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2030 Target Scoping Plan

October 1, 2015

Workshop Outline

- Introduction and Welcome
- 2030 Target Scoping Plan Overview
- Greenhouse Gas Emissions Reduction Focus Areas
  - Short-Lived Climate Pollutants
  - Energy Efficiency
  - Natural and Working Lands
  - Electricity
  - Transportation and Land Use
- Economic Analysis
- Next Steps

CALIFORNIA CLIMATE STRATEGY

An Integrated Plan for Addressing Climate Change

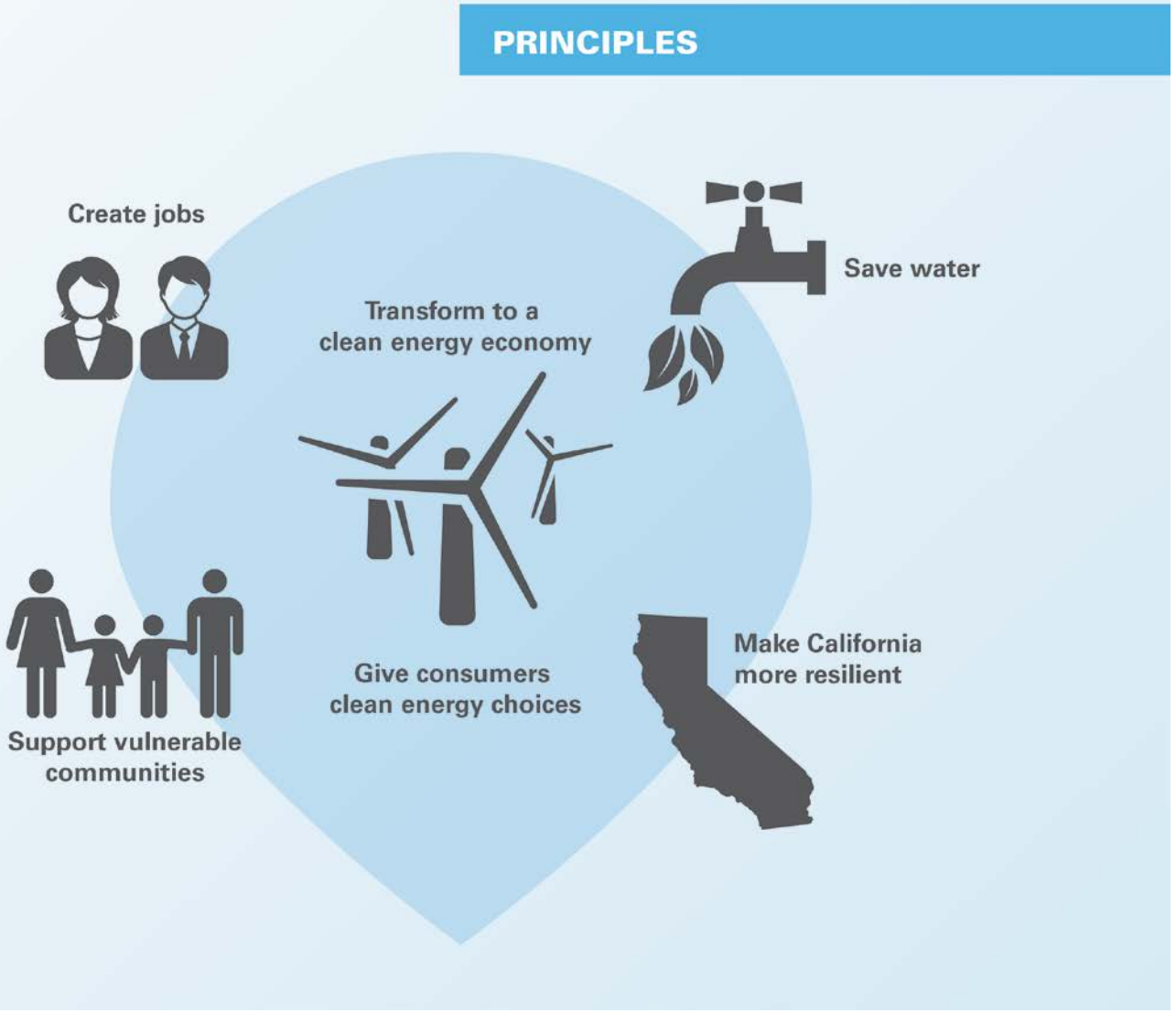
VISION

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

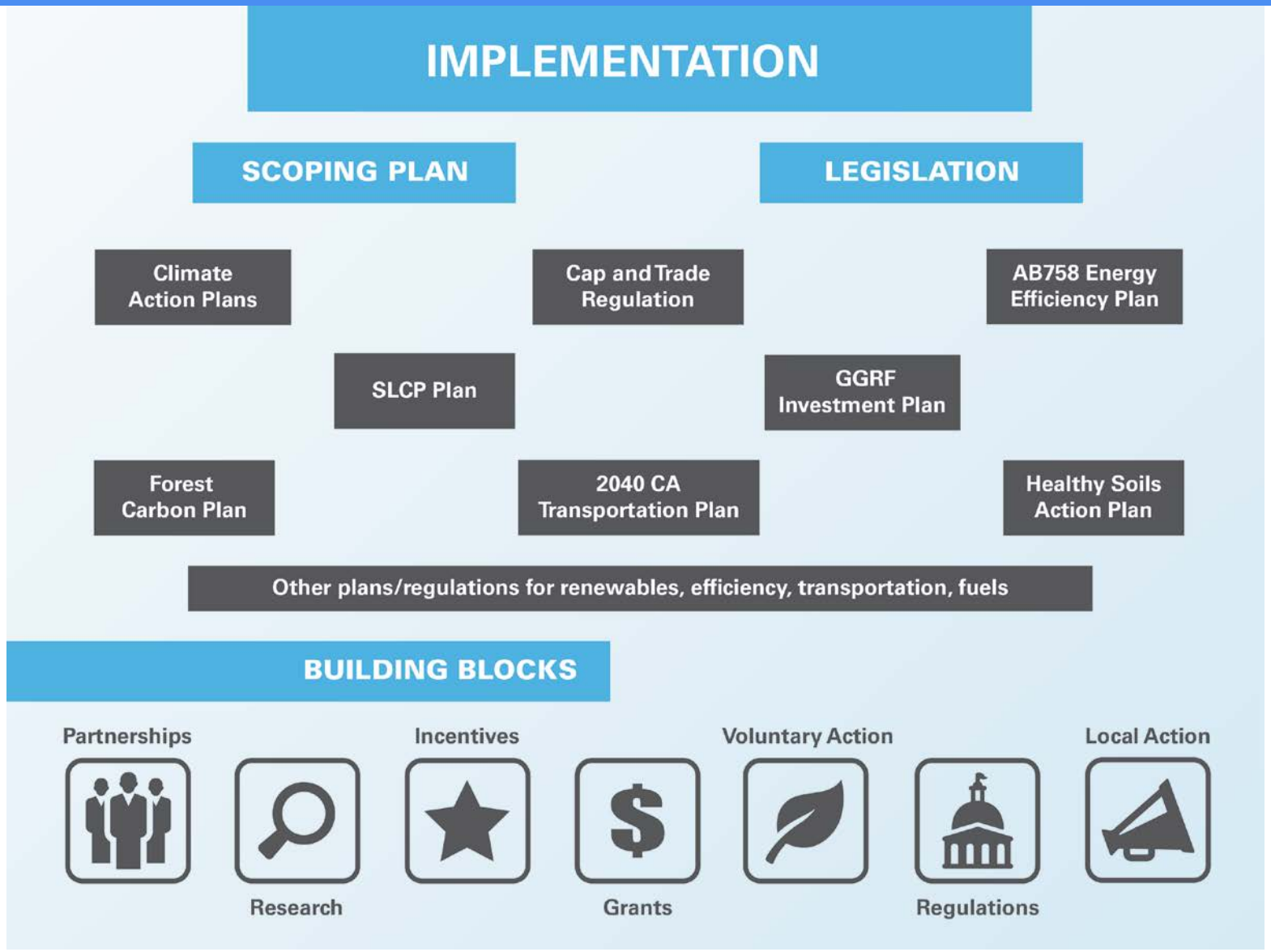
GOALS

- 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



2030 Target Scoping Plan Overview

CALIFORNIA AIR RESOURCES BOARD

AB 32 Objectives

- Develop a balanced approach to address climate change
- Improve air quality and public health
- Provide a consistent policy approach to drive investment in clean technology
- Provide a model for future national and international climate change efforts
- Achieve 1990 emissions by 2020; maintain and continue reductions past 2020 to achieve 2030 and 2050 goals
- Coordinate efforts across government agencies

