CALIFORNIA ENERGY COMMISSION

2014 Integrated Energy Policy Report:

The State of Alternative Transportation Technologies Over the Next 10 Years and Beyond

California Energy Commission

April 10, 2014

California Energy Commission
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Alternative and Renewable Fuel and Vehicle Technology Program

Workshop Objectives

1. Identify Potential Achievements in the Development and Deployment of Alternative Technology Vehicles and Fuels Over the Next 10 Years and Beyond
2. Understand State of the Technologies and Markets for 4 Key Areas

   Hydrogen Fueling — ZEV and Near-ZEV Trucks

   Electric Charging — Biofuels
3. Identify Strategic Uses of ARFVTP Funding to Help Achieve State Policy Goals for Climate Change, Petroleum Reduction and Air Quality

California Transportation: Nation-State Statistics

- Population: 37.8 million
- GDP: $2.0 trillion - 8th largest global economy
- GHG Emissions: 448 MMT*
  - 7.2% of U.S. Emissions (Pew Center)
  - 10th largest emitter on global scale
  - Transportation accounts for nearly 40 % of all GHG emissions
- Vehicles: 26 million cars, + 1 million trucks
- Annual Fuel Consumption: 17.8 billion gallons
  - 14.5 billion gallons gasoline
  - 3.3 billion gallons diesel

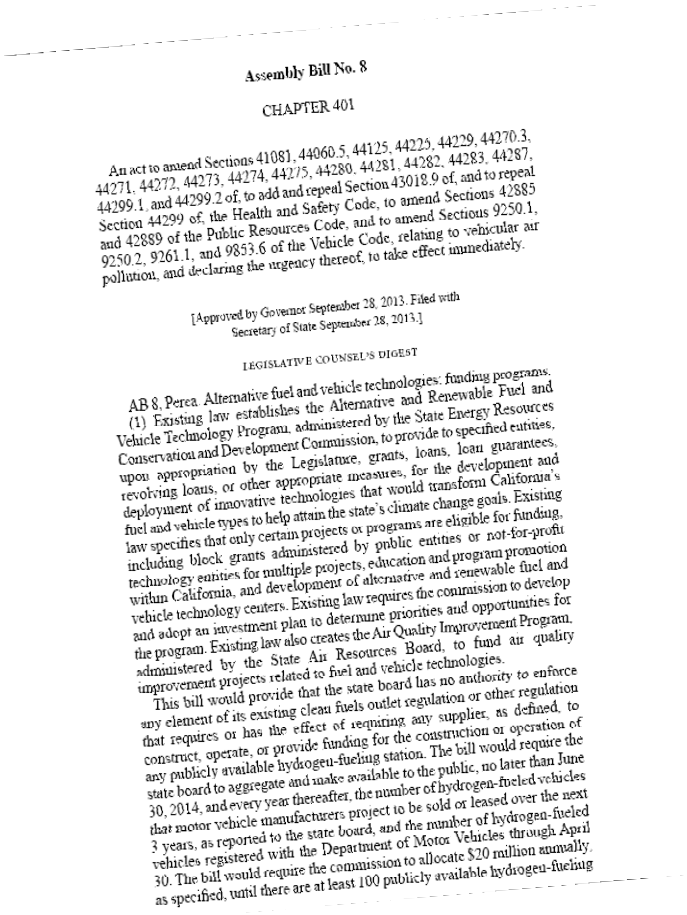
* Source: California Air Resources Board 2011 Inventory

California's Policy Goals and Objectives

Policy Objectives	Goals and Milestones
GHG Reduction	Reduce GHG emissions to 1990 levels by 2020 and 80% below 1990 levels by 2050
Petroleum Reduction	Reduce petroleum fuel use to 15% below 2003 levels by 2020
In-State Biofuels Production	Produce in California 20% of biofuels used in state by 2010, 40% by 2020, and 75% by 2050
Low Carbon Fuel Standard	10% reduction in carbon intensity of transportation fuels in California by 2020
RFS2	36 Billion Gallons of renewable fuel by 2022
Air Quality	80% reduction in NOx by 2023
Governor Brown's ZEV E.O.	Accommodate 1 million EVs by 2020 and 1.5 million by 2025

Assembly Bill 8

(Perea, Chapter 401, Statutes of 2013)



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.

