	20 Projects
Alternative Fuel Infrastructure	Electric Vehicle Charging Infrastructure	$40.7	7,490 Charging Stations
	Hydrogen Refueling Infrastructure	$96.0	49 Fueling Stations
	E85 Fueling Infrastructure	$13.7	158 Fueling Stations
	Upstream Biodiesel Infrastructure	$4.0	4 Infrastructure Sites
	Natural Gas Fueling Infrastructure	$21.0	65 Fueling Stations
Alternative Fuel and Advanced Technology Vehicles	Natural Gas Vehicle Deployment**	$56.6	2,809 Vehicles
	Propane Vehicle Deployment**	$6.0	514 Trucks
	Light-Duty Electric Vehicle Deployment	$25.1	10,700 Cars
	Medium- and Heavy-Duty Electric Vehicle Deployment	$4.0	150 Trucks
	Medium- and Heavy-Duty Vehicle Technology Demonstration and Scale-Up	$93.7	44 Demonstrations
Related Needs and Opportunities	Manufacturing	$57.0	22 Manufacturing Projects
	Emerging Opportunities	†	†
	Workforce Training and Development	$27.7	83 Recipients
	Fuel Standards and Equipment Certification	$3.9	1 Project
	Sustainability Studies	$2.1	2 Projects
	Regional Alternative Fuel Readiness and Planning	$7.6	34 Regional Plans
	Centers for Alternative Fuels	$5.8	5 Centers
	Technical Assistance and Program Evaluation	$5.6	n/a
Total		**$606.0**	

Source: California Energy Commission. *Includes all projects and agreements that have been executed or approved at an Energy Commission business meeting or are expected for business meeting approval following a notice of proposed award. Does not include cancelled projects that received no funding from ARFVTP. **Funding includes both completed and pending vehicle incentives. †Previous awards from this category have been reclassified by project type into other rows.

Investment Plan Allocations

Table 4: Most Recent and Current Investment Plan Allocations (in millions)

Category	Funded Activity	2014-2015	2015-2016	2016-2017
Alternative Fuel Production	Biofuel Production and Supply	$20	$20	$20
Alternative Fuel Infrastructure	Electric Charging Infrastructure	$15	$17	$17
	Hydrogen Refueling Infrastructure	$20	$20	$20
	Natural Gas Fueling Infrastructure	$1.5	$5	$2.5
Alternative Fuel and Advanced Technology Vehicles	Natural Gas Vehicle Incentives	$10	$10	$10
	Light-Duty Electric Vehicle Deployment	$5	-	-
	Medium- and Heavy-Duty Vehicle Technology Demonstration and Scale-Up	$15	$20*	$23*
Related Needs and Opportunities	Manufacturing	$5		
	Emerging Opportunities	$6	$3	$3
	Workforce Training and Development Agreements	$2.5	$3	$2.5
	Regional Alternative Fuel Readiness and Planning	-	$2	$2
Total		**$100**	**$100**	**$100**

Source: California Energy Commission, *2016-2017 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program*

Thank You

Questions:

AB118@energy.ca.gov

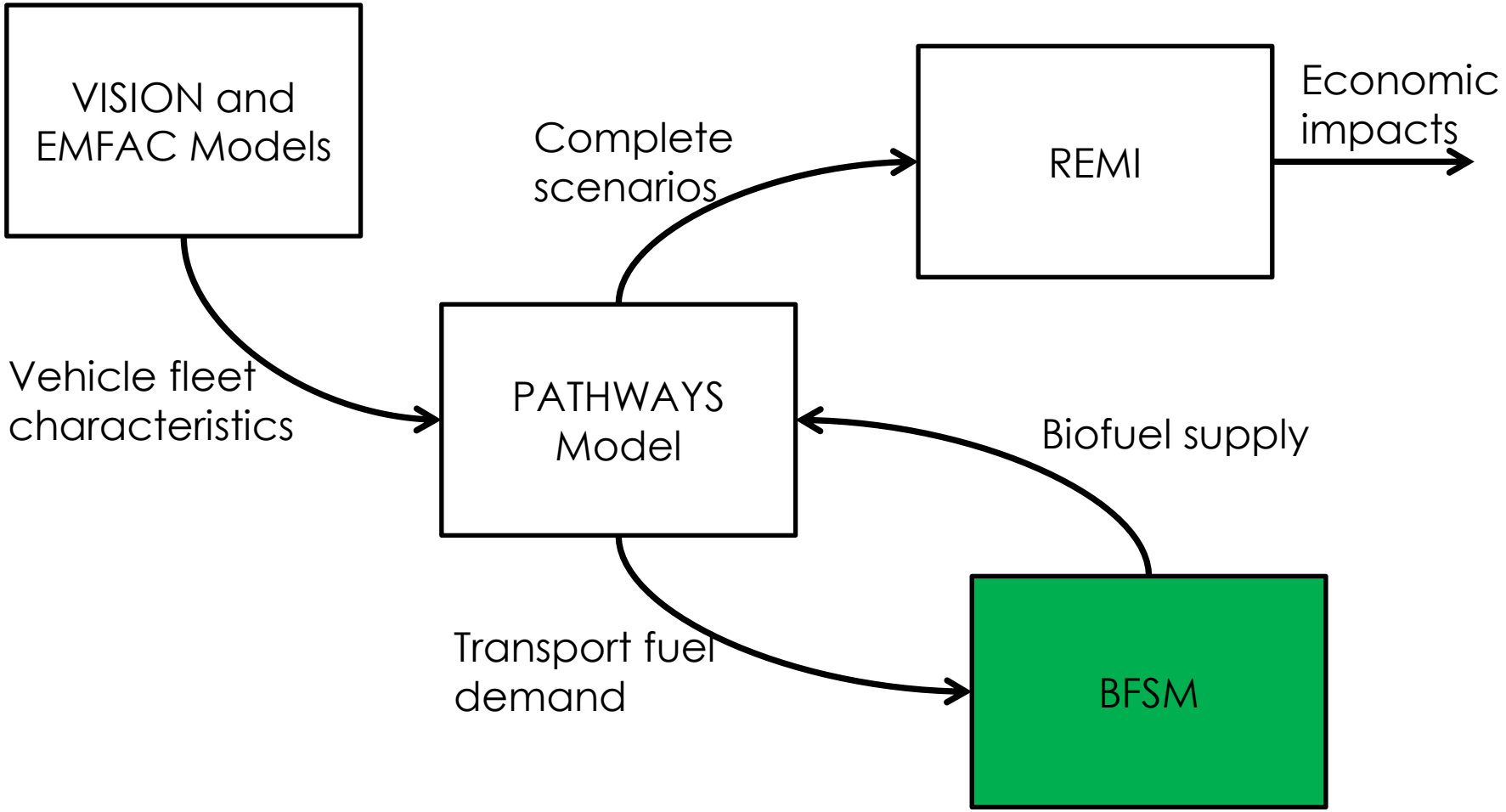
Introduction: Biofuel Supply Module
Public Release v0.83 BETA

