

CEC Investments in Alternative Transportation Fuels/Technology

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Presentation to

The National Academies of Sciences, Engineering and Medicine

Meeting on Fuel Economy Technologies for the 2025-2035 Timeframe

Davis, California

January 24, 2019



California Transportation Statistics

VEHICLES

28.9 millions cars

1 million trucks

GHG EMISSIONS

440.4 MMT CO₂e (2015)

~50% from transportation

AIR QUALITY

Severe Non-Attainment for Ozone

San Joaquin Valley & South Coast

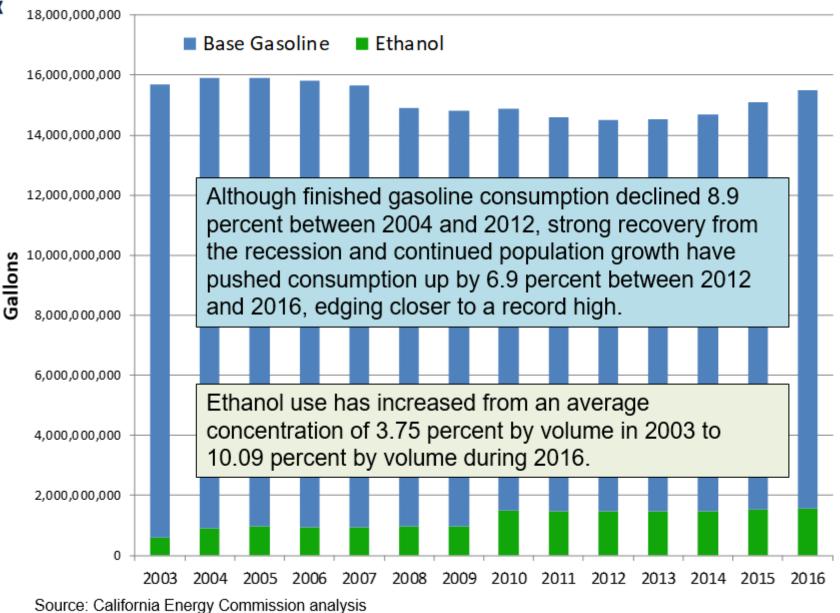
PETROLEUM CONSUMPTION

13.9 billion gallons gasoline

3.3 billion gallons diesel



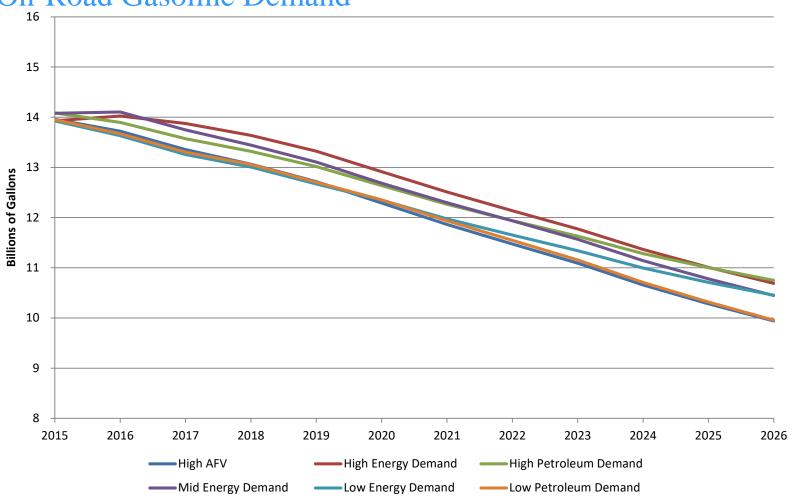
California Gasoline & Ethanol Consumption