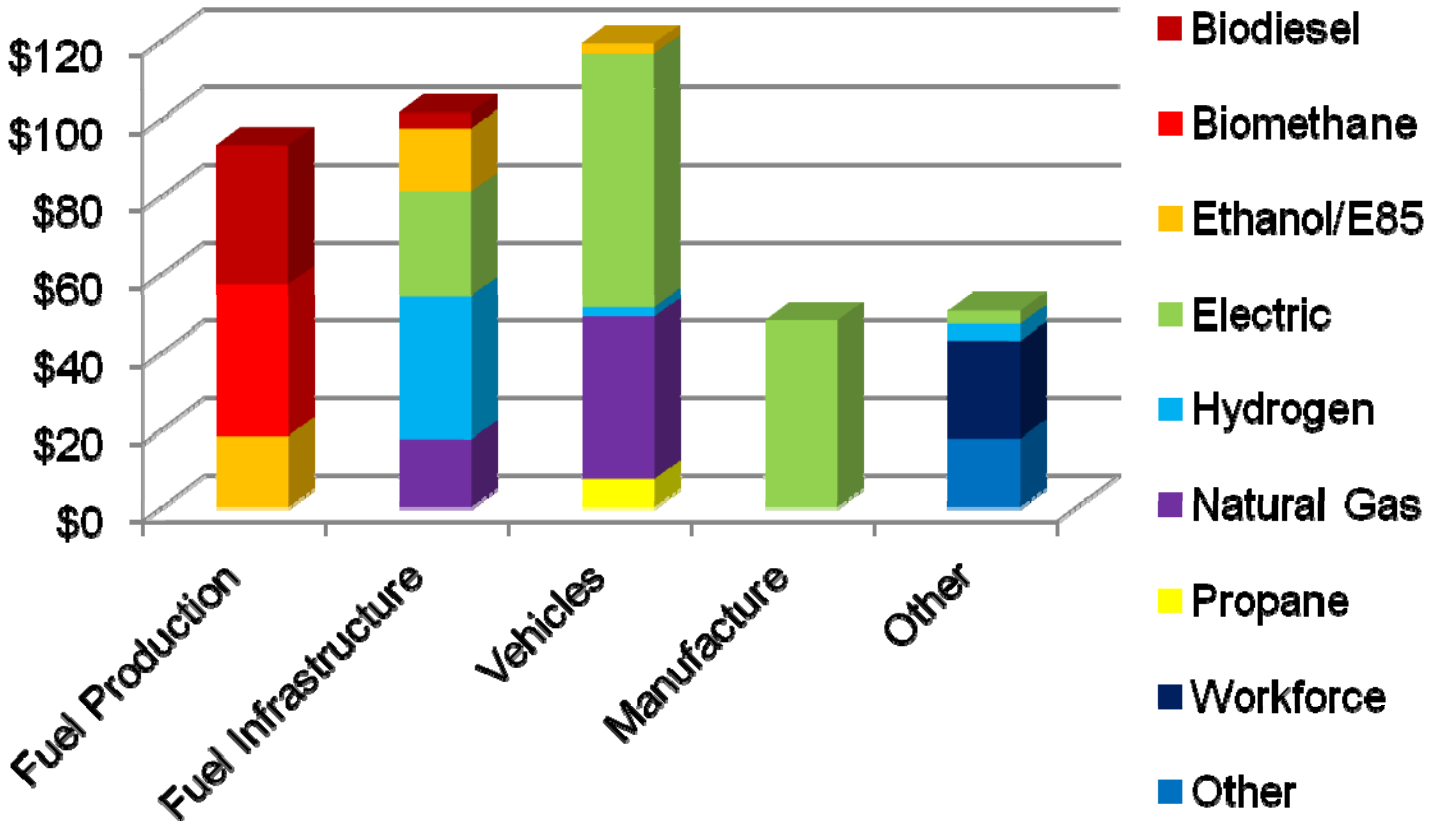
(1) Existing law establishes the Alternative and Renewable Fuel and Vehicle Technology Program, administered by the State Energy Resources Conservation and Development Commission, to provide to specified entities, upon appropriation by the Legislature, grants, loans, loan guarantees, revolving loans, 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 30. The bill would require the commission to allocate $20 million annually, as specified, until there are at least 100 publicly available hydrogen-fueling