California Air Resources Board

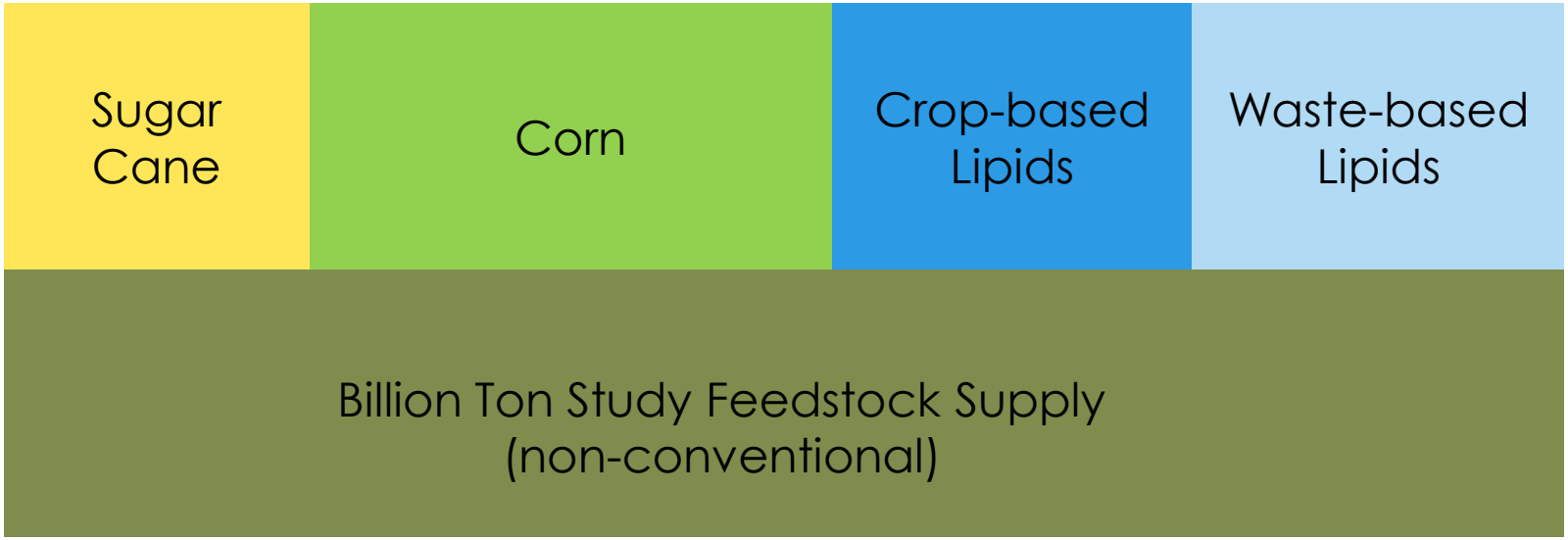
Presentation Overview

- How BFSM fits into the modeling framework for the Scoping Plan
- Conceptual overview of the BFSM methodology
- Presentation of basic model equations used to develop alternative fuel supply curves

BFSM facilitates scenario evaluation of alternative fuel supply to California for the Scoping Plan



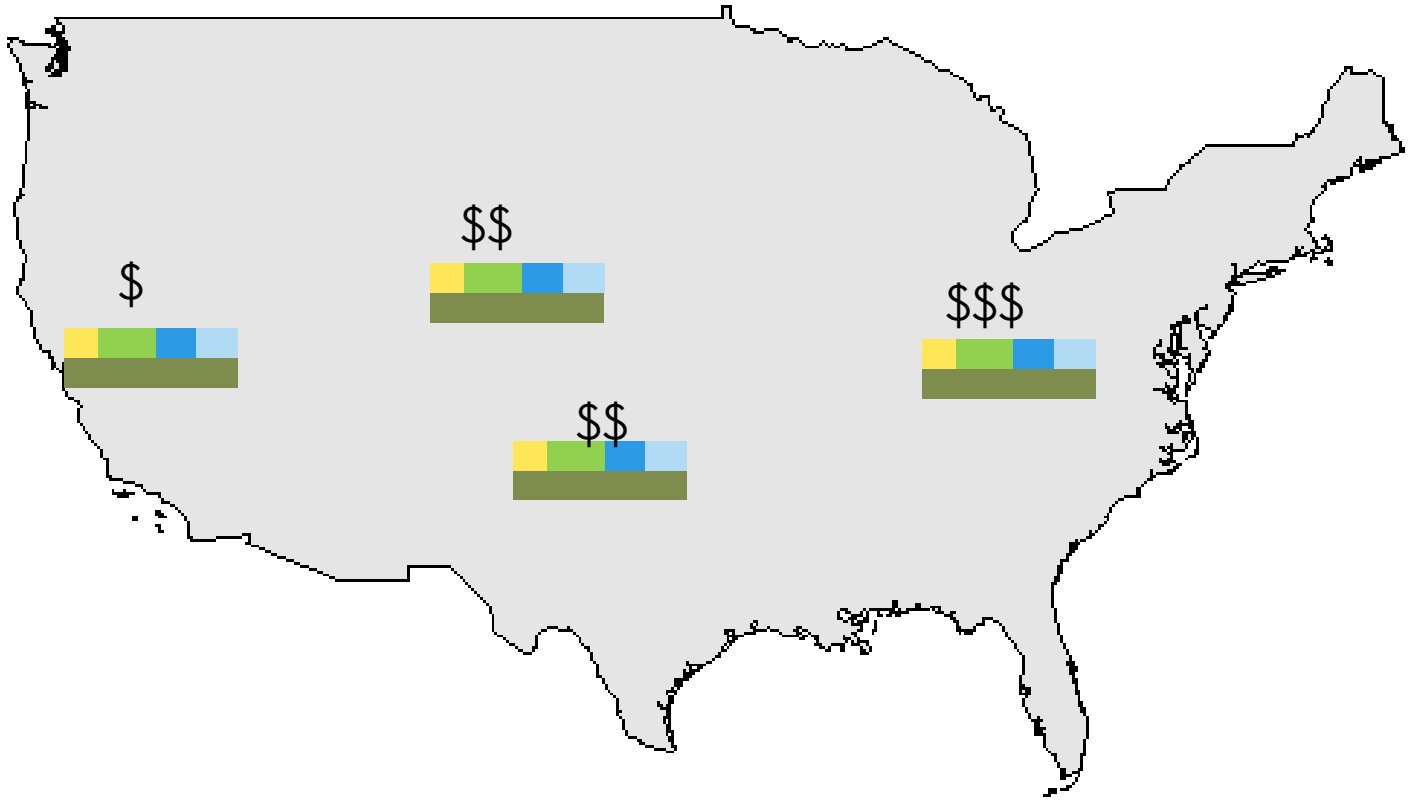
Biofuel supply is calculated using a bottom-up approach, which considers biomass feedstock