Guiding Policies and Regulations



EXECUTIVE ORDER B-16-12 SENATE BILL 1275 (2014) EXECUTE ORDER B-48-18

1 million ZEVs by 20231.5 million ZEVs by 20255 million ZEVs by 2030

250,000 EV chargers by 2025 200 hydrogen stations by 2025

CLEAN AIR ACT

NO_X 1 80% by 2023





CALIFORNIA ENERGY COMMISSION



California Energy Commission

LEAD COMMISSIONER REPORT

2018-2019 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program

California Energy Commission Edmund G. Brown Jr., Governor

April 2018 | CEC-600-2017-010-LCF

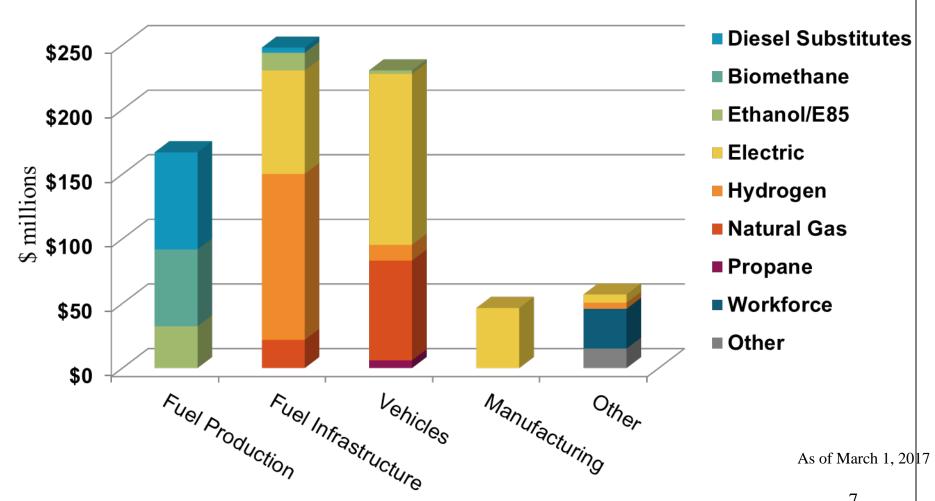


Funded Activity	Cumulative Awards to Date (in Millions)*	# of Projects or Units	
Alternative Fuel Production			
Biomethane Production	\$62.7	21 Projects	
Gasoline Substitutes Production	\$32.1	15 Projects	
Diesel Substitutes Production	\$68.3	23 Projects	
Alternative Fuel Infrastructure			
Electric Vehicle Charging Infrastructure**	\$79.9	7,695 Charging Stations	
Hydrogen Refueling Infrastructure	\$132.4	64 Fueling Stations	
E85 Fueling Infrastructure	\$13.7	158 Fueling Stations	
Upstream Biodiesel Infrastructure	\$4.0	4 Infrastructure Sites	
Natural Gas Fueling Infrastructure	\$21.9	64 Fueling Stations	
Alternative Fuel and Advanced Technology Vehicles			
Natural Gas Vehicle Deployment***	\$65.8	3,148 Vehicles	
Propane Vehicle Deployment	\$6.0	514 Trucks	
Light-Duty ZEV Deployment (Including CVRP Supplemental Funding)	\$28.0	10,700 Cars	
Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project Supplemental Funding	\$4.0	150 Trucks	
Advanced Technology Freight and Fleet Vehicles****	\$126.8	48 Demonstrations	
Related Needs and Opportunities			
Manufacturing	\$46.5	21 Manufacturing Projects	
Emerging Opportunities	†	t	
Workforce Training and Development	\$31.9	17,440 Trainees	
Fuel Standards and Equipment Certification	\$3.9	1 Project	
Sustainability Studies	\$2.1	2 Projects	
Regional Alternative Fuel Readiness	\$9.6	43 Regional Plans	
Centers for Alternative Fuels	\$5.8	5 Centers	
Technical Assistance and Program Evaluation	\$5.5	n/a	
Total	\$750.9		





Projects To-Date





Projections for Statewide PEV Charger Demand

Demand for Level 2 Destination (Workplace and Public) Chargers (The Default Scenario)

	Total PEVs	Lower Estimate (Chargers)	Higher Estimate (Chargers)
As-of-2017	239,207	20,000	28,000
By-2020	650,000	50,000	70,000
By-2025	1,250,000	100,000	125,000

Demand for DC Fast Chargers (The Default Scenario)

	Total BEVs	Lower Estimate (Chargers)	Higher Estimate (Chargers)
As-of-2017	133,386	2,000	6,000
By-2020	350,000	5,000	13,000
By-2025	700,000	9,000	25,000