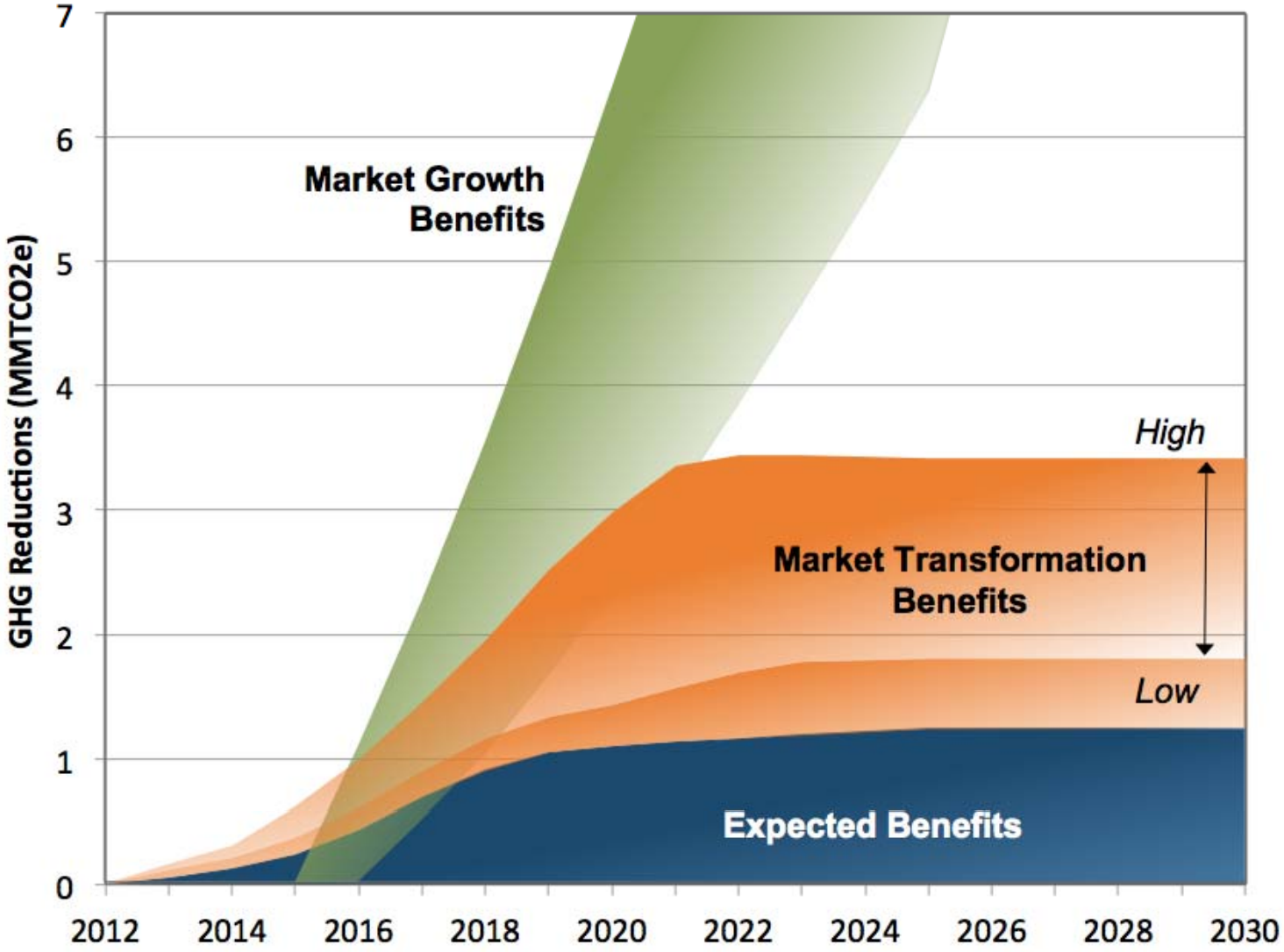
- Extends ARFVTP funding through January 1, 2024
- To transform California's transportation market into a diverse collection of alternative fuels and technologies and reduce California's dependence on petroleum.

  *"…**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 Section 44272(a))

Existing Agreements Through 2013 $413 Million for 264 Projects



Market Transformation and Expected Benefits through 2030 (From NREL 2013 Draft Benefits Guidance Report)



Hydrogen Fueling Infrastructure

Hydrogen Fueling Infrastructure: Goals and Status

- Facilitate Commercial Launch of Light Duty Fuel Cell Vehicles in California

  Help Achieve ZEV Mandate
  Reduce Petroleum Use
  Improve Air Quality
  Reduce Carbon Emissions

- Help Fund a Network of 100 Stations
  - AB 8 Directive
- Bring Down Station Costs
  - AB 8 Directive

Hydrogen Fueling Station Status

- 9 Operational Stations in California
- 20 Stations Funded and In Development with ARFVTP Funding
  - Includes 100% renewable hydrogen stations
- Nearly $30 million in New Station Funding available: 11-13 new stations