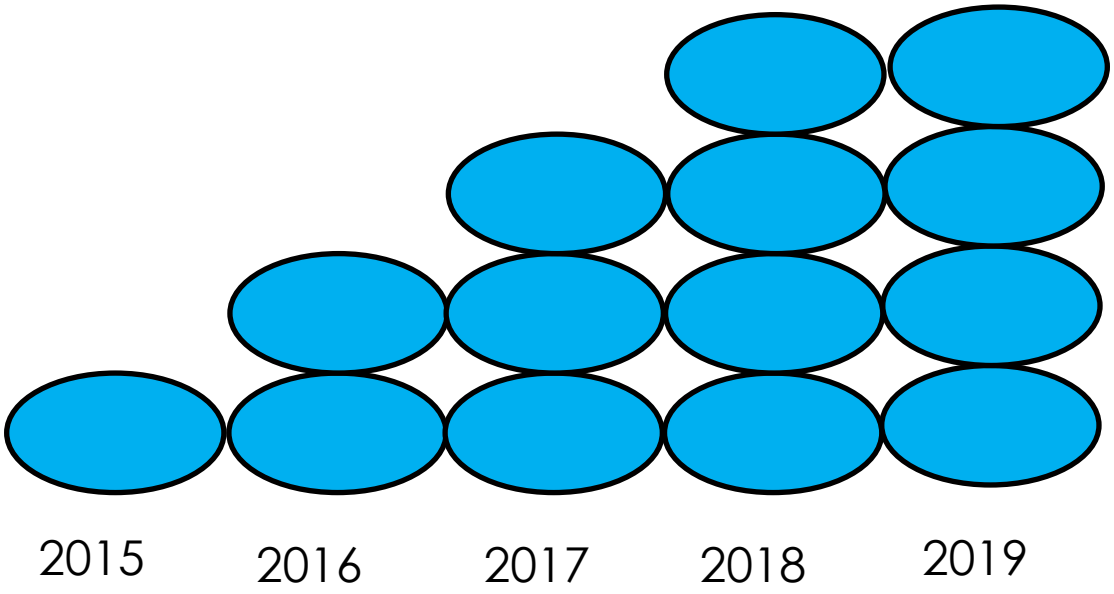
Quantity and cost of non-conventional feedstock for each state in the U.S. is considered

Feedstock supply quantity and costs are considered for each region in the U.S.

Supply cost for produced fuel is further adjusted based on transportation distance to California

