



Regulatory and Infrastructure Landscape

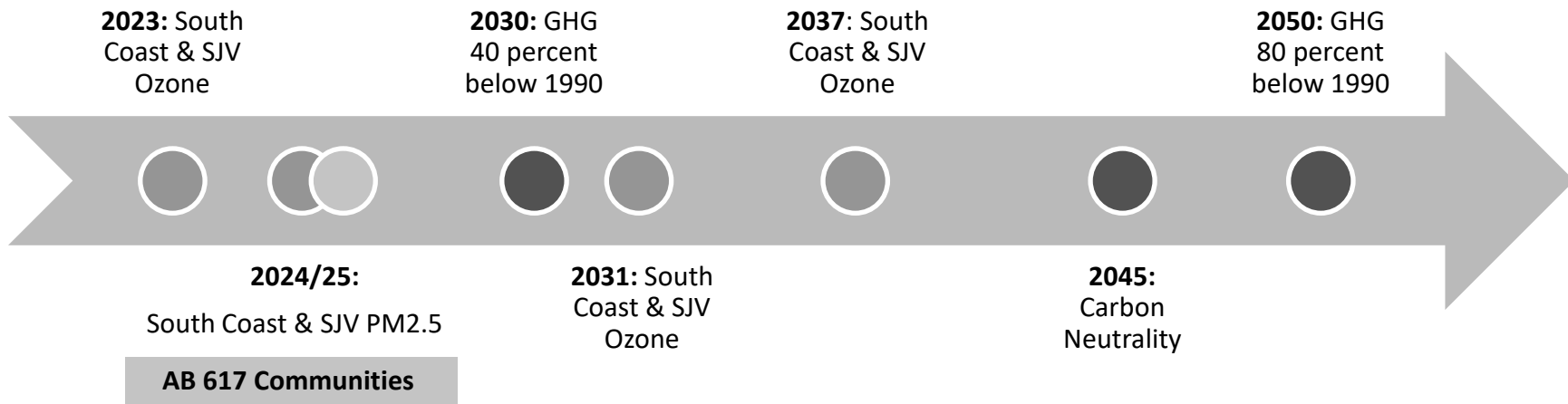
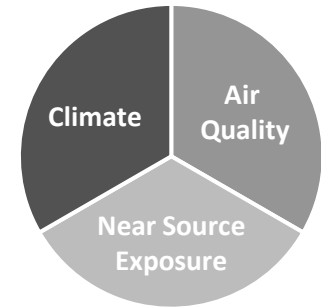
Analisa Bevan

California Air Resources Board

Overview

- California's goals and objectives
- Light-Duty ZEVs
- Medium- and Heavy-Duty ZEVs
- Infrastructure

Clean Air Goals



Disadvantaged Community Objectives

- Assembly Bill (AB) 617 directs CARB to identify community level strategies
- Communities seek action on transportation and freight emissions
- Seek rapid transition to zero-emissions