Southern CA Public Hydrogen Stations

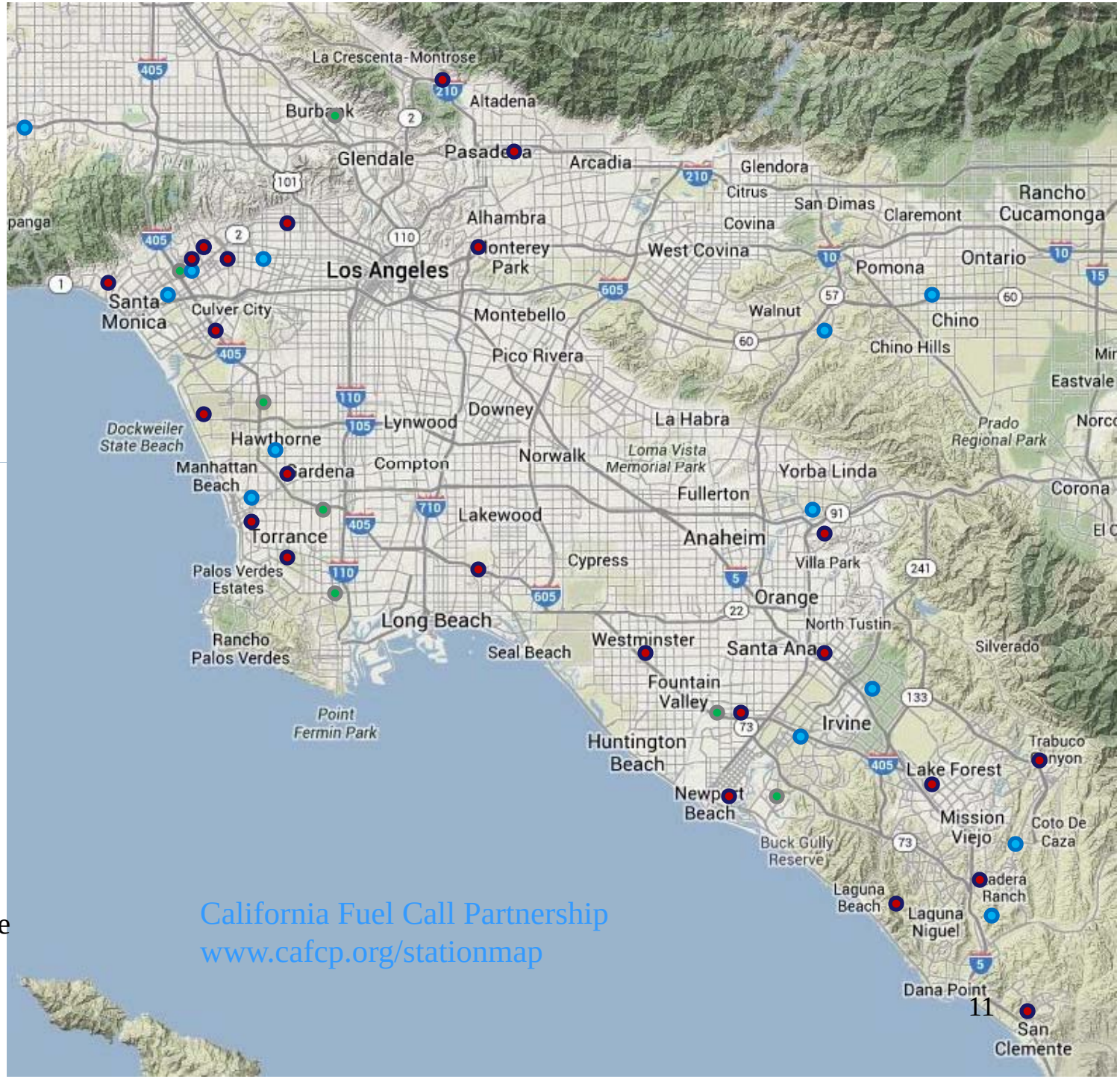
Open

Burbank
Torrance - Shell
Newport Beach - Shell
Irvine - UCI
Fountain Valley - OCSD
West LA - Shell
Thousand Palms - SunLine
Harbor City – Mebtahi SS

In Development

Anaheim
Beverly Hills
Chino (upgrade)
Diamond Bar (upgrade)
Hawthorne
Hermosa Beach
Irvine - UCI (upgrade)
Irvine North
Mission Viejo
San Juan Capistrano
Los Angeles – Cal State LA
Santa Monica
West LA
Westwood - UCLA
Woodland Hills