Prior Scoping Plans

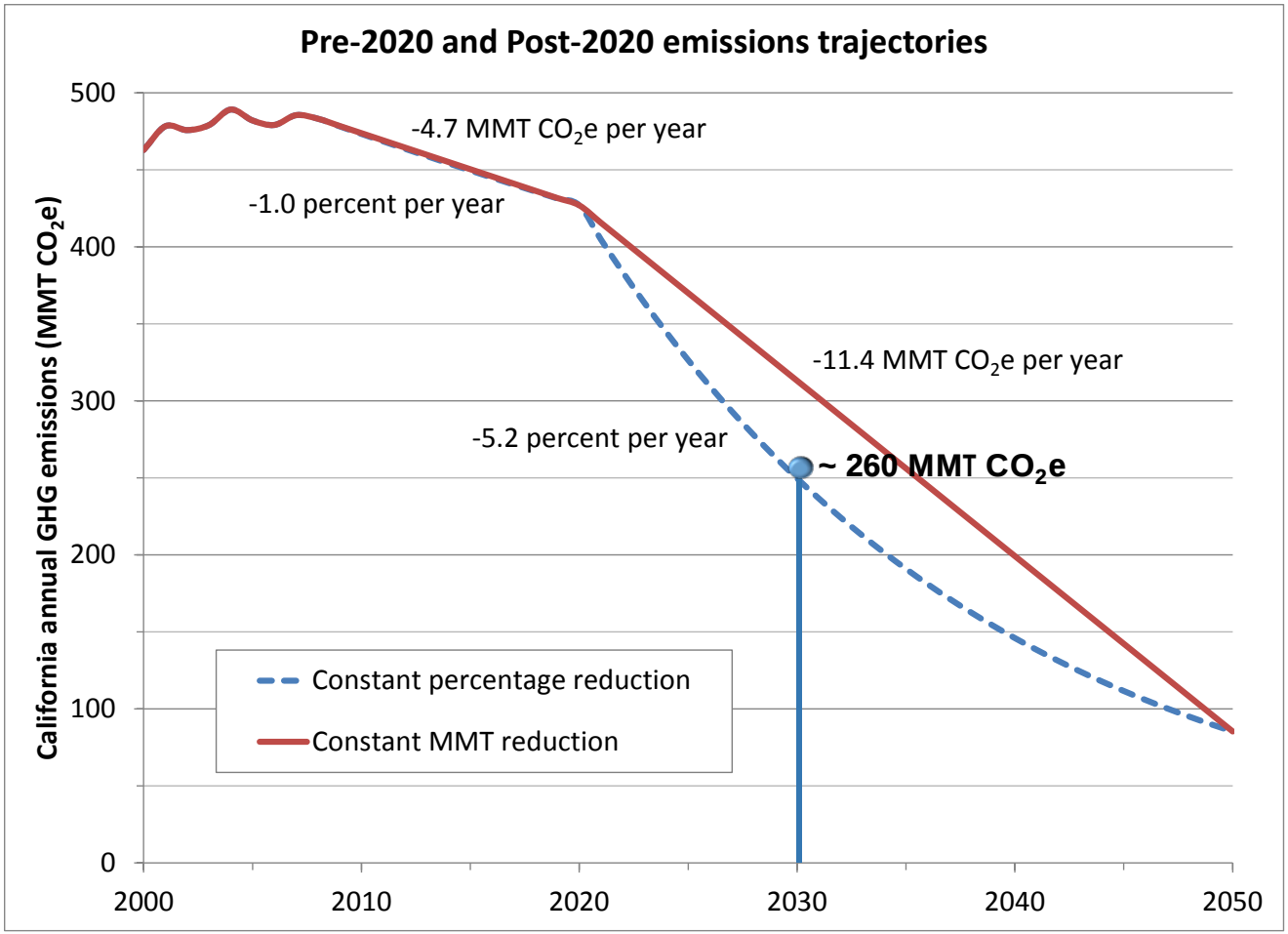
- Established new paradigm for climate mitigation
- First economy-wide climate change plan
- Pioneered the concept of a market-based program supplemented with complementary measures
- Sector-by-sector approach
- Public outreach and education
- Must be updated at least every 5 years

2030 Target Scoping Plan Requirements

- Engagement with State Agencies
- Engagement with Legislature
- Coordination with other plans (i.e. 111(d), Cap & Trade, SIP, Freight Strategy, etc.)
- Economic and Technology Advancement Advisory Committee Engagement
- Environmental Justice Advisory Committee Engagement

- Public Health Analysis
- Environmental Analysis (CEQA)
- Public Process: Workshops (Sacramento and regional)
- Draft Report / Final Report (targeted measures and estimated emission reductions)

Path to 2050 Greenhouse Gas Target



Guiding Principles

- Reduce Greenhouse Gas Emissions to 40% Below 1990 Levels by 2030 (Executive Order B-30-15)
- Create jobs and support a robust workforce
- Save water
- Support Disadvantaged Communities
- Make California more resilient
- Transform to a clean energy economy
- Give consumers clean energy choices

Achieving the 2030 Target

- Continuation of programs established to reach the 2020 GHG emissions reduction target
  - Cap-and-Trade Program
  - Low Carbon Fuel Standard
  - Renewable Portfolio Standard
  - Advanced Clean Cars Program
  - ZEV Program
  - Sustainable Freight Strategy
  - Short-Lived Climate Pollutant Strategy
  - SB 375 Sustainable Communities Strategy

Measure Development Plan

- Governor's Office pillars framework
  - Reduce petroleum use
  - Increase renewable electricity
  - Increase building energy efficiency
  - Reduce short-lived climate pollutants
  - Ensure natural/working lands are carbon sink
- Sector oriented measures
- Maximize GHG reductions across all areas
  - Realize cobenefits at large industrial sources
- Multi-agency collaborative process
- Stakeholder input
  - Public workshops with formal and informal comment periods

Elements of 2030 Strategy

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

Advisory Groups

- Economic and Technology Advancement Advisory Committee
  - Provide input on tools and modeling assumptions to evaluate economic impact of Scoping Plan
- Environmental Justice Advisory Committee
  - September 25, 2015: Board re-convened EJAC for 2030 Target Scoping Plan and approved new members

Environmental Justice Advisory Committee

- AB 32 calls for an Environmental Justice Advisory Committee (EJAC) to advise the Board in developing the Scoping Plan and any other pertinent matter in implementing the Act
  - From communities in State with the most significant exposure to air pollution (i.e., communities with minority populations or low-income populations or both)
- Nine existing members appointed by Board in 2013, four new members appointed September 2015
- Committee meetings are open to the public and include a public comment period

http://www.arb.ca.gov/cc/ejac/ejac.htm

Agency Perspectives
GHG Reduction Focus Areas

- Short-Lived Climate Pollutants
- Energy Efficiency
- Natural and Working Lands
- Electricity
- Transportation and Land Use

GHG Reduction Focus Areas

Short-Lived Climate Pollutants

California Environmental Protection Agency
Air Resources Board

California Natural Resources Agency

cdfa
California Department of Food & Agriculture

CalRecycle


California Public Utilities Commission

Short-Lived Climate Pollutants

- ARB developing Short-Lived Climate Pollutant Reduction Strategy
- Recommended action in the 2014 Scoping Plan Update
- Required by Senate Bill 605
- One of Governor's five pillars to meet 2030 GHG goal
- Concept Paper released for public comment in May 2015
- Draft Strategy just released for public comment and to be discussed at workshops on October 13 (Sacramento), October 14 (South Coast), and October 19 (San Joaquin Valley)