Electric Vehicle Infrastructure Deployment





Program Funding: \$64.6 M for infrastructure

Charging Outlets	Private	Public	Total
Installed	4,346	3,257	7,603
Planned	57	1,026	1,083
Total	4,403	4,283	8,686

California Electric Vehicle Infrastructure Project:

\$38.8 M for incentive projects



http://www.CALeVIP.org





All Public EV Charging in California



Current Operational Statewide (As of August 14, 2018)

4,540 public charging sites 16,640 public charging outlets

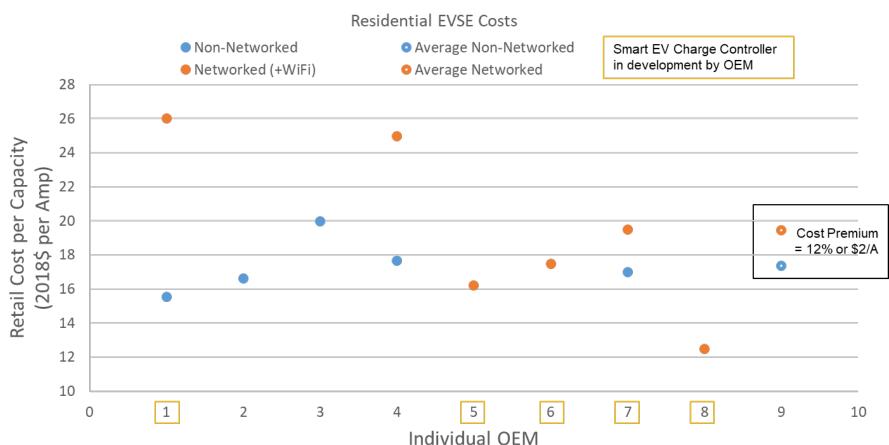
- Chargers in California
- Publicly Accessible
- Outlets by type:
 - o 465 Level 1 outlets
 - o 14,333 Level 2 outlets
 - o 1,842 DC Fast outlets



Map from US DOE Alternative Fuels Data Center https://www.afdc.energy.gov/fuels/electricity_locations.htm



Smart EVSE costs overlap with basic EVSE. Additional functions ensure cost-effective operations.

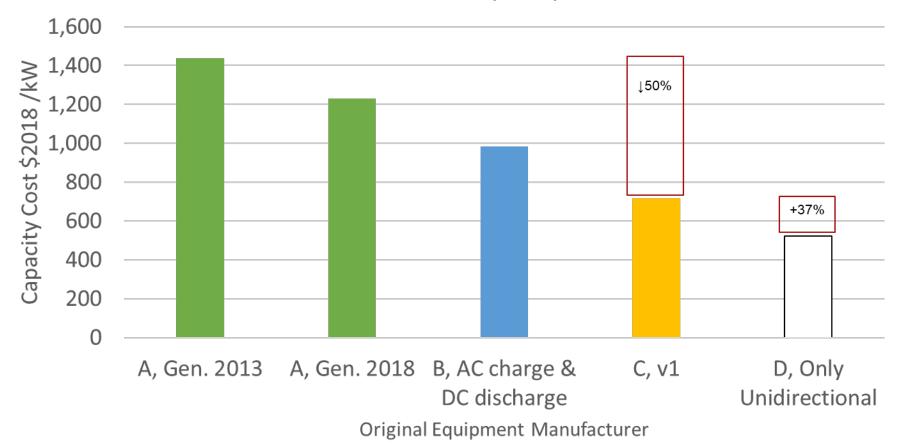


Incremental cost recovered in ~3 months of CA average EV driving with -\$0.10/kWh time-of-use arbitrage.

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Improving technology readiness of vehicle-to-grid charging equipment

Cost of Bidirectional (V2G) DC EVSE





Innovative charging systems are here (and more are coming)!