California Leading the Way for a Sustainable Future

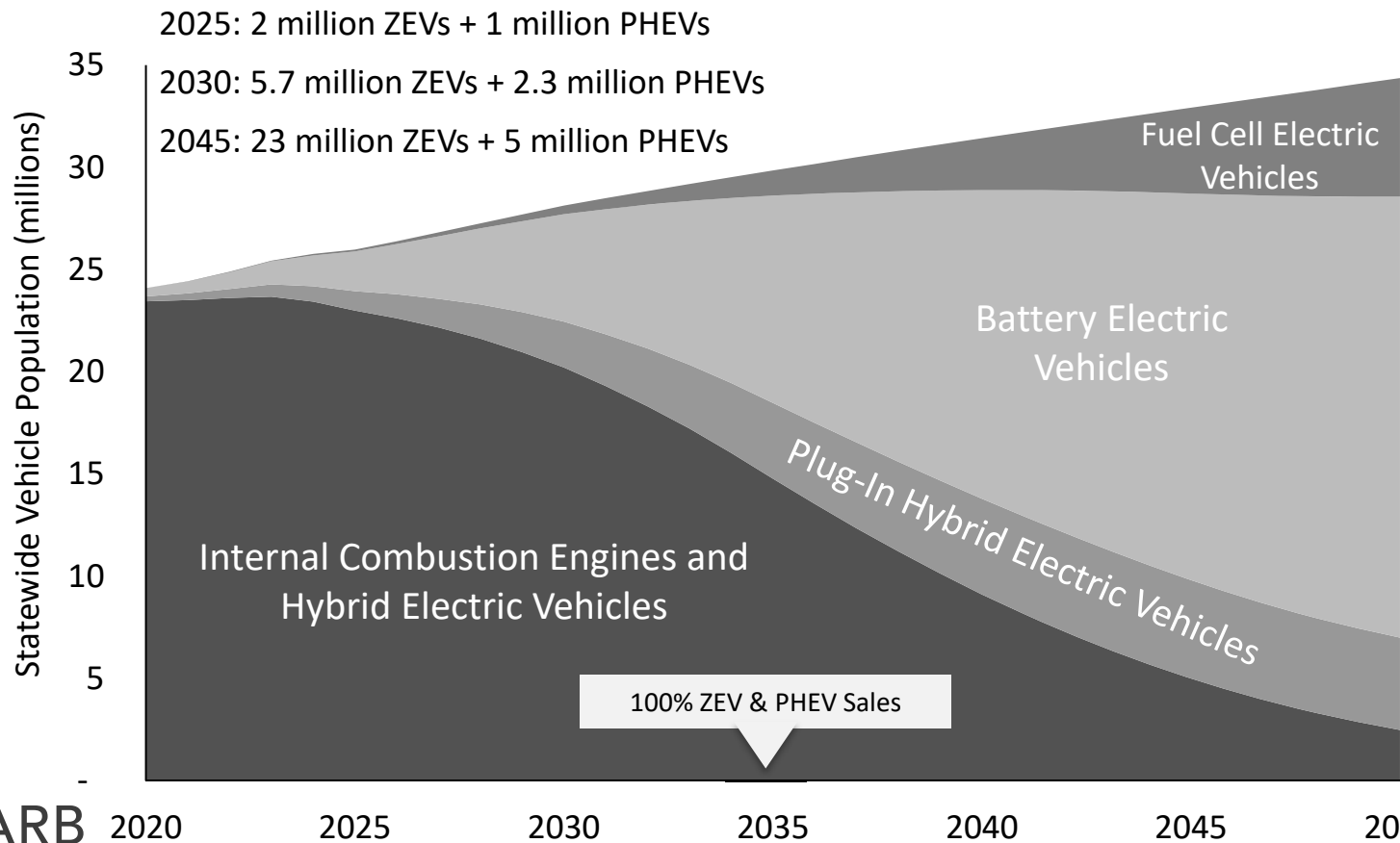
Governor Executive Order N-79-20

 **100% ZEV sales** by 2035

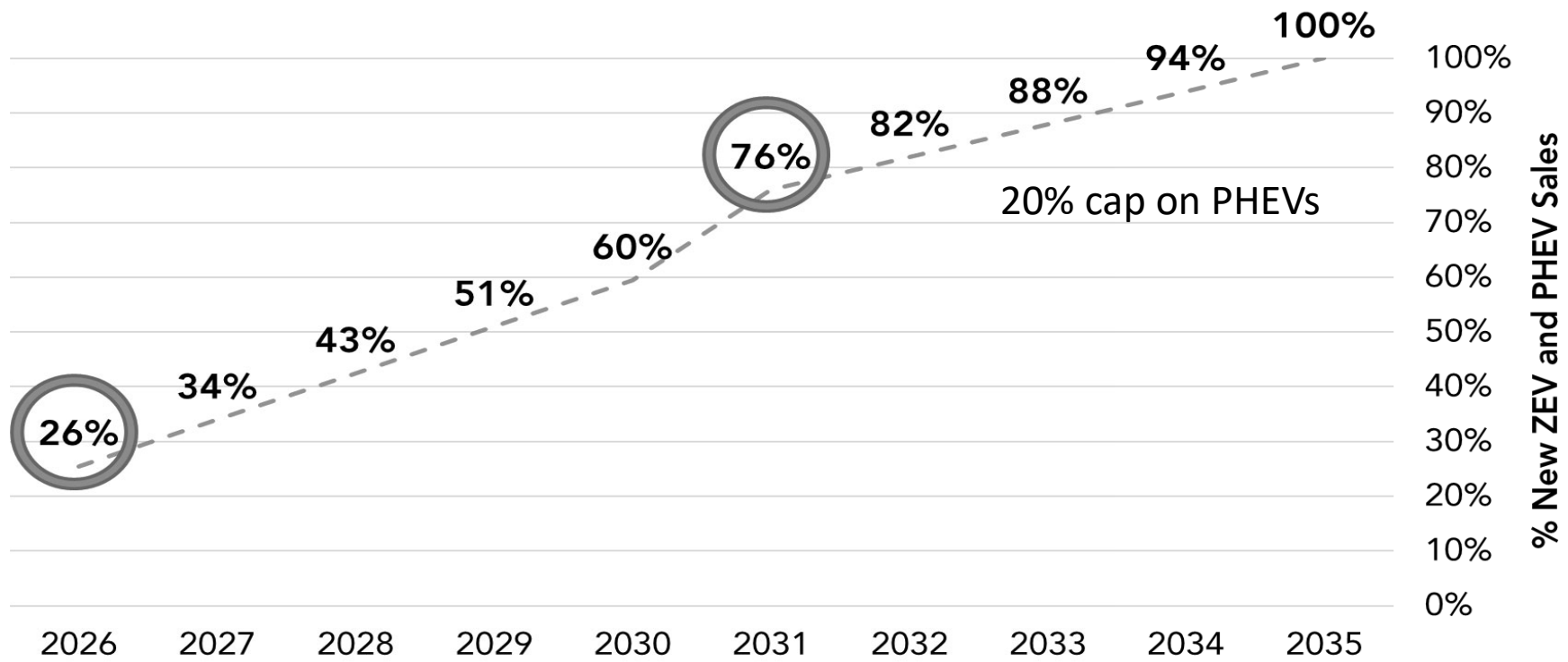
Full transition to
ZEV short-haul/drayage trucks 
by 2035

Full transition to **ZEV buses & heavy-duty long-haul trucks** 
by 2045*

California's Clean Car Future



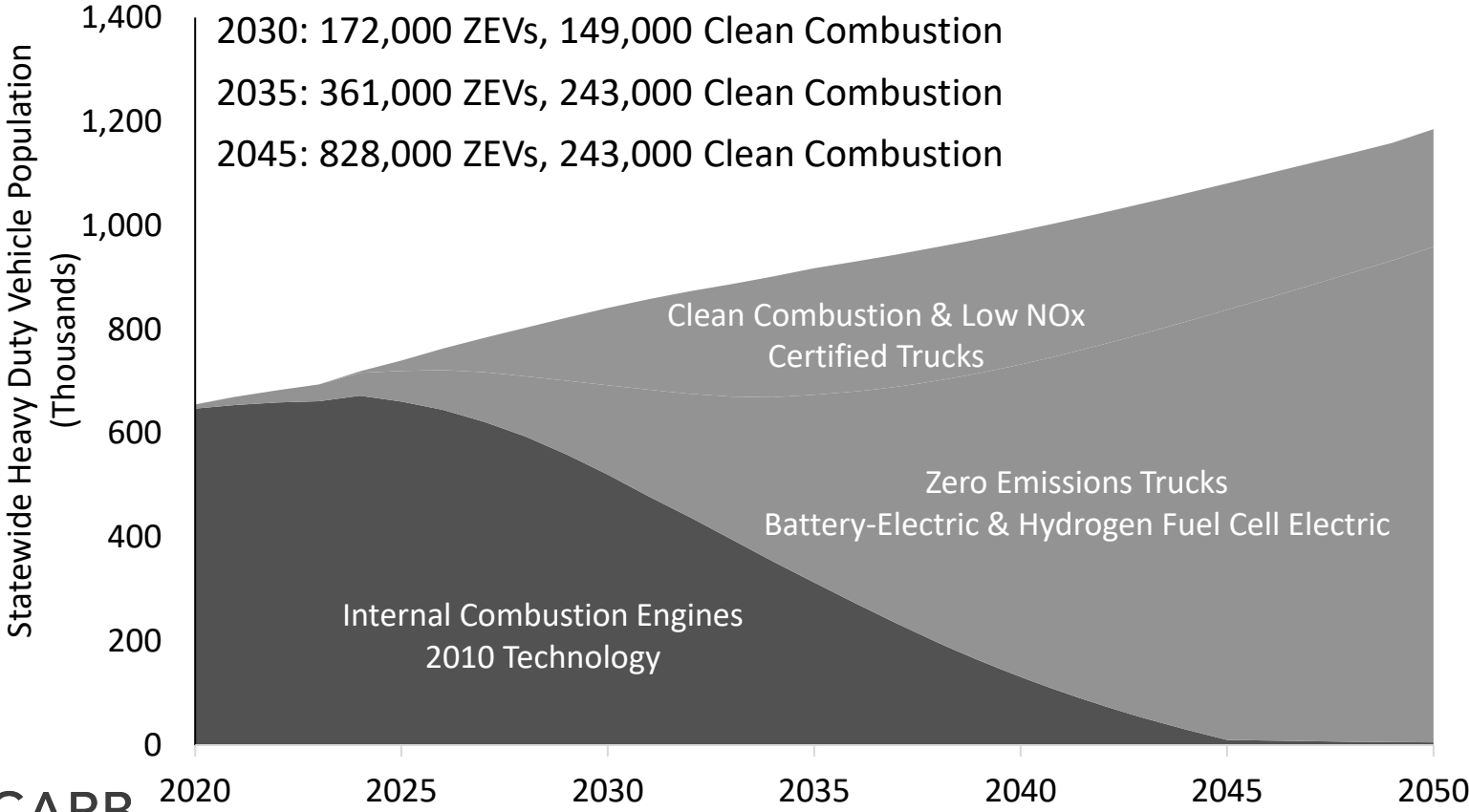
Advanced Clean Cars II: Proposed ZEV Regulation for MY26-35



Advanced Clean Cars II: Proposed Charging-Related Requirements

- BEVs
 - Minimum ~150-mile all-electric range (label)
 - Increase on-board charger from 3.3 kW to 5.76 kW
 - Require convenience cord capable of L1 and L2 charging
 - Require DCFC capability and inlet (CCS or adapter)
- PHEVs
 - Minimum 50-mile all-electric range (label)
 - Exploring increasing on-board charger size from 3.3 kW and L2 convenience cord

Future of California's Heavy Duty Trucks



Advanced Clean Trucks Rule

- The first-in-the-world zero emission truck rule
- Adopted by CARB in June 2020
- Will achieve
 - ~100,000 ZEVs by 2030
 - ~300,000 ZEVs by 2035



Proposed Advanced Clean Fleets rule

- Public Fleets
 - 50% of purchases 2024 – 2026
 - 100% of purchases starting 2027
- Drayage Trucks
 - All Class 7 and 8 drayage trucks operating at intermodal seaports or railyards to be full ZE by 2035
- High Priority Fleets