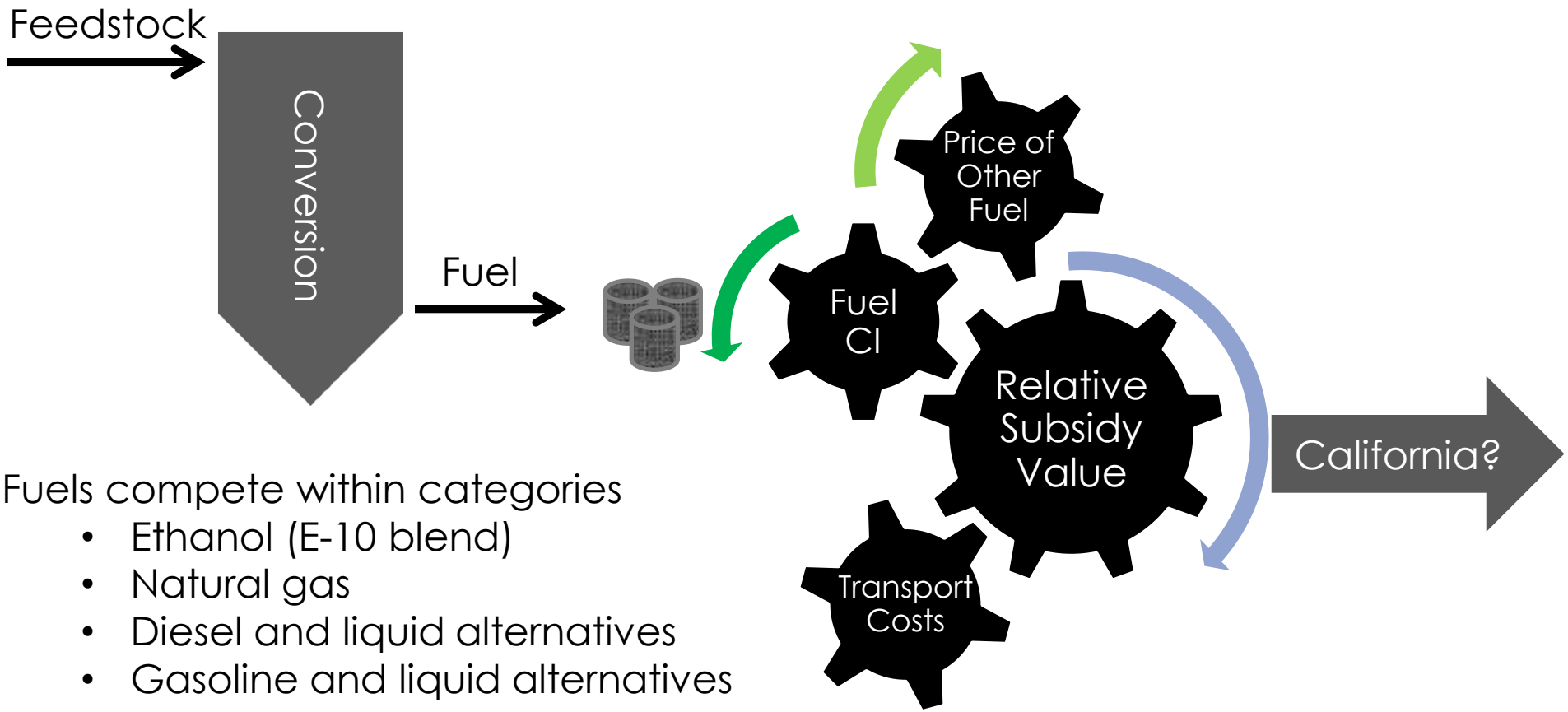


Fuel use is further constrained by feedstock availability and fuel production capacity



Initial liquid fuel capacity comes from Bloomberg New Energy Finance data. Production ramp rates for maximum production of second generation liquid biofuels are based on the historical growth rates in the production of first generation liquid biofuels

Feedstock is converted to fuel, and the lowest cost fuel-conversion pathways result in fuel supply available to California



Fuels compete within categories

- Ethanol (E-10 blend)
- Natural gas
- Diesel and liquid alternatives
- Gasoline and liquid alternatives

A fuel cost is calculated for each feedstock (f) technology (t) pair

Cost of alternative fuels

Price of feedstock (P_f)
Fuel subsidies (S)

Conversion costs ($X_{f,t}$)
Fuel yield ($\gamma_{f,t}$)

$$C_{f,t} = \frac{P_f}{\gamma_{f,t}} + X_{f,t} + S_{LCFS,f,t} + S_{Other,t}$$

$f \in (Billion\ Ton\ Study\ Feedstock, Lipid\ Supply, Sugarcane, Corn)$

$t \in \begin{pmatrix} RD-pyro, RD-HT, Biodiesel, RG-Pyro, Ethanol-Fermentation, \\ Ethanol-EH, Biomethane-LFG, Biomethane-DD \end{pmatrix}$

Cost of conventional fuel

Wholesale price of fuel (P_l)

Fuel subsidies/fees (S)

$$C_l = P_l + S_{LCFS,l} + S_{CAT,l} + S_{Other,l}$$

$l \in (Gasoline, Diesel, Natural\ Gas)$

P_l is wholesale fuel price in the pacific region from the annual energy outlook

Conversion costs and fuel yields come from values presented in the literature

Fuel	Costs taken from
Biomethane	Black and Veatch Study
Renewable Diesel (Pyrolysis)	NREL/TP-6A20-46586
Renewable Diesel (Hydrotreatment)	Holmgrenet al. (2007)
Renewable Gasoline (Pyrolysis)	NREL/TP-6A20-46586
Ethanol (conventional)	Kwiatkowski et al. (2006)
Ethanol (EH)	NREL/TP-6A2-46588, Aden (2008), NREL/TP-5100-47764
Biodiesel	NREL/TP-6A20-58015

Price of feedstock includes costs for transport of feedstock to the refinery, logistics, and fuel transport to California