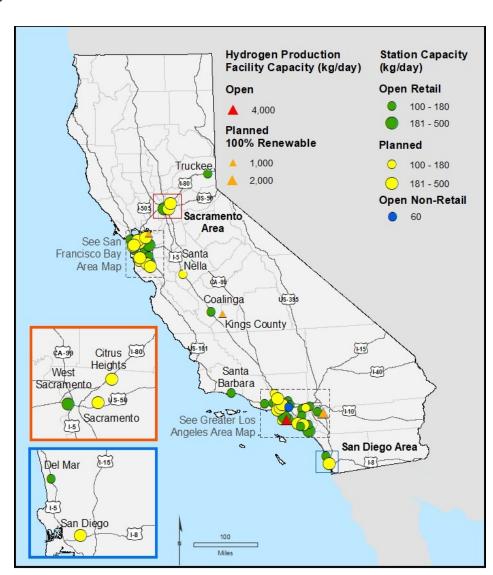


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Current Hydrogen Infrastructure Status

- 35 open hydrogen refueling stations
- 64 stations funded
- 3 renewable hydrogen production facilities funded







Electric Vehicle Charging Infrastructure

\$94.2 million

Proposed Allocation

76,000 – 128,000 chargers installed by 2025

(Expected to be installed under a business-as-usual scenario; from all sources)

Shortfall of 122,000 – 174,000 chargers expected by 2025

Estimated cost: \$963 million to \$2.89 billion

(In addition to currently planned and expected public and private investments)





Hydrogen Refueling Infrastructure

\$20 million

Proposed Allocation

Funding support for additional refueling stations

Complete initial network of up to 100 stations

Provide sufficient fueling capacity into 2022

Enable further FCEV sales throughout the state

Continued funding for Operations & Maintenance support





Manufacturing & Workforce Development for Zero-Emission Vehicle Infrastructure

\$8.5 million

Proposed Allocation

Support for ZEV infrastructure industry & workforce needs

Encourage new or expanded in-state manufacturing facilities

Goals Supported:

- Indirect support for other ARFVTP project types
- Equitable economic development





Low-Carbon Fuel Production and Supply

\$25 million

Proposed Allocation

Proposed funding source:

Greenhouse Gas Reduction Fund

Liquid and gaseous fuels (non-petroleum)

Focus on waste-based & renewable feedstocks

Pilot, demonstration, and commercial scale

Renewable hydrogen production

Biomass and renewable electricity feedstocks



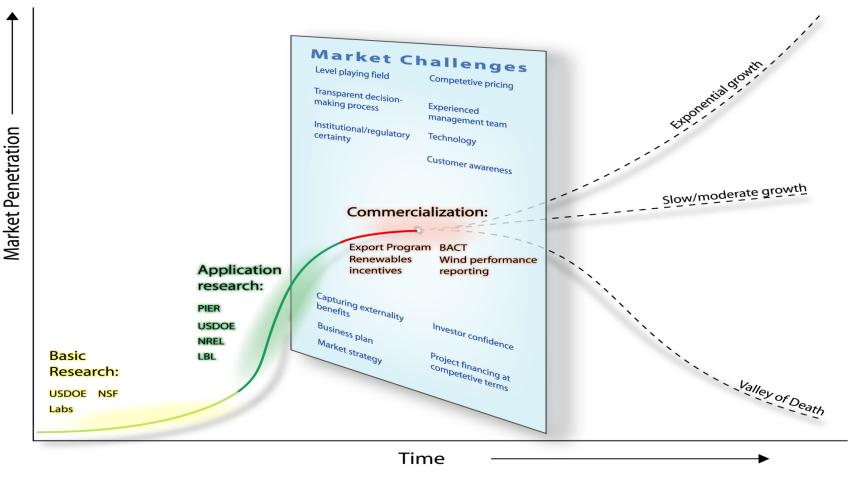
Low Rolling Resistance Tire Efficiency (AB 844)

Requires CEC to develop regulations:

- Rolling resistance reporting system for LDV tire manufacturers (Replacement tires) – rating system to compare fuel economy characteristics
- Adopt minimum fuel economy standards for tires (if feasible)
 - Technical feasibility/cost
 - Tire safety
 - Tire life
 - Tire recycling
- Estimated benefits
 - Gasoline fuel savings up to 300 million gallons per year
 - Up to 4% fuel economy improvement



Energy Technology Market Entry



California Energy Commission

CALIFORNIA ENERGY COMMISSION