GHG Reduction Focus Areas

Energy Efficiency

CALIFORNIA ENERGY COMMISSION

California Public Utilities Commission

California Environmental Protection Agency
Air Resources Board

Scope

- Very large, cross sector potential GHG reductions
  - Energy used by buildings ~25% of GHG emissions
  - Buildings use ~68% of electricity & ~55% of natural gas
- EE almost always the most cost effective approach
  - Less costly to avoid consumption compared to generation
- Improving existing buildings is critical to 2030 goals
  - Current homes will be ~87% of housing in 2030
  - Current businesses will be ~80% of commercial sq ft in 2030
- 2030 goal requires full offset of demographic and economic driven load growth plus begin to reduce total energy consumption

2020 Status Update

- Appliance standards – state & federal
  - TVs, battery chargers, water, LEDs, computer/displays, HVAC
- Utility energy efficiency programs
  - CPUC approves budget and oversees IOU EE programs
  - POUs report progress to CEC
- Building standards
  - Update effective 7/1/2014; next update expected 1/1/2017
- Energy Services Assistance Program & Weatherization Assistance Program ensure services for disadvantaged communities
- Clean Energy Jobs Act (Prop. 39) for K-14 public schools

Legislative Update

- SB 350
  - Establish annual targets for statewide EE savings and demand reduction to achieve doubling of savings by 2030
  - "Measure" EE savings using normalized metered consumption where feasible and cost-effective
- AB 802
  - Incentives for existing buildings coming up to current code
  - Energy performance benchmarking for large buildings
  - Increased energy usage data access for CEC to improve forecasting capabilities

Vision

- Broad market based demand for energy efficiency services
- Innovative business solutions deliver savings
- Efficiency valued as a real estate attribute
- Affordable financing available for all Californians
- Efficiency procured as a clean distributed energy resource, analogous to generation

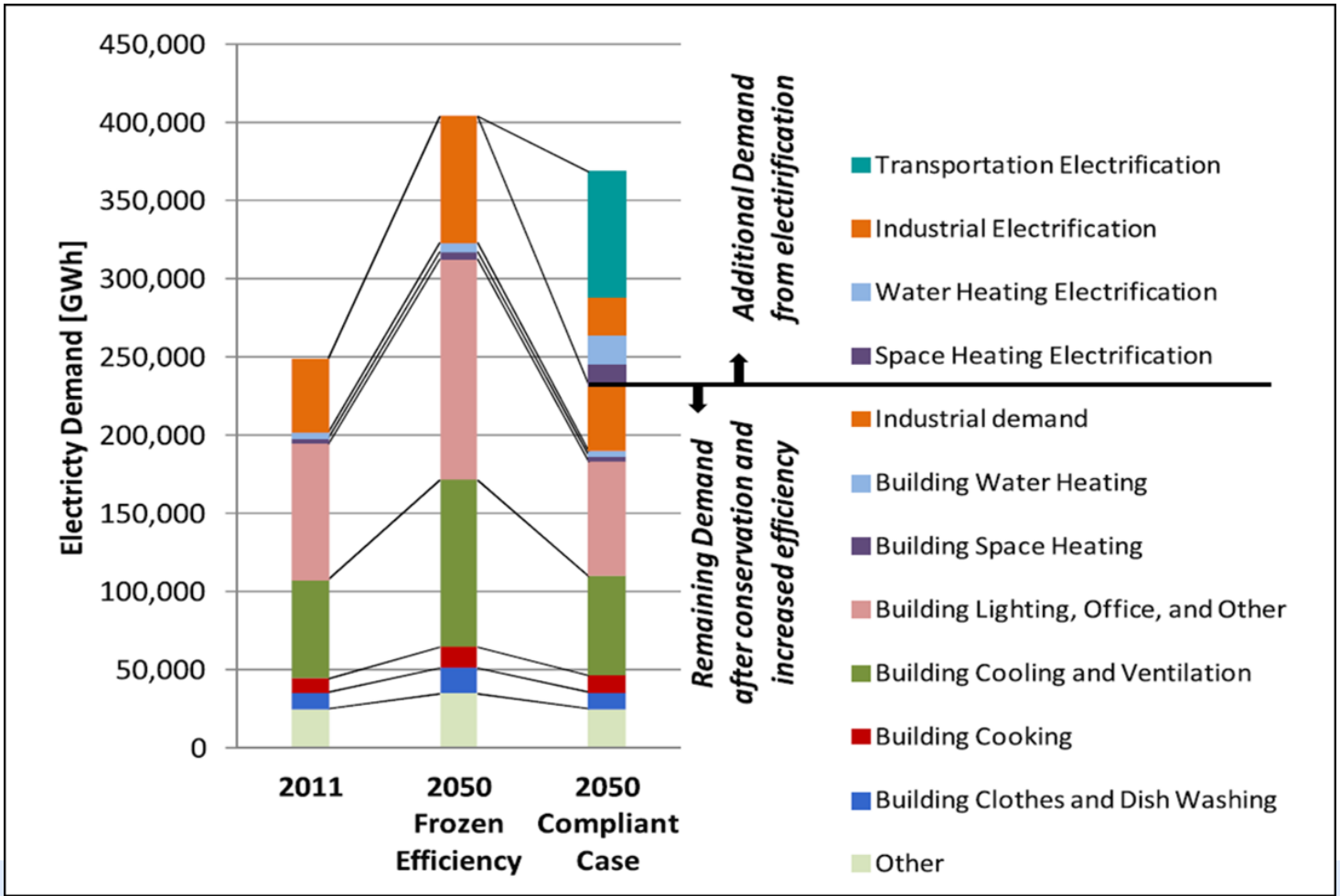
Implementation Tools

- Continued delivery of validated savings from cost-effective utility EE programs and codes & standards
  - Appliance standards to address rapidly growing plug loads
  - Zero net energy new construction policy
  - Complementary utility programs and codes and standards to steadily improve existing buildings
    - Existing Buildings Energy Efficiency Action Plan
- Emerging technologies and R &D
  - LEDs
  - Highly efficient heat pumps
- Market based approaches that attract private capital and enable innovative business models and financing

Overlap with Other Sectors

- Electricity sector is primary overlap
  - Increasing EE reduces electricity infrastructure needs
  - Increasing EE lowers renewable energy procurement requirements
  - Potential for electrification of end uses that are primarily natural gas today (water heating, space heating)
- Transportation sector is secondary overlap
  - Increasing EE creates headroom lessening infrastructure build out for electrified transportation

Overlap with Other Sectors



Source: Wei et al., 2013

Green Buildings – Scope

- Energy Efficient AND
  - Conserve Water
  - Recycle and Prevent Waste
  - Reduce Transportation Impacts
  - Contribute to Cool Communities
- Comprehensive approach to support climate goals
- Strategy focused on new and existing buildings

2020 Status Update

Measure	Update
State Leading by Example	On track to meet or exceed goals
Green Building Standards Code	Mandatory requirements and voluntary “reach” standards
Beyond Code	Local governments advancing innovative programs
Existing Building Retrofits	Roadmap to action

Implementation Tools

- Strengthen the CALGreen Code
- Expand voluntary efforts
- Advance green building rating systems
- Expand emphasis of existing buildings
- Augment existing incentive programs
- Continue research activities

Overlap with Other Sectors

Energy	• GHG reductions counted under energy efficiency measure
Water & Waste	• Perform much better in certified green buildings
Transportation	• Dominates carbon footprint of buildings
Certified Green Buildings	• Achieve significant GHG savings

Mid- and Long-Term Vision

- Vision for 2030
  - Build upon ZNE and green building programs
  - Establish goals and a path towards zero carbon buildings

- Vision for 2050
  - Buildings generate zero or near-zero GHG emissions over the course of the year