Fuel transportation costs are calculated as part of the feedstock cost

Price of feedstock (P_{f-adj})
Billion Ton Study Feedstock Price($P_{BTS,r}$)
Fuel Transport Cost (δ)
Transport Distance to California(D_r)
Costs and Logistics for transport to biorefinery (σ)

$$P_{f-adj} = P_{BTS,r} + \sigma + \delta D_r$$

$r \in (US\ States)$

This shifts the BTS supply curve

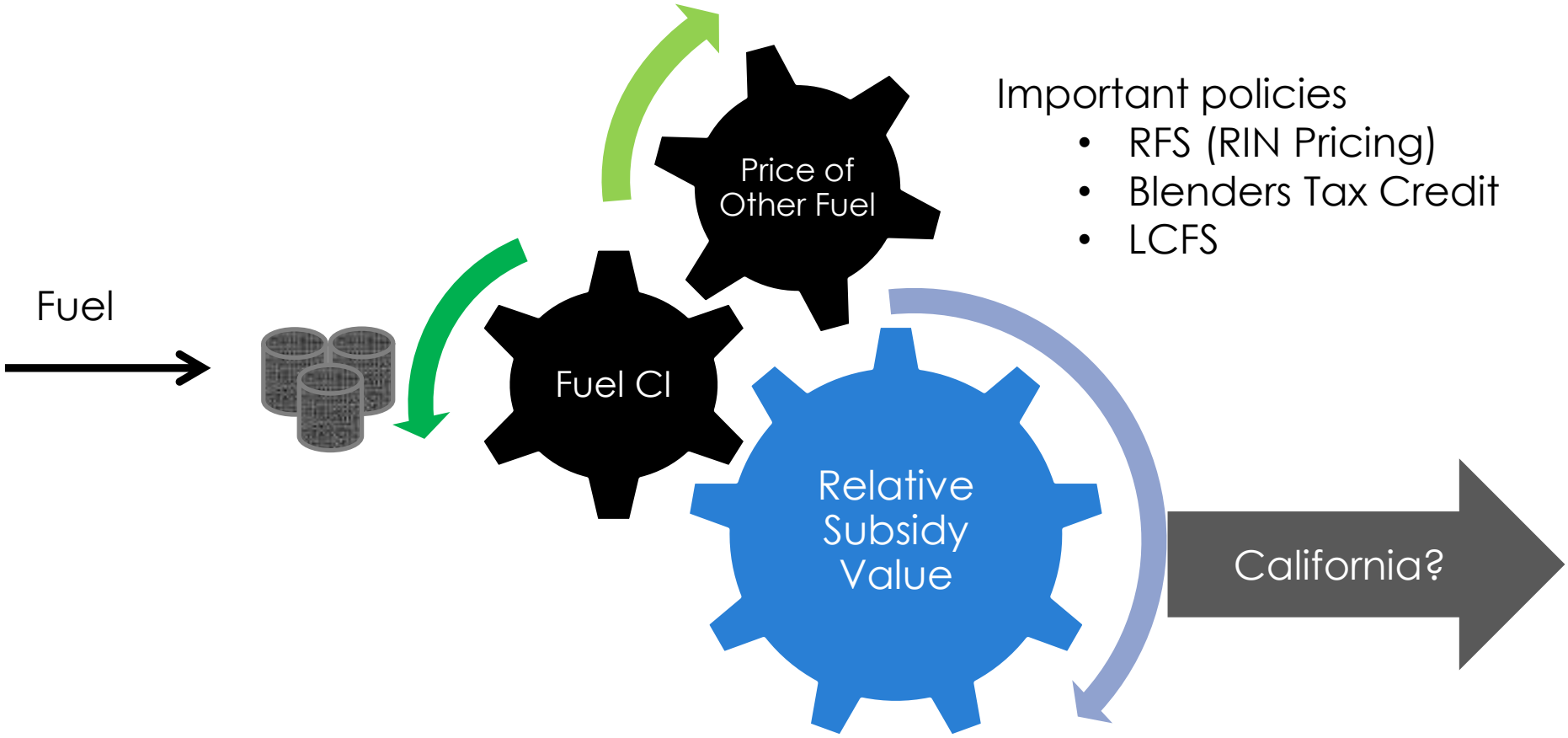
Logistics and biorefinery transport costs were derived from the Billion Ton Study 2016 cost curves

A regression model was used to estimate how these costs change as a function of feedstock price (P_f)

$$\sigma = \alpha + \beta_1 P_{BTS,r} + \beta_2 \{Feedstock\ Type\} + \varepsilon$$

Note: logistics and transport costs can increase some feedstock costs by more than 2x

Policies ultimately impact the cost of delivering alternative fuel relative to conventional fuels



Important policies

- RFS (RIN Pricing)
- Blenders Tax Credit
- LCFS

LCFS Credits are important for promoting biofuel supply in California

$$S_{LCFS,f,t} = \left(CI_{std} - \frac{CI_{f,t}}{EER} \right) E_D \times \frac{P_{LCFS}}{10^6}$$

$CI_{f,t}$ is the carbon intensity of fuel being converted
CI_{std} is the carbon intensity of the standard in a given year
EER is the energy efficiency ratio