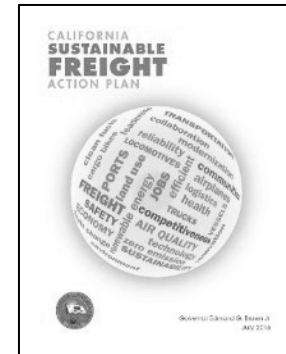
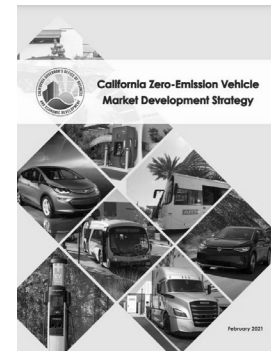
Zero-Emission Fleet Percentage	10%	25%	50%	75%	100%
Box trucks, vans, two-axle buses, yard trucks	2025	2028	2031	2033	2035
Work trucks, day cab tractors, three-axle buses	2027	2030	2033	2036	2039
Sleeper cab tractors and specialty vehicles	2030	2033	2036	2039	2042

Infrastructure

- Access
 - Multi-family homes
 - Truck parking
- Reliability
- Grid considerations
 - Grid capacity, need for upgrades, peak demand
 - Resiliency
- Timing
 - Time to install
 - Phased installation
- Cost
 - Variations in fuel costs
 - Availability of funding
- Hydrogen supply

CARB's Role

- Vehicle target setting
 - State SIP Strategy, Mobile Source Strategy, Scoping Plan
 - Regulations
- Planning
 - State SIP Strategy infrastructure summary
 - ZEV Market Development Strategy
- Facilitating
 - Coordination with agencies
 - Feedback loop





Thank you



California Energy Commission & Zero-Emission Infrastructure

September 24, 2021

Elizabeth John, Manager
Medium- and Heavy-Duty Zero Emission Technologies Office
California Energy Commission



EV Charging Infrastructure





Benefits to Californians - EVs

Cleaner
transportation

Grid-friendly
infrastructure

Convenience



Source: CEC, FreeWire Technologies, Beam Global



Scope of AB 2127 Assessment

	Road and Highway Electrification				Other EVs
Existing Chargers	<i>Counting Chargers</i>				
	Including in Low-income Communities (<i>SB 1000</i>)				
Future Chargers	<i>Electric Vehicle Infrastructure Projections (EVI-Pro 2)</i>	<i>Electric Vehicle Infrastructure for Road Trips (EVI-RoadTrip)</i>	<i>Widespread Infrastructure for Ride-hailing EV Deployment (WIRED)</i>	<i>Medium- and Heavy-Duty EV Infrastructure Load, Operation, and Deployment (HEVI-LOAD)</i>	<i>Off-Road, Port and Airport Electrification</i>
	Charging Hardware and Software (<i>Equipment Components, Standards, and Interoperability</i>)				
Make-Ready Electrical Equipment (<i>Community-Centric Plans, Building Codes, and Grid Evaluation</i>)					
Other Programs to Accelerate the Adoption of Electric Vehicles (<i>Incentives, Investments, and Others</i>)					



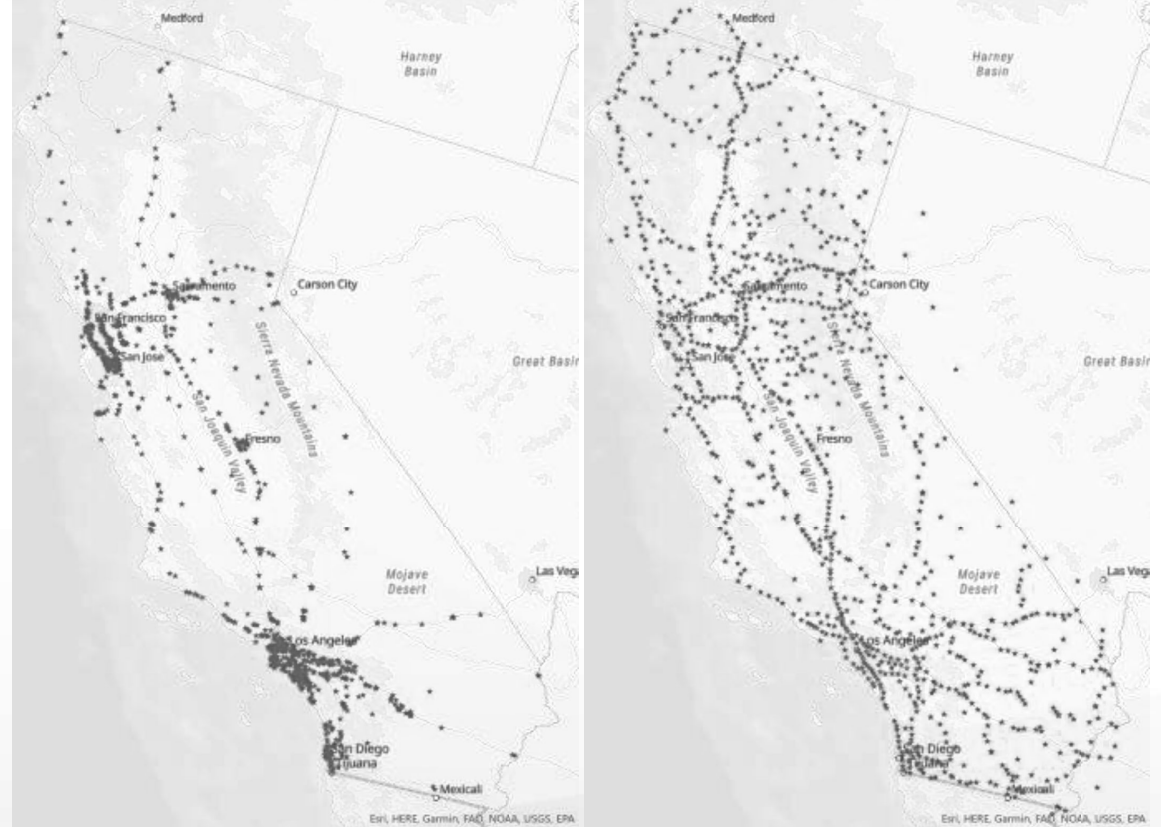
Modeling Approach

Inputs

- ✓ ZEV population (Hydrogen, pure battery electric, plug-in hybrid)
- ✓ Residential charging access
- ✓ Travel data
- ✓ Vehicle attributes by class
- ✓ Charger utilization

Outputs

- ✓ Number of chargers needed at statewide and countywide level
- ✓ Broken down by charger type and location type
- ✓ Statewide load profiles



Source: CEC, National Renewable Energy Laboratory, and Alternative Fuels Data Center