Questions & Comments

ENERGY EFFICIENCY

GHG Reduction Focus Areas

Natural & Working Lands

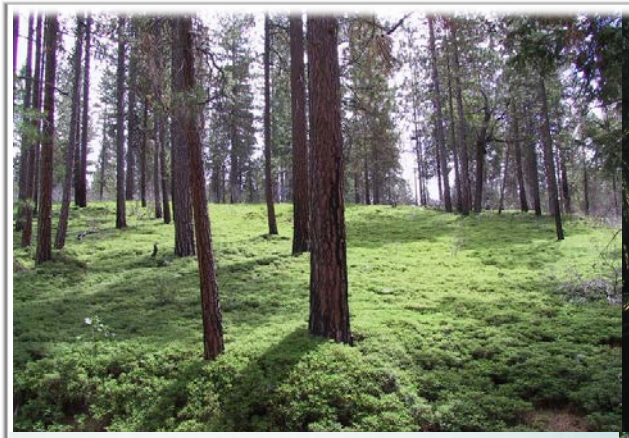
California Environmental Protection Agency
Air Resources Board

cdfa
CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

CALIFORNIA natural resources AGENCY

Scope

Forests



Wetlands

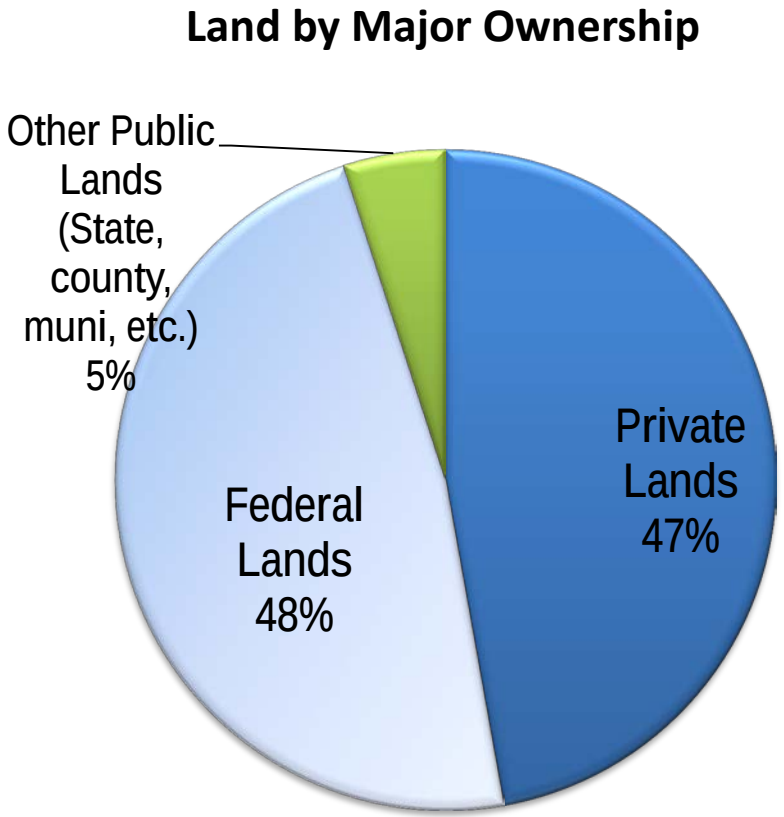
Rangeland

Farmland

Photo Credits: USDA NRCS, USDA forest Service

Scope


FRAP
STATE OF CALIFORNIA
LAND COVER
Multi-Source Data Compiled in 2006
Forestland
Conifer Forest
Hardwood Forest
Forest and Rangeland
Conifer Woodland
Hardwood Woodland
Rangeland
Shrub
Herbaceous
Wetland
Desert
Other
Agriculture
Barren/Other
Urban
Water
Counties
Pacific Ocean
MEXICO

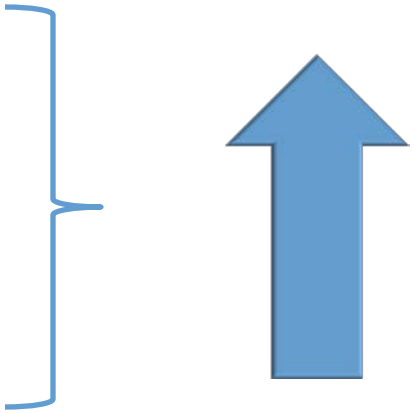

Land by Major Ownership
Other Public Lands (State, county, muni, etc.) 5%
Private Lands 47%
Federal Lands 48%

The Value

- **California's land base stores carbon** below ground, in soil and root systems, and above ground, in trees, shrubs, grasses and other plant biomass
- **Healthy and resilient natural and working lands provide sustainable public benefits in addition to carbon sequestration,** such as water filtration, improved air quality, wildlife habitat, temperature moderation through shading, and soil fertility that supports food production
- **Conservation of natural and working lands supports sustainable communities**
- **Natural and working lands provide jobs, support regional economies and improve quality of life for all California residents**.

These Values are Threatened

- Land Conversion for Development
- Degradation
- Drought
- Sustained Heat
- Fire



2020 Status Update

- Investments
  - Land Conservation
  - Habitat Restoration
  - Enhanced Land Management
  - New Technology
  - Agricultural Water Use Efficiency
  - Dairy Digesters

2020 Status Update

- Planning
  - Forest Carbon Plan
  - Bioenergy Action Plan
  - Water Action Plan
  - State Wildlife Action Plan
  - General Plan Guidelines
  - Safeguarding California

2020 Status Update

- Collaboration
  - Forest Fire Risk Reduction
  - Watershed Improvement Program
  - Natural Disaster Resiliency Competition
  - Healthy Soils Initiative

Vision 2030 and 2050

- **Protect** Minimize Conversion
- **Enhance** Carbon Sequestration Potential
- **Innovate** Across Sectors
- **Develop** Sequestration Targets
- **Align** Climate Targets with Co-Benefits

Implementation Tools: Protect

- Sustainable Agricultural Lands Conservation Program
- Forest Legacy Program
- Land Use Planning

Implementation Tools: Enhance

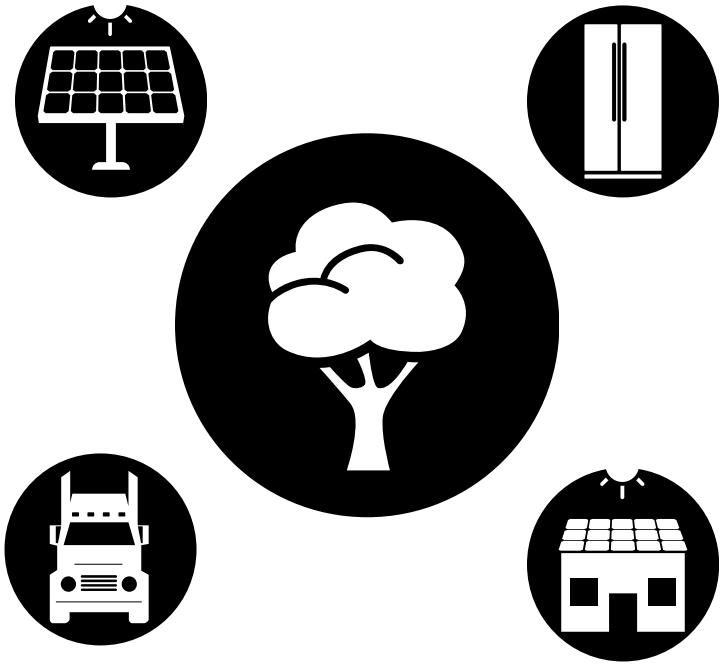
- Management for Forest Health:
  - Reforestation, Insect and Disease Infestations, High Fire Risk Areas
- Wetland Restoration
- Healthy Soils Initiative
  - Building soil organic matter to sequester carbon, increase water retention, improve air and water quality, reduce sediment erosion and dust, improve biological diversity and improve plant health and yields.
- CDFA Fertilizer Research and Education Program

Implementation Tools: Innovate

- Biomass Waste Diversion
  - Bioenergy
  - Biofuels
  - Compost
- Urban Greening
  - Energy Efficiency
  - Active Transportation