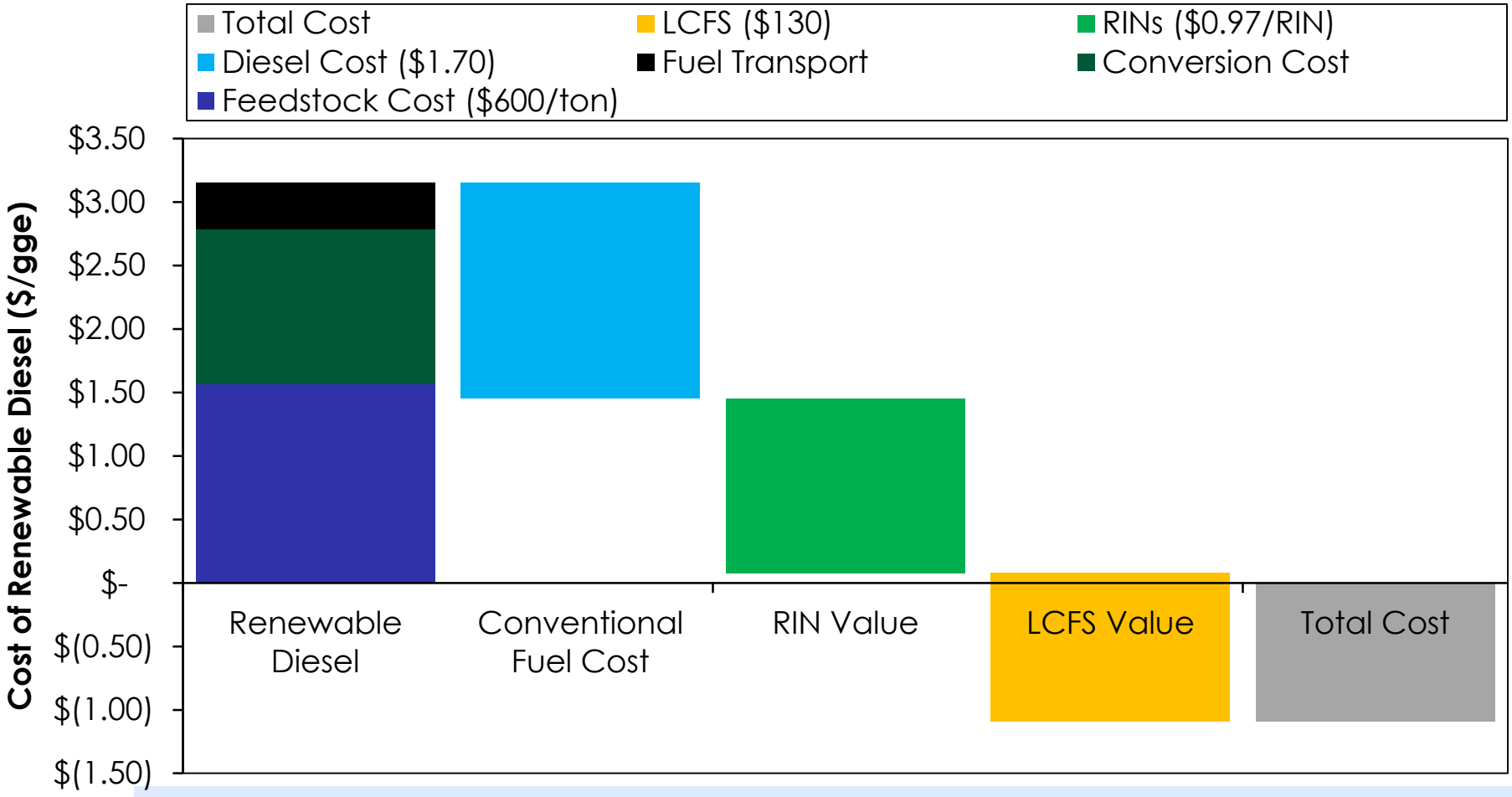
P_{LCFS} is an input variable into the model

LCFS subsidies are considered on a gallon of gasoline equivalent basis

$$E_D = 115.83\ MJ/gge$$

Note: because prices are eventually compared against the conventional fuel, price competition is independent of CI_{std}