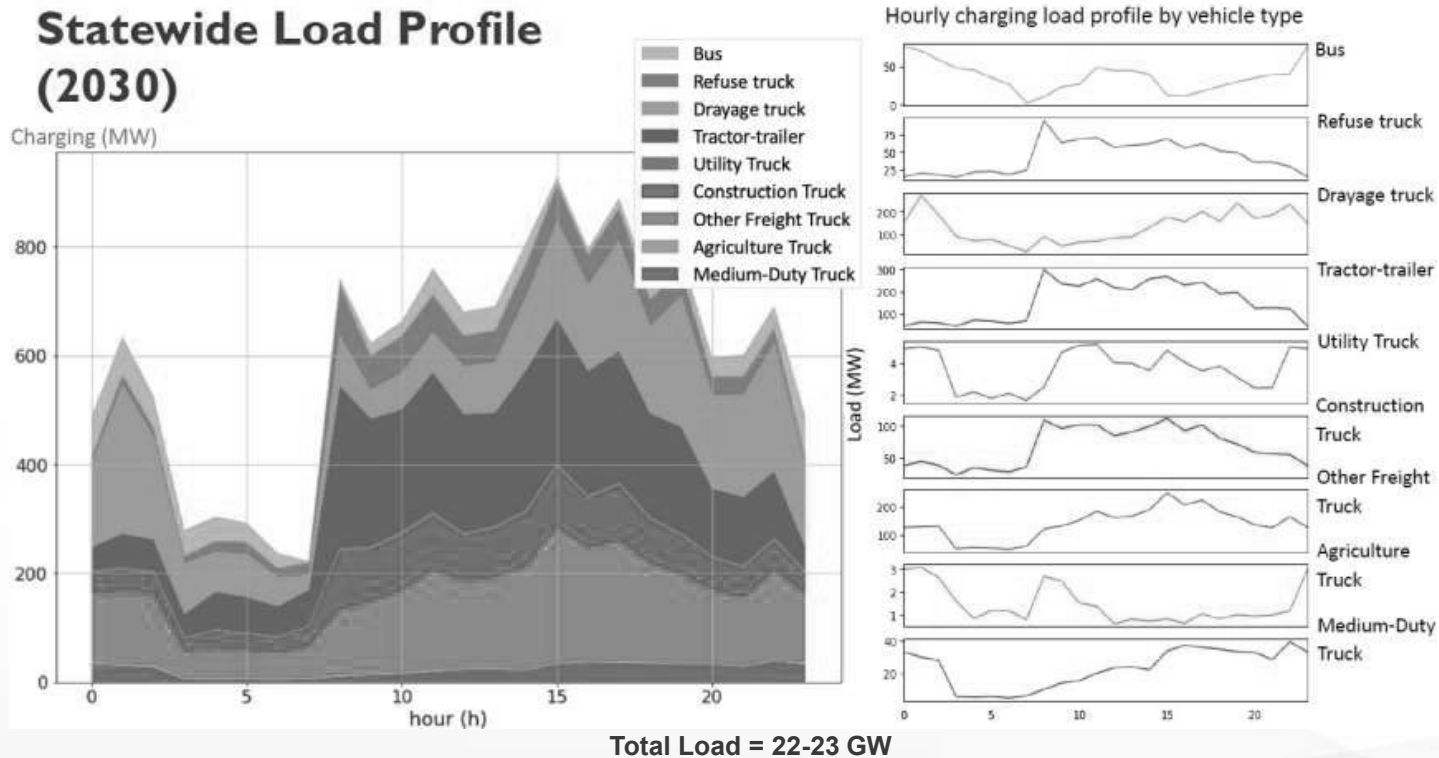


Medium- and Heavy-Duty Results

- **180,000** medium- and heavy-duty ZEVs in 2030 to achieve EO N-79-20 goals
- Modeling suggests **157,000** DC fast chargers needed
- Ongoing analysis will investigate higher charging power



Projected Load on the Grid: Medium- and Heavy Duty (HEVI-LOAD)

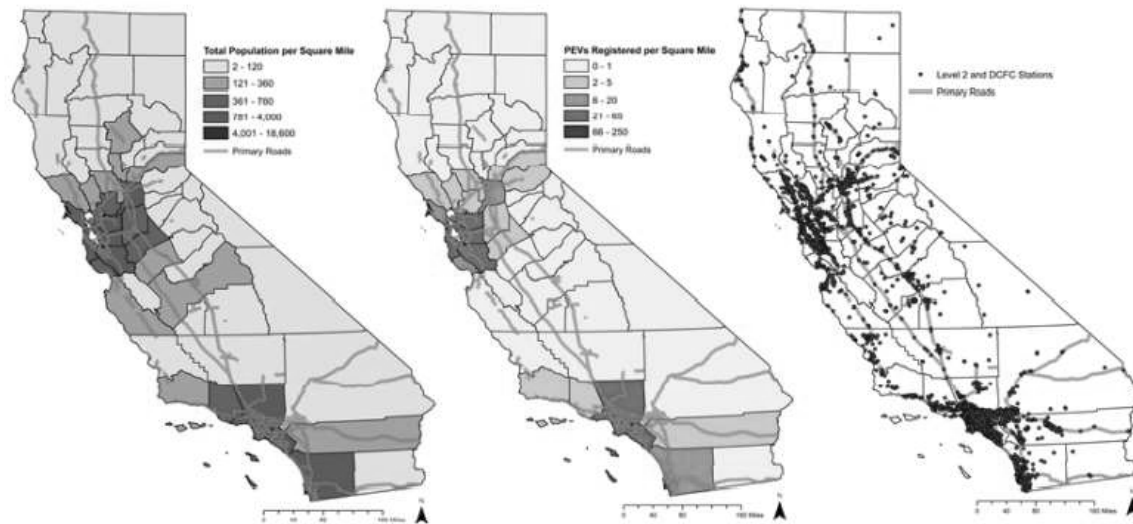


Projected 2030 load curve for medium- and heavy-duty on-road vehicles across major segments



SOUTH COAST AQMD

Figure 5: Population Density, PEV Density, and Public Chargers by County



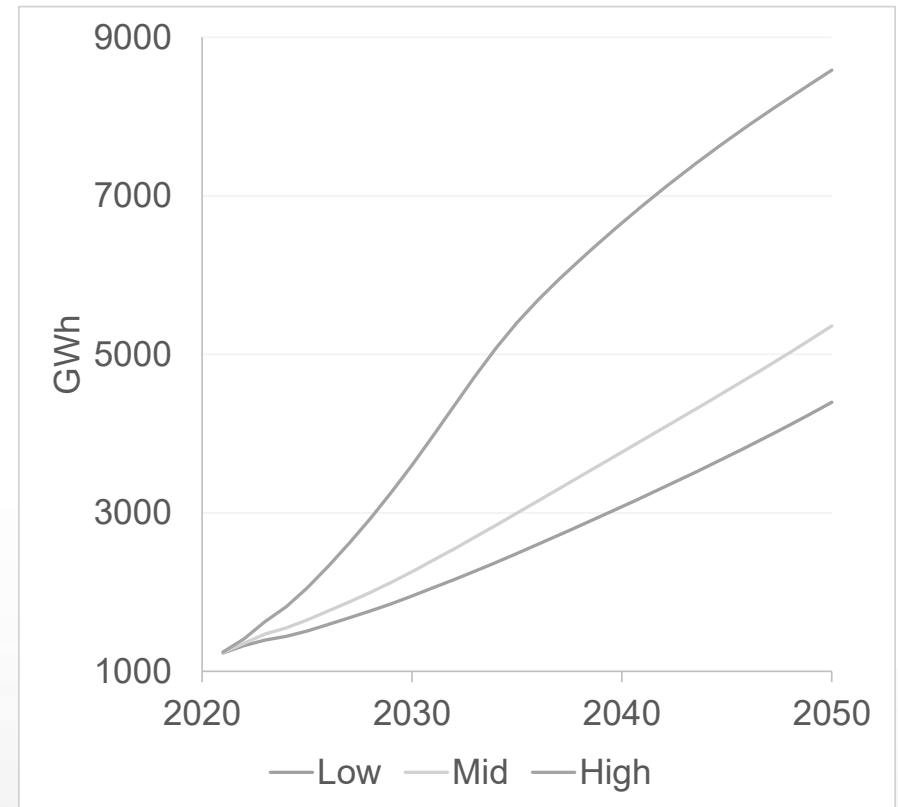
At the county level, existing chargers are generally found in areas with high concentrations of people and PEVs, particularly those in the Bay Area and South Coast.