Biomass Diversion
& SLCP Reductions

Forest
Management
& Bioenergy



Land Protection
& Avoided VMT;
Urban Greening

Ag & Forest Waste
Diversion to Biofuels

Questions & Comments

Natural and Working Lands

GHG Reduction Focus Areas

Electricity

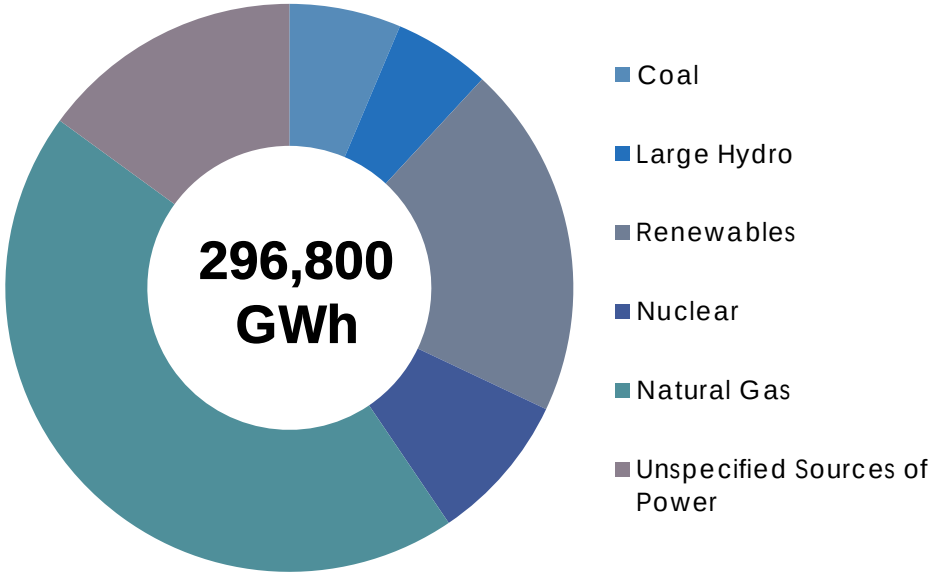
CALIFORNIA ENERGY COMMISSION

California Public Utilities Commission

California Environmental Protection Agency
Air Resources Board

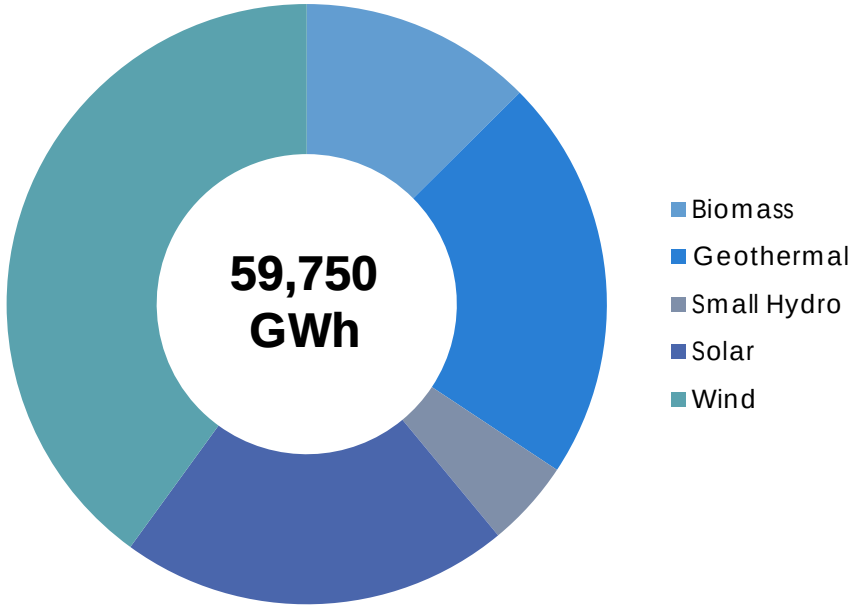
Electricity Sector in California

Total California Generation (GWh)



Instate: 198,900 GWh Imports: 97,900 GWh

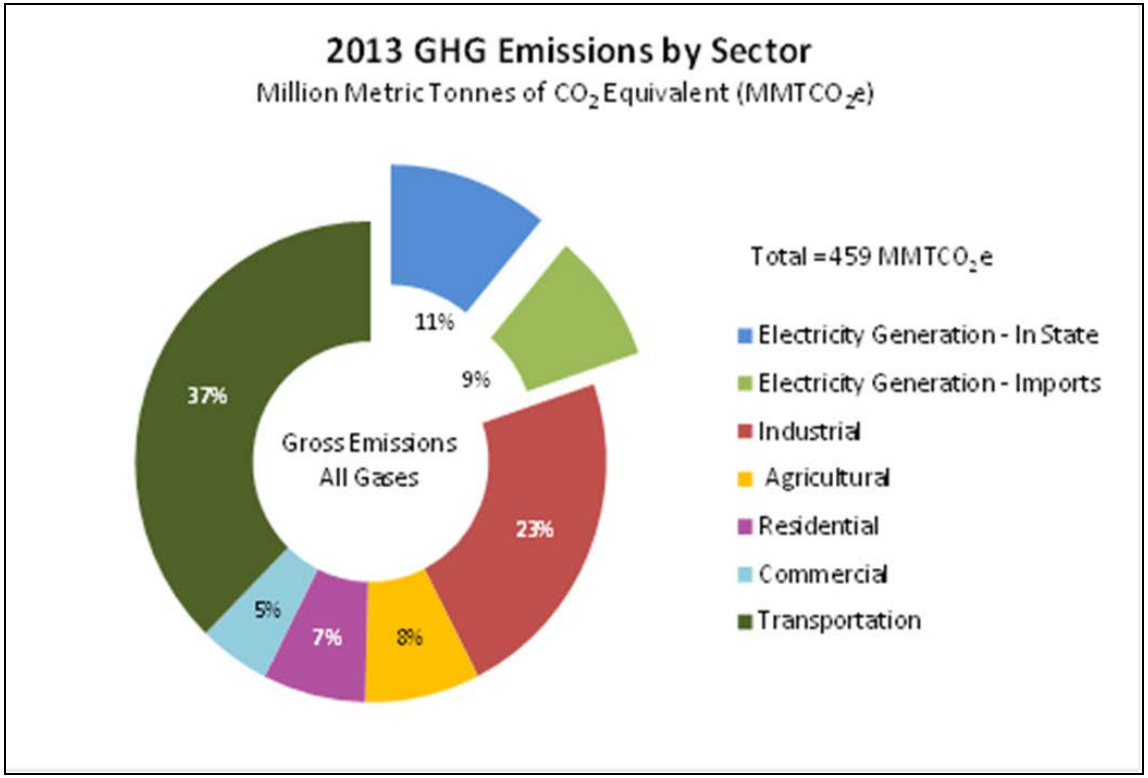
Total Renewable Generation (GWh)



Instate 44,850 GWh Imports: 14,900 GWh

Focus Area Description & Scope

Executive Order B-30-15 sets statewide goal to reduce GHG emissions 40% below 1990 levels by 2030

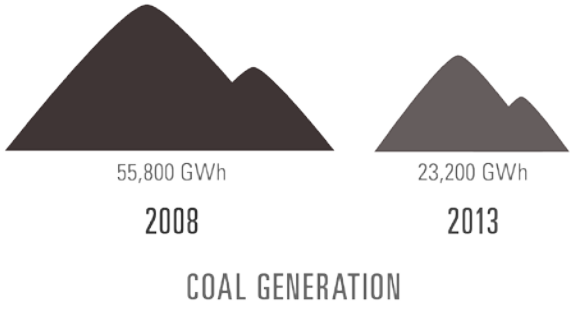


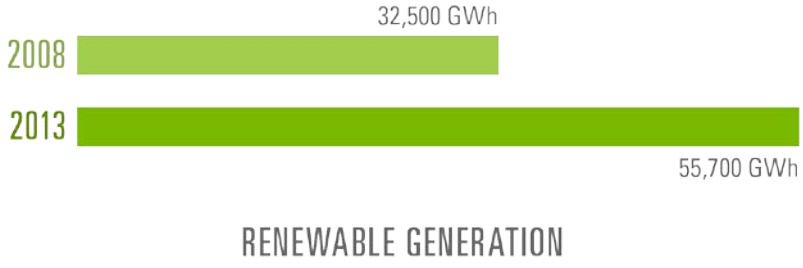
GHG Emissions Statewide

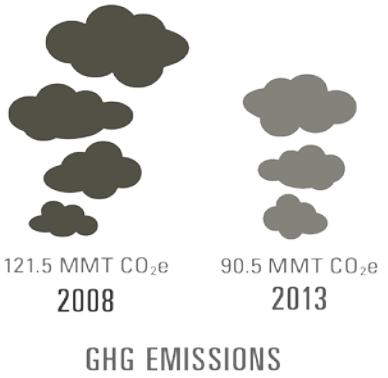
- 20% from electricity sector
- About ½ from out-of-state electricity
- 37% from transportation