Targets areas for future funding



California Fuel Call Partnership
www.cafcp.org/stationmap

January 2014

Northern CA Public Hydrogen Stations

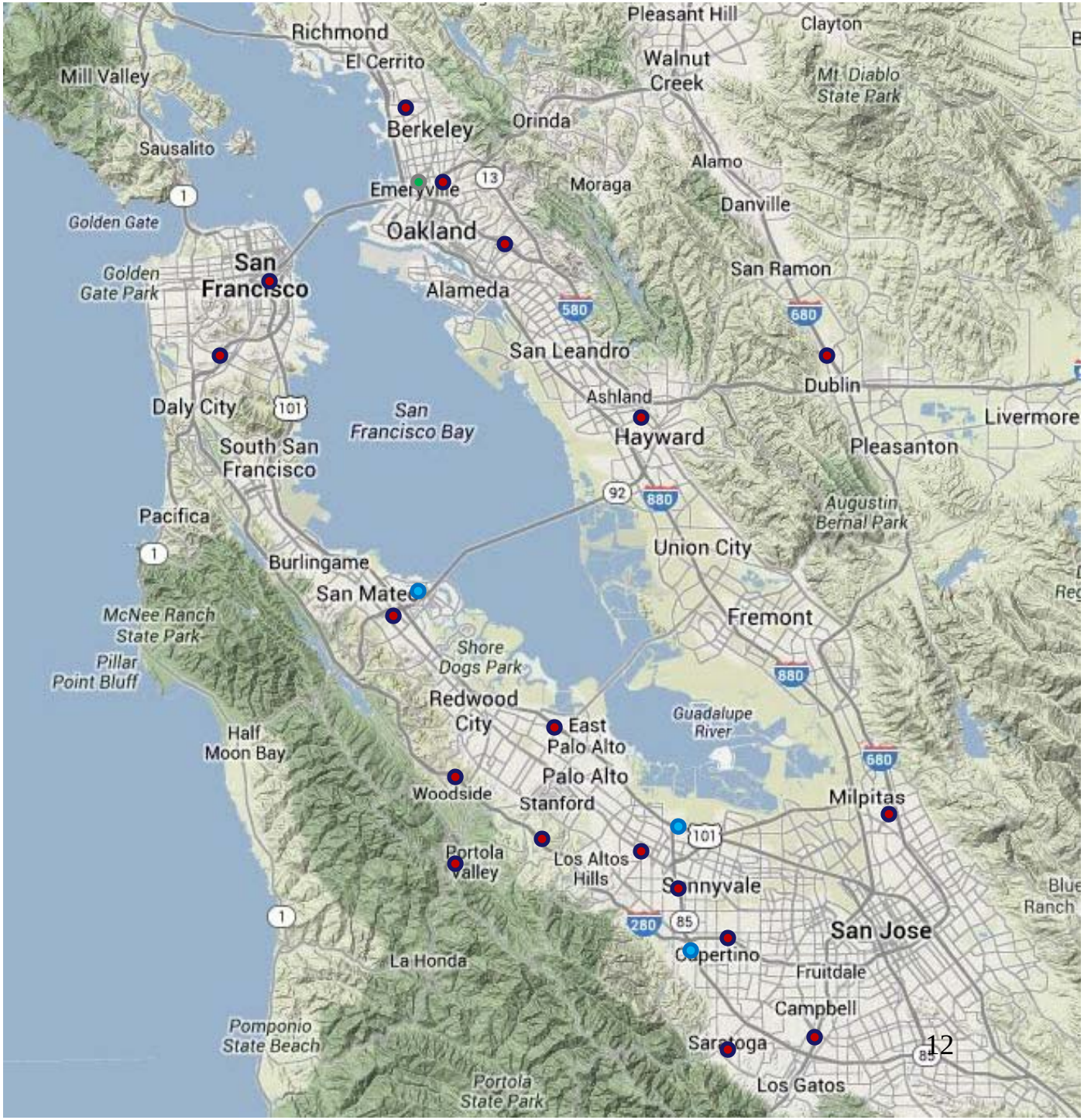
- Open

  Emeryville – AC Transit

- In Development

  Cupertino
  Foster City
  Mountain View
  West Sacramento

- Target areas for future funding



Managed by BKi

Electric Vehicle Charging

Electric Vehicle Charging Infrastructure: Goals and Status

- Support Consumer Acceptance of Light Duty Electric Vehicles
  - Complement ARB Clean Vehicle Rebate Project
- Achieve Governor's ZEV Mandate Targets:
  - ✓ Support 1 million ZEV's by 2020
  - ✓ Support 1.5 million ZEV's by 2025
- Additional Policy Goals