Source: CEC



Off-Road Electrification

- Preliminary update to off-road electricity demand forecast projects significant growth
 - ~7x increase by 2050 in high case, which reflects N-79-20 targets
- Upcoming analysis will discuss off-road charging challenges



Annual off-road electricity demand

Source: CEC



Beyond Charger Numbers

- Focus on Equity
- Local “best-fit” solutions
- Financing innovations and continued public support
- Vehicle-grid integration
 - Bidirectional charging
- Standard connectors and communications
 - Convenience
 - Grid-friendly charging



Source: Ford Motor Company



Hydrogen Refueling Infrastructure



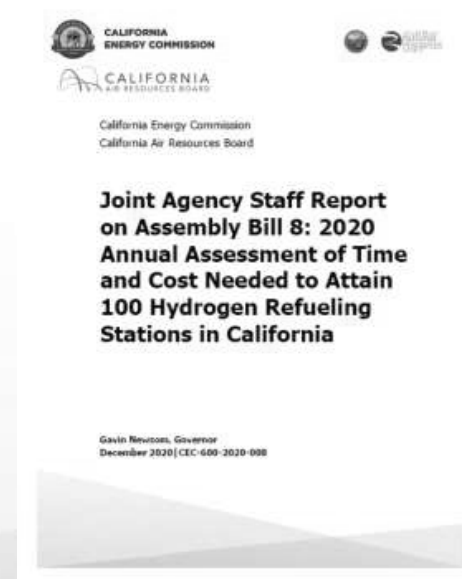
AB 8 Reporting Requirements

The “Annual Evaluation” prepared by the California Air Resources Board (CARB) each summer



https://ww2.arb.ca.gov/sites/default/files/2020-09/ab8_report_2020.pdf

The “Joint Report” prepared by the Energy Commission and CARB each winter

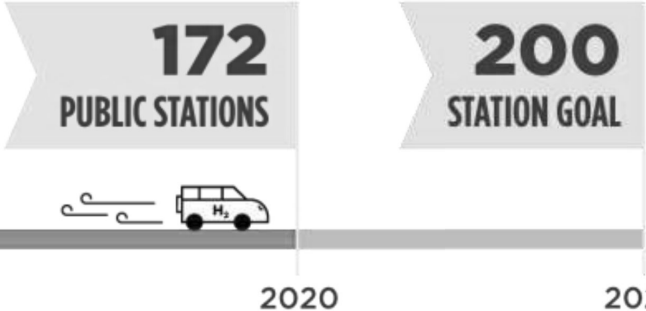


<https://ww2.energy.ca.gov/2020publications/CEC-600-2020-008/CEC-600-2020-008.pdf>



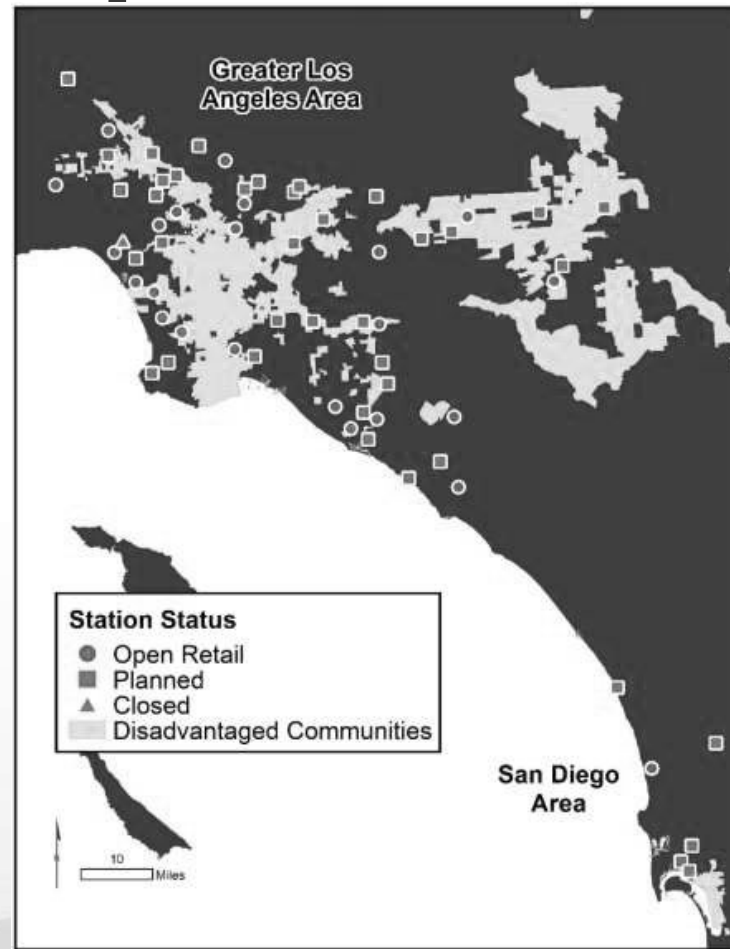
Key California ZEV Policy Goals

Progress Report
200 Hydrogen Fueling Stations by 2025





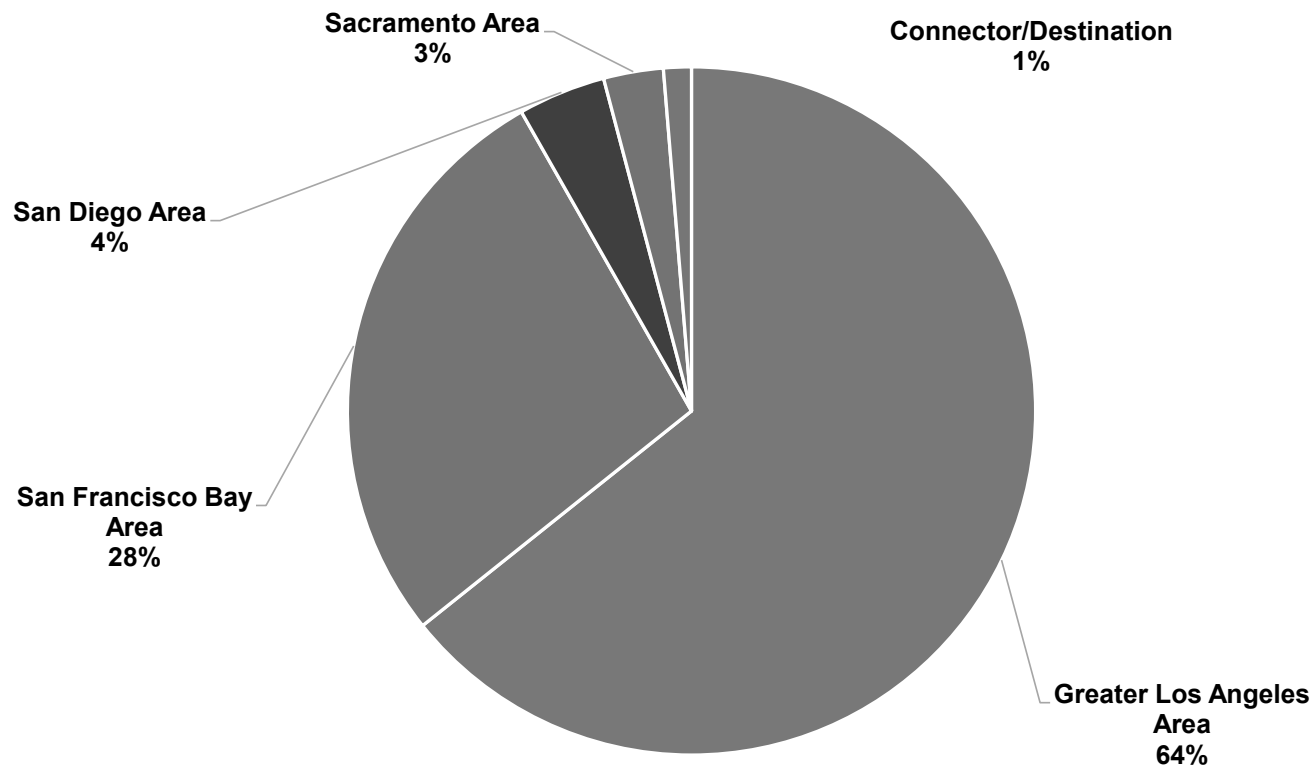
Greater Los Angeles Area Station Map



Source: California Energy Commission staff



Percentage of Hydrogen Dispensing in Each Region



Source: 2020 AB 8 Joint Agency Staff Report



Regional Projection for Fuel Demand by 2026

Region	Projected # of FCEVs in 2026	H2 Needed for Projected FCEVs in 2026 (kg/day)	H2 Capacity of Stations in 2026 (kg/day)	Additional # of FCEVs That Stations Could Support in 2026
Greater Los Angeles Area	22,700	15,900	40,800	35,600
San Francisco Bay Area	15,700	11,000	21,900	15,600
Sacramento Area	1,900	1,300	2,300	1,400
San Diego Area	2,600	1,800	5,700	5,600
Remainder of the State	6,000	4,200	600	(5,100)
Total	48,900	34,200	71,300	53,100