Vision to 2020

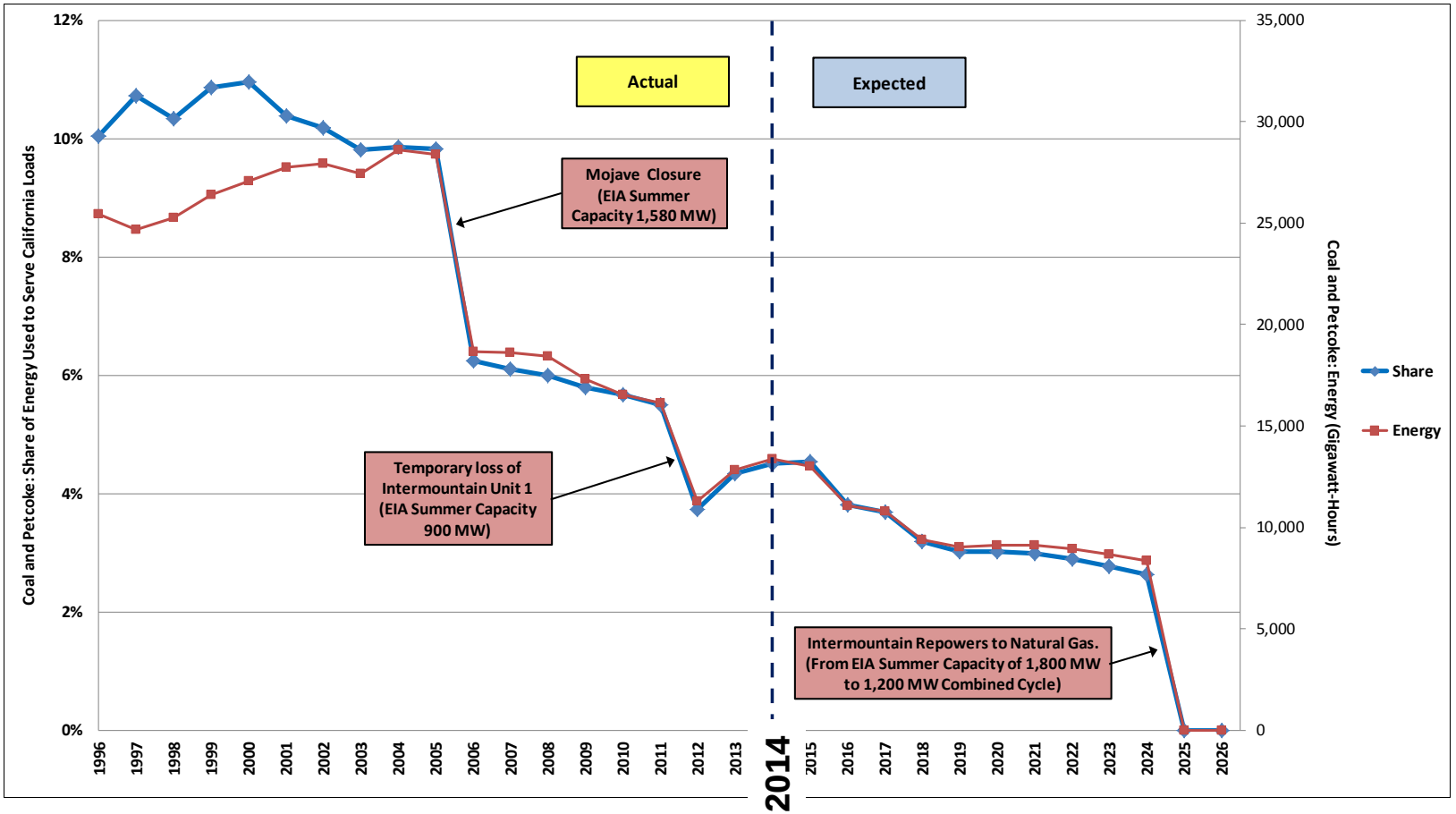
- Electricity sector is about 20% below 1990 GHG emission levels
- From 2008 to 2013:
  - Renewable generation almost doubled
  - Coal generation reduced by more than half
  - GHG emissions reduced by a quarter



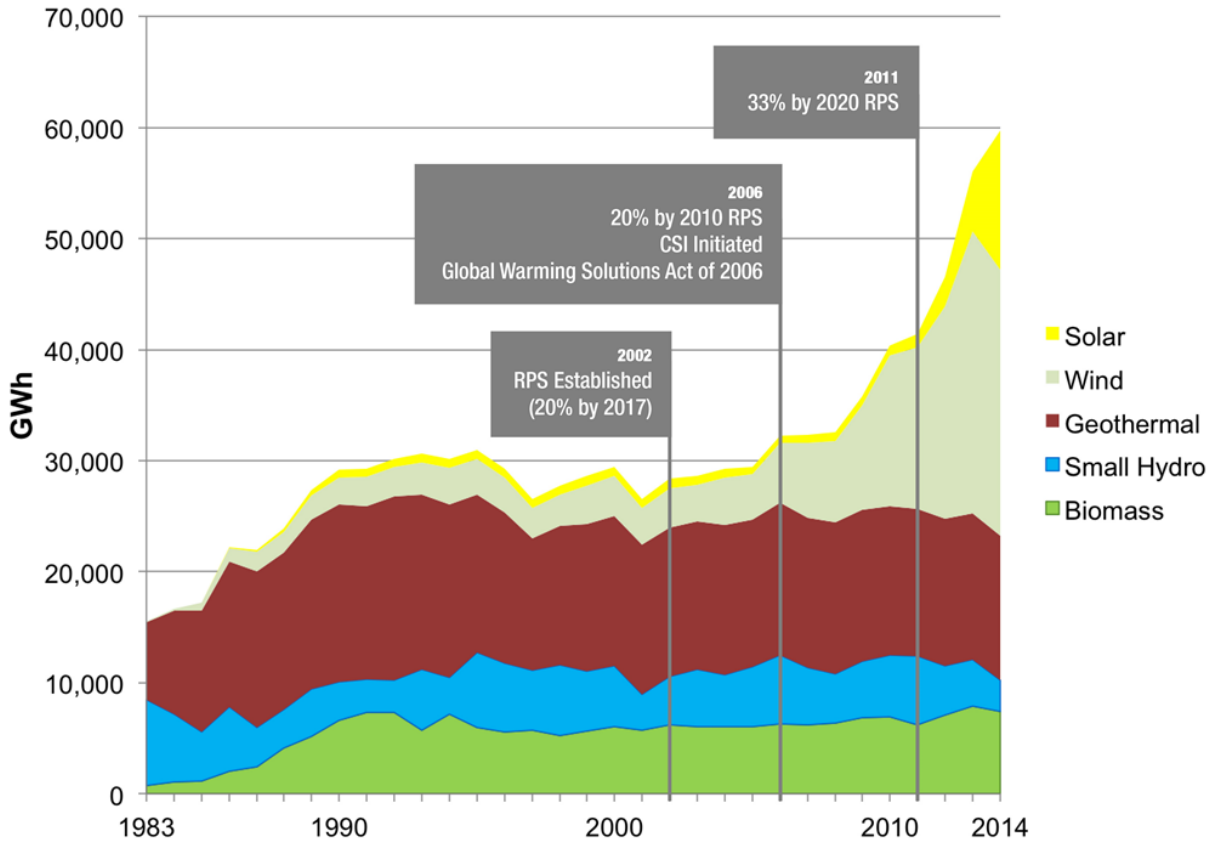




Annual and Expected Energy from Coal Used to Serve California, 1996 – 2026 (Includes Imports)



California Renewable Energy Generation by Resource Type (In-state And Out-of-state)