Fuel cost example for renewable diesel transported 1900 miles to California



Lowest cost fuels are selected first and are subject to a set of constraints

The competitive fuel price $(A_{f,t})$ is used in the fuel selection algorithm to determine which fuels appear in California first. This is the difference between the alternative fuel ($C_{f,t}$) and the conventional fuel (C_l)

$$A_{f,t} = C_{f,t} - C_l$$

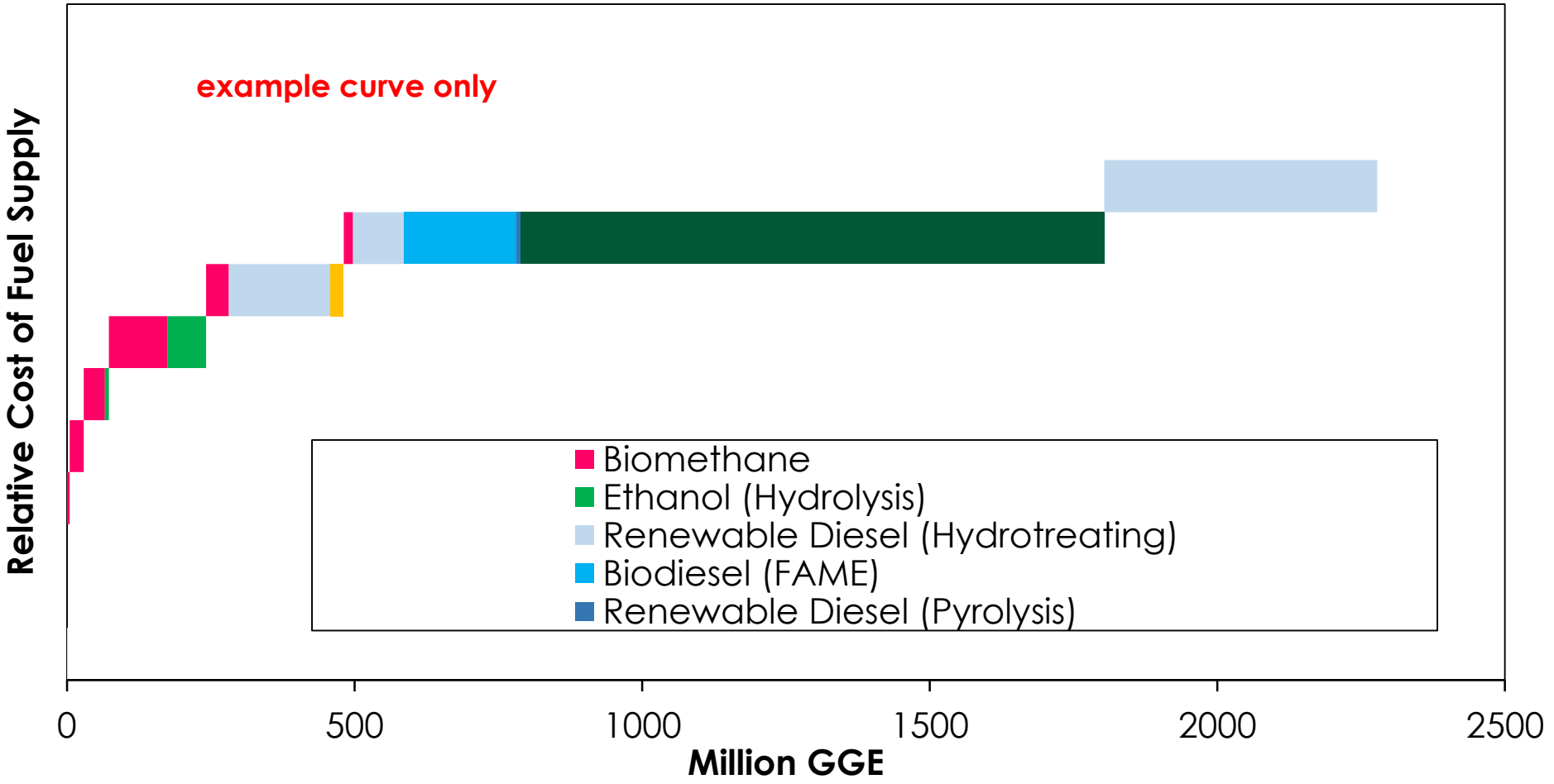
Supply of the feedstock $(F_{f,t})$ is limited by the amount of feedstock available, and the exogenously specified fuel production capacity. Blend walls are also applied.

$\sum_{t=i}^{n} F_{f,t} \leq F_{BTS,f}$ Cannot exceed BTS supply

$\sum_{t=i}^{n} \frac{F_{f,t}}{\gamma_{f,t}} \leq CP_t$ Cannot exceed production capacity in a given year

$\sum_{f=j}^{k} \sum_{t=i}^{n} \frac{F_{f,t}}{\gamma_{f,t}} + F_{conv} = D(t)$ Supply is equal to demand

This results in a biofuel supply curve for biofuel entering California



Questions and Comments

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Public Discussion

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