Network Capacity

- Network capacity of the 46 stations is nearly 15,000 kilograms per day
- Enough to support nearly 21,500 light-duty FCEVs
- 45 planned stations will add nearly 53,500 kilograms per day of capacity
- When all these stations are open, the network will have enough capacity to support nearly 98,000 FCEVs, more forecasted fueling capacity than the forecasted need in 2026



Clean Transportation Program MD/HD Hydrogen Funding



ENERGIZE
COMMERCIAL VEHICLES

- Energy Infrastructure Incentives for
- Zero-Emission Commercial Vehicles

Recipient Name	Purpose	Dollar Amount	Nameplate Capacity
Equilon Enterprises LLC	Renewable hydrogen fueling station for freight at the Port of Long Beach	\$8,000,000	1,000 kg/day station
North County Transit District	North County Transit District Next Generation Hydrogen Fueling Infrastructure Project	\$4,013,750	Unknown, still designing
Sunline Transit Agency	Liquid hydrogen refueling infrastructure for transit buses	\$4,986,250	~1680kg/day station
Alameda Contra-Costa Transit District	Division 4 Hydrogen Fueling Infrastructure Upgrade	\$4,565,975	Unknown at this time
Center for Transportation and the Environment	NorCAL Drayage Truck Project	\$9,185,045	3,000 kg storage 1,600 kg/day station
Equilon Enterprises LLC	Shell Multi-Modal Hydrogen Refueling Station (at the Port of West Sacramento for Sierra Northern Hydrogen Locomotive Project)	\$4,000,000	1,450 kg/day station



Funding





2020 Solicitations and Awarded Projects

GFO #	Title	Total Amount
GFO-20-601	Blueprints for MD/HD Zero-Emission Vehicle Infrastructure	~\$8 million (\$7,954,105)
GFO-20-602	Zero-Emission Transit Fleet Infrastructure Deployment	~\$36.2 million
GFO-20-603	Block Grant for MD/HD Zero-Emission Refueling Infrastructure Incentive Projects	\$17 million (\$50 million total*)
GFO-20-604	Hydrogen Fuel Cell Demonstrations in Rail and Marine Applications at Ports (H2RAM) (Joint project with ERDD)	\$4 million
GFO-20-605	BESTFIT Innovative Charging Solutions	~\$8 million
GFO-20-606	Zero-Emission Drayage Truck and Infrastructure Pilot Project (Joint solicitation with the CA Air Resources Board)	\$44.3 million CEC (~\$108.2 M total)
GFO-20-610	Vehicle-Grid Innovation Lab (ViGIL)	\$2 million



Future Funding

CEC ZEV Infrastructure Package - dollars in millions				
	2021-22	2022-23	2023-24	Total
Drayage Trucks	\$ 85.0	\$ 85.0	\$ 80.0	\$ 250.0
Drayage Truck & Infrastructure Pilot Project	\$ 25.0	-	-	\$ 25.0
Transit Buses	\$ 30.0	\$ 30.0	\$ 30.0	\$ 90.0
School Buses	\$ 20.0	\$ 15.0	\$ 15.0	\$ 50.0
ZEV Manufacturing Grants	\$ 125.0	\$ 125.0	-	\$ 250.0
ZEV Infrastructure	\$ 500.0	-	-	\$ 500.0
Total CEC ZEV Infrastructure Package	\$ 785.0	\$ 255.0	\$ 125.0	\$ 1,165.0



Thank you

Contact Information:

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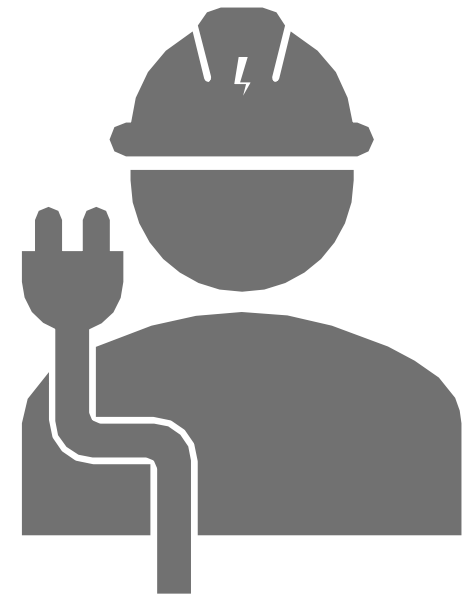
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Role of Electric Utilities in Medium/Heavy-Duty Transportation Electrification

Yuliya Shmidt, Advisor to
Commissioner Rechtschaffen

California Public Utilities
Commission

09-24-21



Outline

Utility Transportation
Electrification Programs

Electric Vehicle Rates

Interconnection and Planning for
New Load

Additional Policy Considerations

Utility Transportation Electrification Programs



Role of California Public Utilities Commission and Utilities

CPUC regulates investor-owned electric utilities (IOUs)

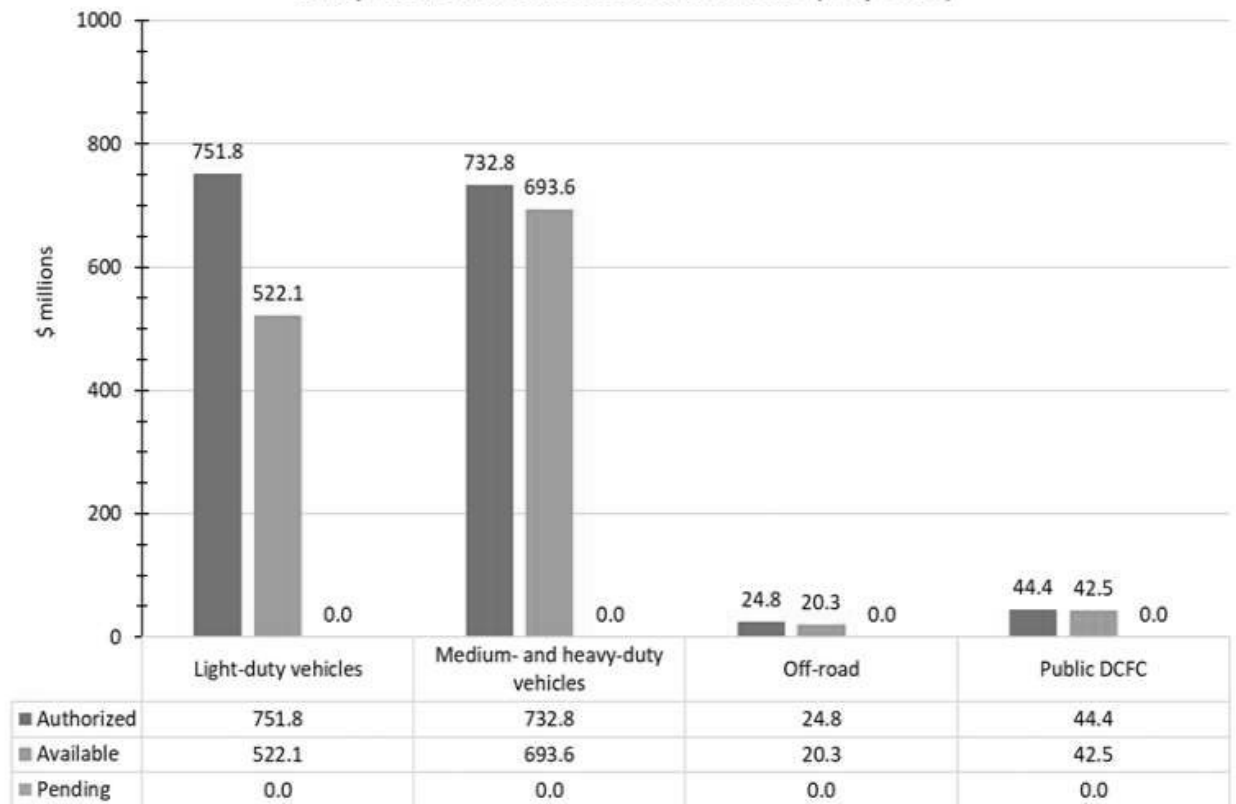
- Provide 78% of Californians with transmission and distribution infrastructure
- Provide half of Californians with electricity
- Regulated utilities are:
 - Large IOUs: PG&E, SCE, SDG&E
 - Small IOUs: Liberty, PacifiCorp, Bear Valley