Source: CEC Tracking Progress Web Page

Achieving 2020 Goals

- Electricity sector is about 20% below 1990 GHG emission levels
- Energy/Water Nexus
- GHG reduction/climate programs
  - Renewables Portfolio Standard
  - Customer-side distributed generation programs
  - Cap-and-Trade
  - Combined Heat and Power Programs
  - Energy Efficiency
  - Electric Vehicle Programs
  - Integrating variable resources

SB 350, De León

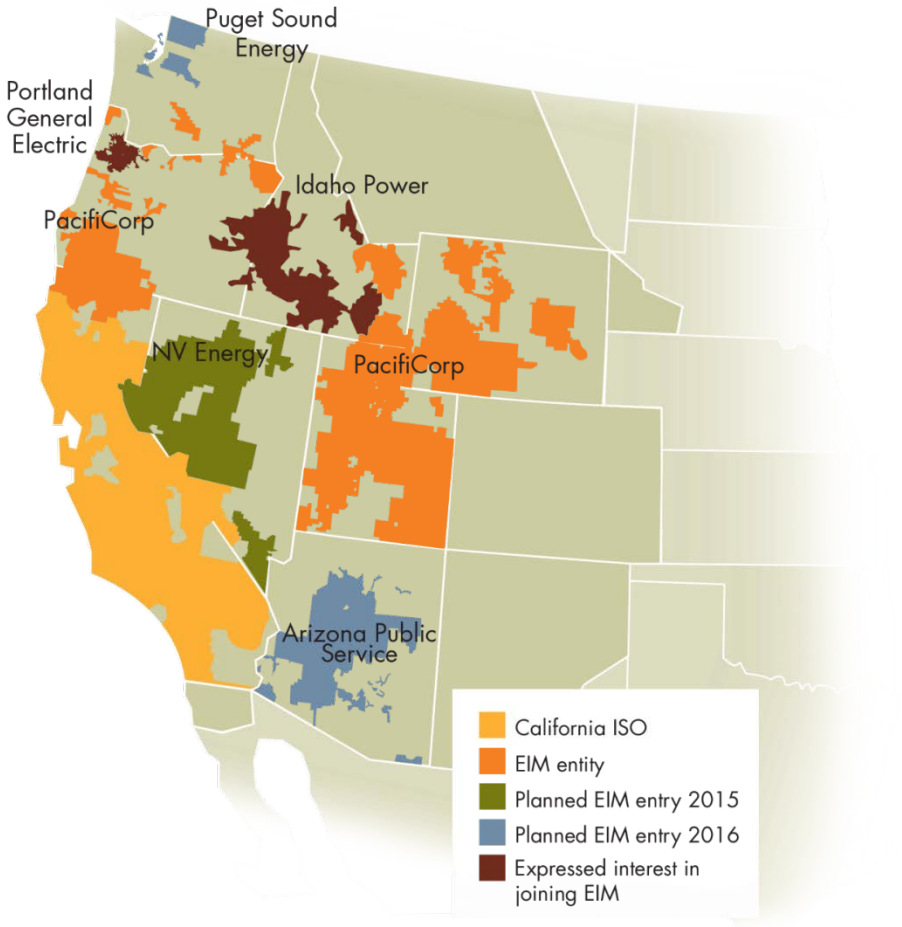
- Increases the 33% RPS to 50% RPS
- Paves the way for transformation of the California ISO into a regional organization
- Requires integrated resource plans
- Requires studies on low-income customers' access and barriers to clean technologies
- Ensure low-income residents benefit from clean energy policies

50% Renewables and Reliability

- Increasing renewables beyond 33% creates integration challenges
- Overgeneration expected at some times-of-day
- Flexible supply and demand needed
- Regional marketplace supports renewable integration

Solutions
Target energy efficiency
Increase storage and demand response
Enable economic dispatch of renewables
Decarbonize transportation fuels
Retrofit existing power plants
Align time-of-use rates with system conditions
Diversify resource portfolio
Deepen regional coordination

Energy Imbalance Market



Implementation Tools

Market-Based Mechanisms

- Cap-and-Trade

Planning Initiatives

- Comprehensive clean energy procurement
- RETI 2.0
- Regional grid

Implementation Tools

Research and Development

- Synchrophasors
- Improved forecasting and grid modeling
- Microgrids
- Energy storage
- Demand response

Questions & Comments

ELECTRICITY

GHG Reduction Focus Areas

Transportation and Land Use

California Environmental Protection Agency
Air Resources Board

CalSTA
CALIFORNIA STATE TRANSPORTATION AGENCY

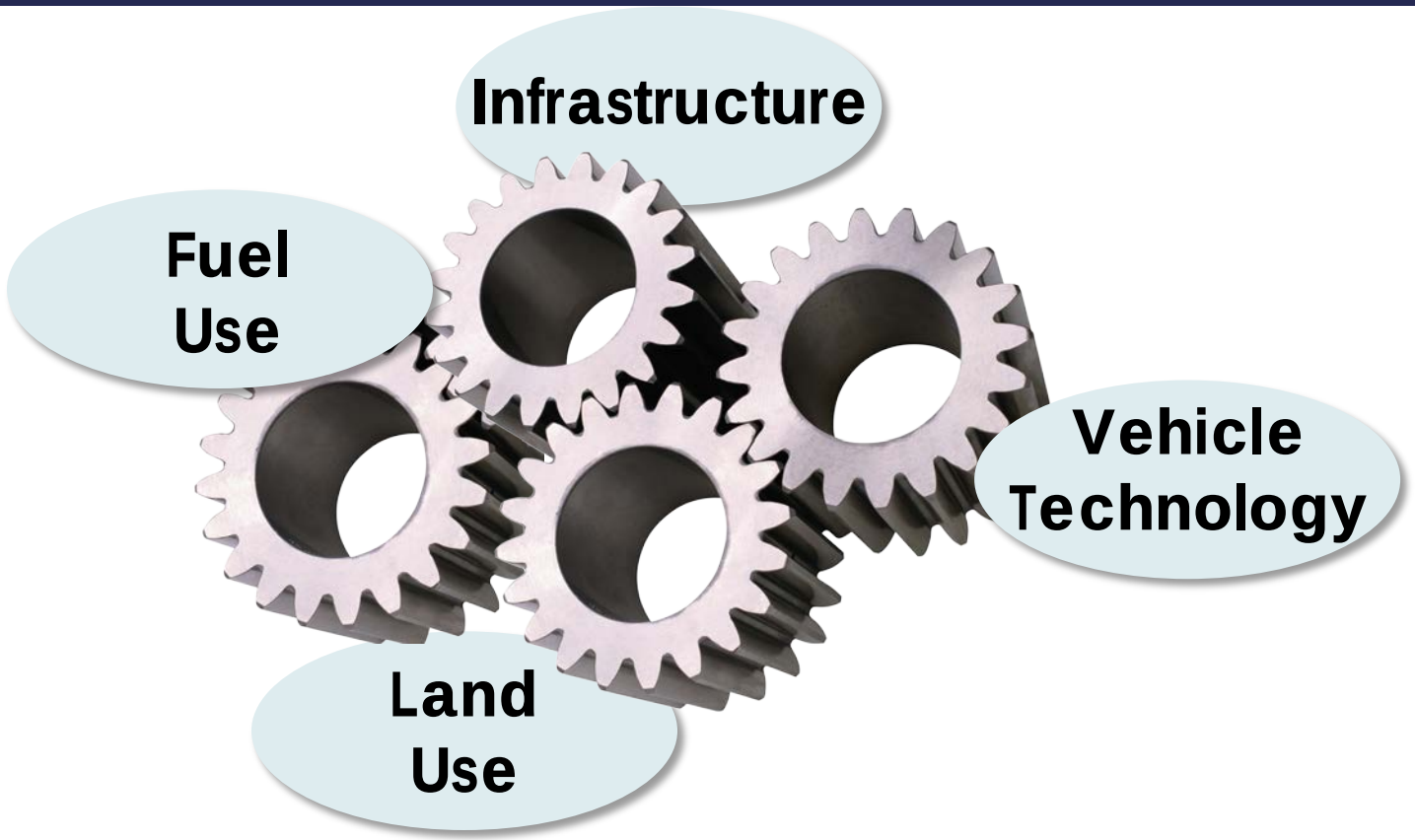
Caltrans

California
Strategic Growth Council

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH
STATE OF CALIFORNIA

CALIFORNIA
ENERGY COMMISSION

The Transportation Sector



An Interwoven Transportation "System"