  Improve Air Quality Reduce Carbon Emissions

  Reduce Petroleum Use

ARFVTP EV Charger Support

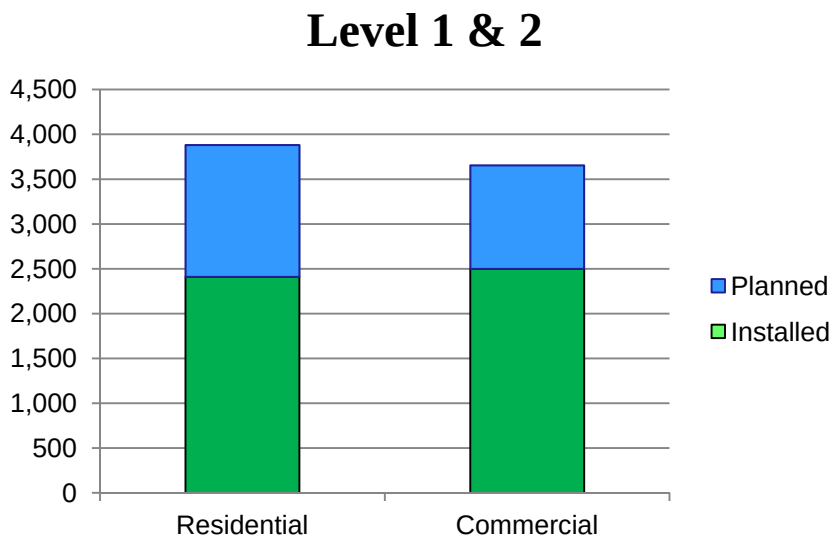
EVSE Funding to Date = $26.8 million

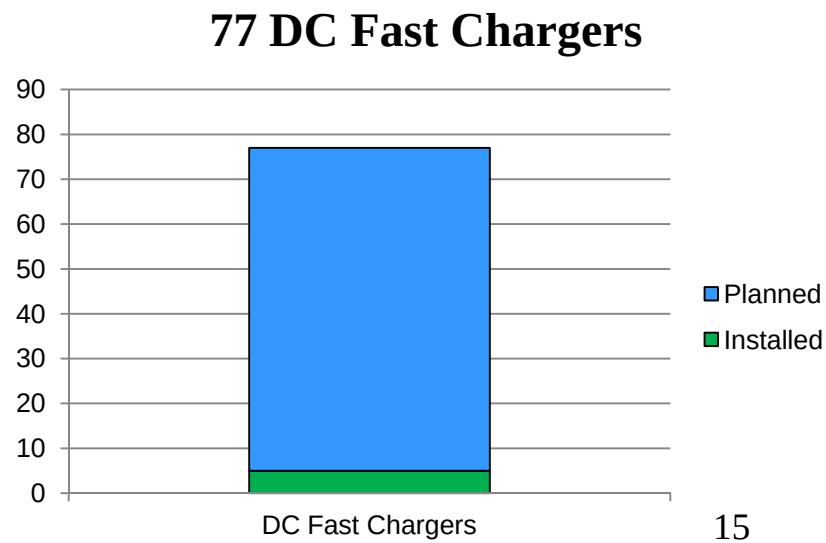
Total Funded = 7,798 charge points

- Commercial = 3,096
- Residential = 3,882
- Workplace = 743
- DC Fast = 77

Plus 11 Regional Readiness Planning Grants = $2.2 M

~64,000 EVs in California



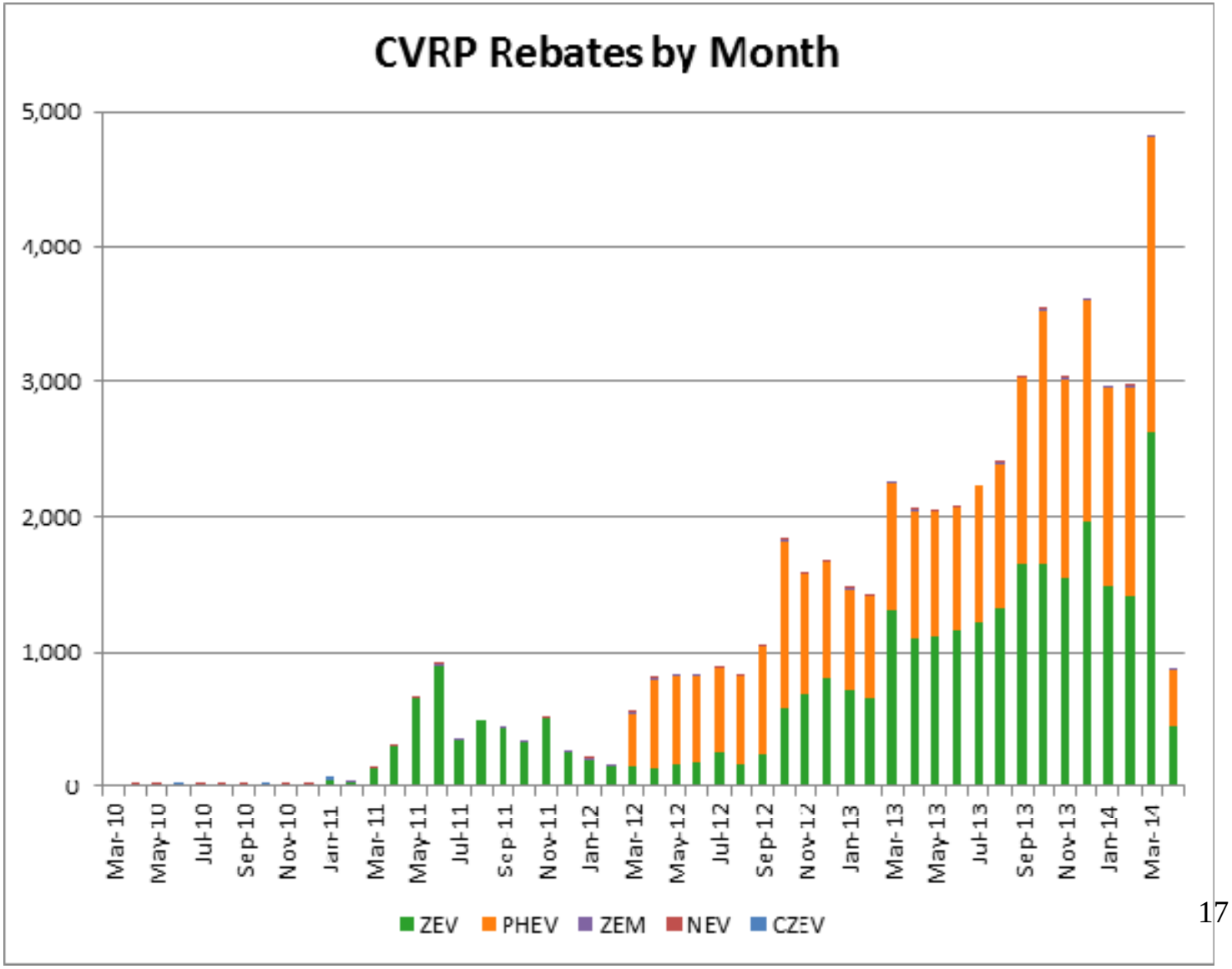


Electric Charger Providers

- NRG Settlement with CPUC
  - 200 combo fast charge/Level 2 station ("Freedom Stations")
  - Infrastructure for 10,000 level 2 EVSEs for multi-family housing, workplace, schools and hospitals.
- Tesla Supercharger Network
  - 10 in California
- Private Charger Installations
- Air District Charger Funding

49,000 Rebates

$103 M



Source: CCSE 2014

Zero and Near-Zero Emission Medium and Heavy Duty Vehicles

ZEV and Near-ZEV MD-HD Vehicles Goals and Status

- Facilitate Technology Development and Commercialization of MD and HD Vehicles for Goods Movement and Freight Transport