Utilities have an “obligation to serve”

CPUC must ensure utilities charge “just and reasonable rates” and provide safe and reliable service

CPUC has authorized over \$1.5B in utility investment across dozens of programs of which ~18% have been spent

Transportation Electrification Investments (May 2021)



Medium and Heavy-Duty (MD/HD) Infrastructure Programs

PG&E and SCE MD/HD Programs (Decision 18-05-050, May 2018)

- \$600 million for programs targeting school buses, forklifts, transit agencies and other market segments
- Between 25% and 40% of funds invested in disadvantaged communities

SDG&E MD/HD Programs (Decision 19-08-026, Aug 2019)

- \$107 million to electrify approximately 3,000 medium and heavy-duty vehicles
- At least 30% of funds invested in disadvantaged communities

Near Term Priority Investments (Decision 21-07-028, July 2021)

- Creates expedited approval process for new utility programs of up to \$20 million each
- Designates medium and heavy-duty TE as a priority category for investment
- At least 50% of funds must be spend in underserved communities

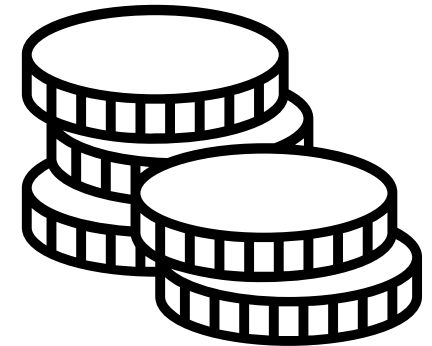


Transportation Electrification Rates

California Public Utilities Commission

Rate Design: a Crucial Component of TE

- EV rates should accomplish two goals: accelerate TE adoption and incentivize beneficial charging behavior
- Fuel cost savings motivate EV adoption
 - SB350 mandates that EV rates reduce consumer costs compared to conventional fuels
 - Time-of-use (TOU) rates provide fuel cost savings for customers that charge off-peak
- Rates can be time-differentiated, include fixed charges, and be based not just on volumetric use (kWh) but also highest monthly demand (kW)
 - Electric rates can be designed in a variety of ways to uphold policy principles
 - Avoid cross-subsidies
 - Be based on actual grid costs
 - Provide financial incentive for when to charge, and when not to charge, based on grid reliability and GHG conditions



Electricity is Often Cheaper than Gasoline

IOU Territory	PG&E/SCE	SDG&E
Off-peak residential EV charging rate (\$/kWh)	\$ 0.13	\$ 0.24
EV fueling is roughly equivalent to (\$/gal)	\$ 1.12	\$ 2.07
% difference to charge EV than to fuel with gas	-72%	-48%
Total monthly EV fueling cost	\$ 45.50	\$ 84.00
Total monthly gasoline fueling cost	\$ 162.34	\$162.34

Rate Designs Vary by Type of Customer

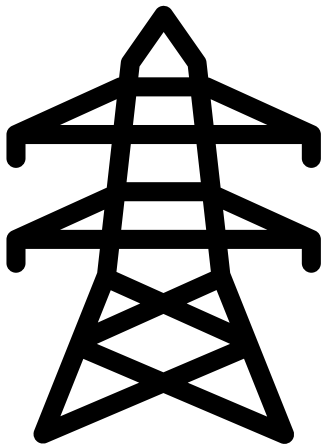
- Residential charging may be best served with a simple rate such as time-of-use
- Commercial medium/heavy-duty customers and fleet operators may need a more refined rate design such as a dynamic rate that both deters grid impacts and allows for fuel cost savings
- SB1000 (Lara, 2018) requires reconsideration of demand charges
 - Demand charges are assessed to commercial and industrial electric customers based on their highest demand of the month. The charge is intended to compensate the utility for distribution grid costs caused by the customer
 - For some types of customers, demand charges are a large proportion of their monthly bill
 - CPUC has approved restructured EV demand charges for each large utility

Utility MD/HD EV Rates

- PG&E commercial EV Rate (CPUC Decision 19-10-055, November 2019)
 - Subscription-based EV rate design for commercial and industrial customers, similar to cell phone bills
 - Includes transit fleet operators, owners of electric delivery trucks and providers of public charging stations
 - Include time-of-use volumetric energy charges that encourage customers to charge off-peak
 - SCE's commercial EV rate (Decision 18-05-040, May 2018) offers a five-year demand charge "holiday" to promote EV investment for public transit and other fleets
 - SDG&E's commercial EV rate (Decision 20-12-023, December 2020) is a subscription-based rate similar to PG&E

Interconnection and Planning for New Load

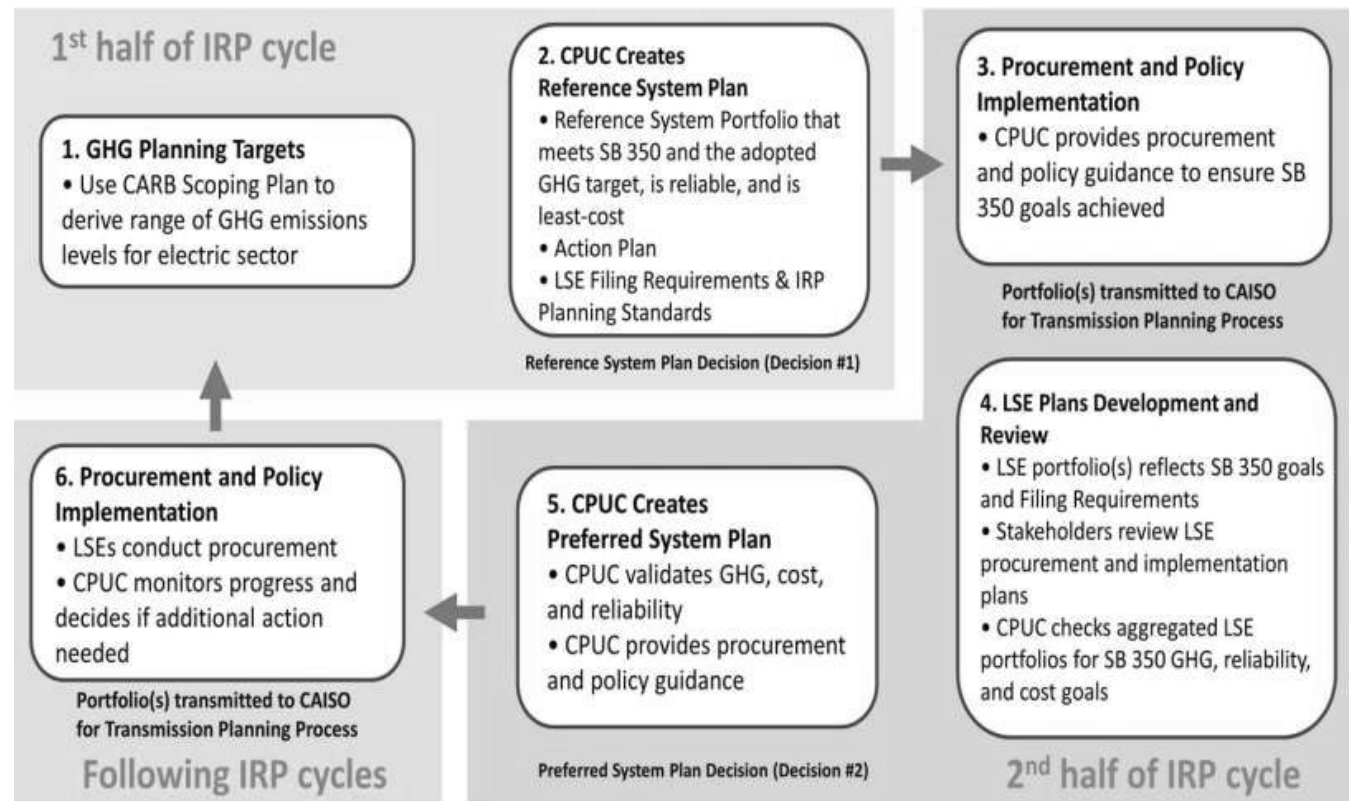
Transmission and Distribution for New Load