Transportation and Land Use

Focus Area Description & Scope

Vehicle Tech

- Aerodynamics, Weight, tires
- Conventional powertrain improvements
- Hybrids
- Battery EVs
- Fuel Cell EVs

Fuel Use

- Liquid fuels (fossil and renewable sources)
- Electricity
- Gaseous fuels (hydrogen, natural gas)

Land Use

- Infill, mixed use
- Transit oriented development

Infrastructure

- High-Speed Rail
- Integrated mass transit systems
- Bike and pedestrian facilities
- Freight facilities

Achieving 2020 Goals

Vehicle Technology:

- 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: Electric shore power at dock
- Rail: Commuter rail enhancements (e.g. electric Caltrain)

Numerous other policy actions enacted to address regional ozone and local pollutants

Achieving 2020 Goals

Fuel Use (Supply/Distribution):

- Low Carbon Fuel Standard (LCFS)
- Cap-and-Trade
- Renewable electricity and hydrogen supply requirements
- Hydrogen fueling infrastructure (planning, state $)
- Electric utility EV rate setting
- Electric utility EV infrastructure investments

Achieving 2020 Goals

Land Use:

- SB375 Sustainable Communities Strategies (SCS)
- GHG reduction targets for 2020 and 2035
- SCSs deploy strategies reducing trips and trip length
- Results in more compact urban form, transit oriented development, transportation choices
- CEQA streamlining encourages more infill and TOD
- SB 743, Shift to VMT metric

Achieving 2020 Goals

Infrastructure:

- Expansion and integration of rail and transit systems across the state
- Development and implementation of a sustainable freight plan pursuant to EO 32-15
- Active Transportation Program

Vision for 2030 and 2050

Vehicle Technology:

- Continued efficiency gains
- Electric drivetrains (LDVs, HDVs)
- Rail efficiency and electrification, expansion at ports
- High-Speed Rail with electrified locomotives
- Aviation aircraft efficiency and smart routing
- Vehicle automation (LDVs, HDVs)

Vision for 2030 and 2050

Fuel Use (Supply/Distribution):

- Large expansion of renewable fuels in-state
- Continued growth in natural gas (especially renewable natural gas)
- Expanded use of electricity and hydrogen

Vision for 2030 and 2050

Land Use:

- Continue to support planning to reduce vehicle activity by 2035 and beyond
- Incentivize and catalyze compact development
- Encourage local government implementation of regional SCSs
- Provide guidance for sustainable development practices – General Plan Guidelines update

Vision for 2030 and 2050

Infrastructure:

- High-Speed Rail phase I in service by 2030, with mode shift from cars and aircraft
- Infrastructure supportive of freight efficiency
- Integrated and robust local/regional transit networks – transit linked with an integrated schedule and a single ticket
- Improved bike and pedestrian facilities for safety and increased mode share
- Road surface innovations to reduce fuel consumption and improve ecosystem resilience

Vision for 2030 and 2050

Image Credits- Urban Advantage, Roma Design Group, City of Dana Point

Vision for 2030 and 2050

Image Credits- Urban Advantage, Roma Design Group, City of Dana Point

Vision for 2030 and 2050

Image Credits- Urban Advantage, Roma Design Group, City of Dana Point

Implementation Tools

Vehicle Technology:

- LDV: Advanced Clean Cars 2 (post 2025)
- HDV: Phase 2 GHG vehicle standards, possibly Phase 3
- LDV & HDV: Expanded incentives & demonstrations
- Zero emission rail and transit vehicles, state and Federal $

Implementation Tools

Fuel Use (Supply/Distribution):

- Market-Based Mechanisms
  - Low Carbon Fuel Standard
  - Cap-and-Trade
- ISO and PUC policies to foster “vehicle to grid” services

Implementation Tools

Land Use: SB375

- Financing tools for infill development
- Improve technical modeling tools
- Provide tools and resources for local SCS implementation
- Update targets in 2016

Implementation Tools

Infrastructure

- Financing tools for transportation infrastructure that reduces emissions
- Operating support for transit to get better use of existing infrastructure
- Active Transportation Program
- Freight infrastructure capital improvement in line with the sustainable freight strategy

Interaction with Other Sectors

- Trans fuel production is from industrial sector
  - Refineries, Oil/Gas wells, biofuel production, electricity
- "VGI" – Vehicle Grid Interaction (electricity)
  - Vehicle load demand response
  - Vehicle to grid storage and grid services
- Biofuel feedstock from Agriculture & Waste sectors
  - Farmed crops, WWTP gas, landfill gas, forest thinings
- Energy – Water Nexus
  - Water requirements to produce fuels

Interaction with Other Sectors

Multiple Benefits of Sustainable Development

- Water and Resource Conservation
- Economic Health
- Public Health
- Equity
- Energy Use in Buildings
- Municipal Fiscal Sustainability
- Household and Transportation Costs
- Availability of Workforce Housing for Economic Growth

Questions & Comments

TRANSPORTATION AND LAND USE

ALL FOCUS AREAS

Economic Analysis

CALIFORNIA AIR RESOURCES BOARD

Goal

- Evaluate the economic impact of options for achieving the 2030 GHG target
  - Estimate the economic impact of various technology pathways and carbon pricing
  - Inform measure development
  - Assess the economic impact of options for achieving the 2030 GHG emission target on the California economy, California businesses, and individuals

Technology Pathways

- Potential pathways
  - Combinations of candidate measures
  - Evaluate:
    - Adoption rates: stock rollover
    - Emissions
    - Costs and savings
    - Cross-sector interactions
- Key Drivers:
  - Reference scenario conditions
  - Technology attributes: availability; cost; performance

Carbon Pricing

- Define carbon pricing in the macroeconomic analysis
  - Changes relative prices in the economy
  - Moves money in the economy
- Evaluate:
  - Structural responses
  - Macroeconomic indicators
  - Emissions feedback

Models

- Energy and Environmental Economics Pathways Model
  - Economy-wide stock rollover model
    - Define technology pathways for achieving emission targets
    - Estimate the costs and savings of the pathways
- Regional Economic Models, Inc. (REMI)
  - Input-Output based dynamic general equilibrium model
  - Estimate macroeconomic impact of technology costs and savings
  - Estimate the macroeconomic impact and macroeconomic adjustments due to carbon pricing

Economic and Technology Advisors

- Experts in economics and modeling
- Serve in an advisory capacity in the assessment of the economic impacts of the 2030 Scoping Plan
- Coordinate with California agencies and external researchers
- Conduct their activities in public meetings

Economic Advisor Scope of Work

- Provide feedback on the proposed analytical methods
- Review the economic and technical assumptions and methods in the technology pathways analyses
- Review the assumptions and methods in the macroeconomic analyses
- Review and comment on the overall analyses

Questions & Comments

ECONOMIC ANALYSIS

Next Steps

CALIFORNIA AIR RESOURCES BOARD

Tentative Schedule

- First Board update – November 19, 2015
- Draft 2030 Target Scoping Plan – Spring 2016
- Regional workshops – Fall 2015
  - Bay Area, Los Angeles, Central Valley
- Technical Workshops – Fall 2015 to Mid 2016
  - Economic/environmental analyses
- Final 2030 Target Scoping Plan presented to Board – Fall 2016

Public Comments

- To facilitate consideration by state agencies ahead of measure specific workshops*, please provide comments by October 16, 2015
- Links to submit both written comments and view all comments received can be found at: http://www.arb.ca.gov/cc/cc.htm

*There will be additional opportunities to comment at these workshops

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CalEPA
California Environmental Protection Agency

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH
STATE OF CALIFORNIA

CALIFORNIA natural resources AGENCY

CALIFORNIA ENERGY COMMISSION

CalSTA
CALIFORNIA STATE TRANSPORTATION AGENCY

cdfa
CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Public Utilities Commission

Caltrans

California Environmental Protection Agency
Air Resources Board

CalRecycle

California Strategic Growth Council