- Support Multiple Near-Term and Long-Term Technology Pathways:

Natural Gas	Hydrogen Fuel Cell
Electric Drive	Hybrid and Range Extender Combinations

- Policy Goals

Reduce Diesel Fuel Use	Enhance Public Health
Improve Air Quality	Reduce Carbon Emissions

ARFVTP Truck Sector-Related Funding

About 30 Percent of Total Program Funding

Technology	Funding ($ Millions)	No. of Vehicles, Fueling Stations or Projects
Commercial Natural Gas Trucks	33.5	1,375 Trucks
Natural Gas Infrastructure	17.5	62 Stations
Commercial Propane Trucks	7.3	600 Trucks
Commercial ZEV Trucks (Class 6 package delivery)	4	160 Trucks
Advanced Technology Truck Demonstration or Manufacturing	70.4	36 Projects
Total Funding	**132.7**	

ARB HVIP Truck and Bus Funding: Through January 2014

Vehicle Category	No. of Vehicles	Funding ($million)
Parcel Delivery	567	17.4
Beverage Delivery	422	14.5
Other Truck	218	7.2
Food Distribution	162	4.5
Uniform – Linen Delivery	117	3.0
Propane Delivery	46	0.9
Buses	33	0.9
Tow Truck	25	0.7
Refuse Hauler	14	0.5
Totals	**1,604**	**49.8**

Biofuels Technology Assessment

Biofuels:
Policy Goals and Status

- Displace Petroleum as Predominant Vehicle Fuel in California
- Support Low Carbon Fuel Standard Regulatory Goal of 10 Percent Carbon Intensity Reduction by 2020
- Develop Commercial Products and Markets for:

  Ethanol and Green Gasoline

  Biodiesel and Renewable Diesel

  Biogas
- Additional Policy Goals

  Reduce Diesel Fuel Use

  Improve Air Quality

  Enhance Public Health

  Reduce Carbon Emissions

California Biofuel Capacity and Production

Ethanol

Capacity = 240 MGY

Production = 150 MGY

Total In-State Use ~ 1 Billion GY

Biodiesel

Capacity = 50 MGY

Production = 25 MGY

Biofuels Funding

Category	Funding ($ millions)	No. of Projects
Fuel Production		
Biogas	48.9	12
Biodiesel / Renewable Diesel	35.9	14
Ethanol	12.4	5
CEPIP	6.0	3
Total Fuel Production	**103.2**	**34**
Fueling Infrastructure		
Biodiesel Tankage	4.0	4
E85 Retail Stations	16.5	205
Total Infrastructure	**20.5**	**209**

Panel 1: Hydrogen Infrastructure

Hydrogen Fueling Infrastructure: Goals and Status

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  Reduce Petroleum Use
  Improve Air Quality
  Reduce Carbon Emissions

- Help Fund a Network of 100 Stations
  - AB 8 Directive
- Bring Down Station Costs
  - AB 8 Directive

Key Questions

1. Are there critical technology issues that need to be resolved in order to drive down station costs, or are the cost issues a function of low volume and non-standardized station designs?
2. How can ARFVTP funding be used to overcome specific technology and market barriers?
3. What role can hydrogen fuel cell vehicles play in helping to meet California's climate policy goals through 2023 and beyond?

Panel 2:
Electric Charging Infrastructure

Electric Vehicle Charging Infrastructure: Goals and Status

- Support Consumer Acceptance of Light Duty Electric Vehicles
  - Complement ARB Clean Vehicle Rebate Project
- Achieve Governor's ZEV Mandate Targets:
  - ✓ Support 1 million ZEV's by 2020
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- Additional Policy Goals

  Improve Air Quality Reduce Carbon Emissions

  Reduce Petroleum Use

Key Questions

1. Do we have the fundamental technologies that are needed for a mass market EV charging system, or are additional technology innovations needed?
2. Do we have the fundamental tools to create a widespread, consumer friendly charging network, or are additional business, technology or regulatory measures needed?
3. How can ARFVTP funding be used to overcome specific technology and market barriers?
4. What role can electric drive vehicles play in helping to meet California's climate policy goals through 2023 and beyond?

Panel 3:
ZEV and Near-ZEV MD and HD Vehicles

ZEV and Near-ZEV MD-HD Vehicles Goals and Status

- Facilitate Technology Development and Commercialization of MD and HD Vehicles for Goods Movement and Freight Transport
- Support Multiple Near-Term and Long-Term Technology Pathways:

Natural Gas	Hydrogen Fuel Cell
Electric Drive	Hybrid and Range Extender Combinations

- Policy Goals

Reduce Diesel Fuel Use	Enhance Public Health
Improve Air Quality	Reduce Carbon Emissions

Key Questions

1. In advance of the pending 2023 federal regulatory NOx requirements for truck emissions, what level of market penetration and acceptance can be achieved through 2023 for ZEV and Near-ZEV trucks?
2. What key technology and cost challenges must be surmounted?
3. Assuming that technology and cost issues can be resolved, what needs to occur to spur market demand and acceptance in a conservative, cost-conscious industry? How can ARFVTP funding be used to overcome specific technology and market barriers?
4. What role can zero and low emission advanced technology trucks play in helping to meet California's climate policy goals through 2023 and beyond?

Panel 4: Biofuels

Biofuels:
Policy Goals and Status

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- Develop Commercial Products and Markets for:
  - Ethanol and Green Gasoline
  - Biodiesel and Renewable Diesel
  - Biogas
- Additional Policy Goals
  - Reduce Diesel Fuel Use
  - Improve Air Quality
  - Enhance Public Health
  - Reduce Carbon Emissions

Key Questions

1. When will advanced technology biofuels surmount the cost, process technology hurdles and feedstock controversies to make meaningful contributions to California's efforts to reduce carbon and criteria emissions from the transportation sector?
2. How does waste-based biodiesel and renewable diesel fit into long-term state strategies for low carbon, zero emission freight movement?
3. Is there a fundamental constraint with the availability of sustainable feedstock sources?