- **New interconnection requests**
 - New EV customers may request service under a new account or request expanded service under their current account
 - Utilities may need to study the proposed new load to determine if circuit upgrades or other work is necessary
 - CPUC has issued draft resolutions implementing AB841 (Ting, 2020) which ensure that in most cases EV customers will not pay for distribution upgrades for TE load
- **Distribution planning**
 - CPUC has launched a new Rulemaking to study and plan for future new load with a focus on TE
- **Transmission planning**
 - The California Independent System Operator studies the electric grid biannually -- using a demand forecast that incorporates TE -- to determine if new transmission is necessary

Ensuring Sufficient Generation Capacity for New Load

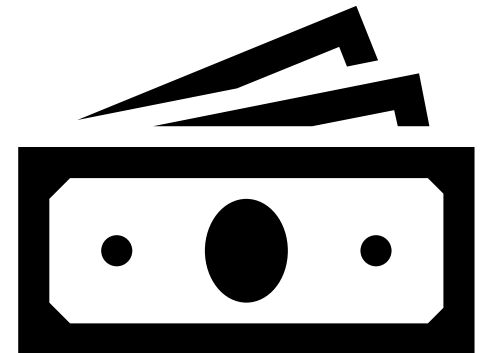
CPUC plans for new generation using a complex ten-year process, Integrated Resource Planning (IRP)



Additional Policy Considerations

Who Pays for Utility TE Costs?

- Utility costs generally receive one of two ratemaking treatments
- Costs can be treated as expenses
 - Ratepayers pay the costs as they are incurred, without interest
 - Typically used for non-capital investments such as operations and maintenance of facilities, programmatic and administrative costs
- Costs can be placed into ratebase
 - Costs are treated as long-term assets for which ratepayers repay the utility over time, with interest
 - Typically used for “steel in the ground” investments such as transmission and distribution infrastructure, generation facilities
- However, TE investments lead to higher electric sales which can drive down rates



Equity

- Governor Newsom's Executive Order N-79-20 prioritizes TE accessibility for disadvantaged and low-income communities
- CPUC's Environmental and Social Justice Action Plan, adopted February 2019, established agency goals including improving outreach and public participation, promoting economic and workforce opportunities, and improving access to services and programs
- CPUC-approved programs direct investment to disadvantaged communities as defined by CalEnviroScreen, which considers pollution levels, income and other socio-economic factors



Vehicle Grid Integration: crucial to TE development

VGI is an umbrella term for a host of measures and behaviors that better integrate EV charging with the electric grid

- VGI: smart charging (i.e. charging that is responsive to TOU or dynamic price signals)
- Vehicle-to-Grid (V2G): vehicle batteries feeding power back to the grid
- Vehicle-to-Home (V2H) or Vehicle-to-Load (V2L): vehicle batteries providing power to home or other customer electric load for example during power outages



Benefits of VGI

Reduce grid impact or even create grid benefit from additional electric load.

Deliver grid services by providing power back to the grid during needed times

Reduce customer cost of charging by allowing drivers to employ managed charging

Reduce customer cost of ownership by allowing drivers to earn revenue from their cars.



California Public Utilities Commission

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ZEV Market Development

(a team sport)

September 24th, 2021

Tyson Eckerle
Governor's Office of Business &
Economic Development (GO-Biz)



Executive Order N-79-20

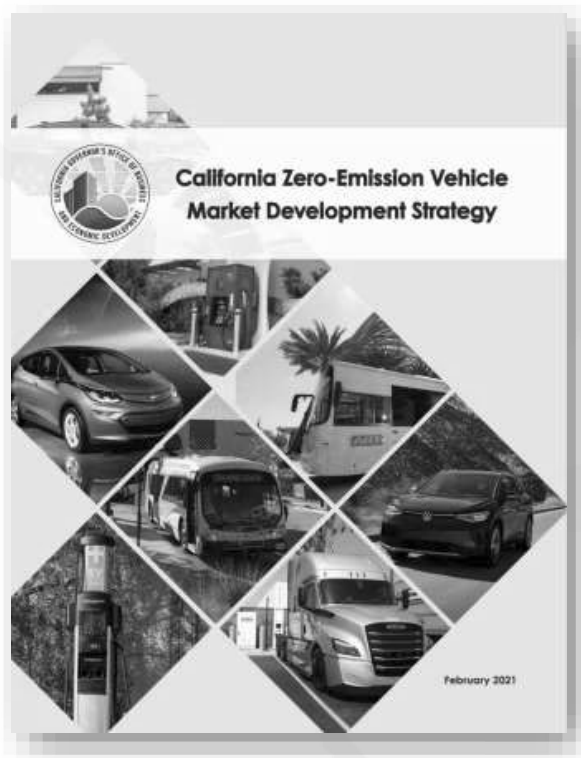


Sets three crucial goals for the ZEV Market:

1. 100% of in-state sales of new passenger cars and trucks will be zero-emission by 2035.
2. 100% zero-emission medium and heavy-duty vehicles in the State by 2045 where feasible and by 2035 for drayage trucks.
3. 100% zero-emission off-road vehicles and equipment by 2035, where feasible.



ZEV Strategy Overview



ZEV Strategy Website

Advantages ▾ Industries ▾ Newsroom About ▾ Apps Search

Zero-Emission Vehicle Market Development Strategy

The ZEV Market Development Strategy is meant to help California collectively move forward and deliver zero-emission benefits to all Californians. It outlines how state agencies and stakeholder groups key to our transition can move together with the scale and speed required to reach the state's ZEV targets:

100 % of in-state sales of new passenger cars and trucks will be zero-emission by 2035.	100% of medium- and heavy-duty vehicles in the State will be zero-emission by 2045 and by 2035 for drayage trucks.	100% of off-road vehicles and equipment will be zero-emission by 2035.
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The ZEV Strategy is a living document that will adapt overtime based on feedback and lessons learned. If you have questions or feedback, please email us.

ZEV Market Development Strategy Executive Order N-79-20

ZEV Market Development Strategy Webinar Sign-Up for ZEV Strategy Implementation Updates

1. Public ZEV Strategy Website

- Latest information; document repository
- Progress and metrics tracking

2. ZEV Strategy Document

- Guiding document: principles, objectives, direction
- Updated at least every 3 years

3. Annual State Agency Action Plans

4. Annual Pillar Priority

- Pillar Priorities Implementation Framework
- Equity Engagement & Implementation

<https://business.ca.gov/industries/zero-emission-vehicles/zev-strategy/>



State Agency Action Plans



1. Public ZEV Strategy Website

- Latest information; document repository
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3. Annual State Agency Action Plans

4. Annual Pillar Priority Action Plans

- Equity Engagement & Implementation
- Multi-Pillar Action Plan



A little summary

- SCAQMD → Implementation/Investment
- CARB → Create Market Certainty
- CEC → Infrastructure Planning and Investment
- CPUC → Infrastructure System Interconnection
- GO-Biz → Coordination

- All (including you) → Problem Solving



What's Needed Going Forward?

Relentless focus on End Users



Scale, with a focus on Equity.

Getting there takes all of us.





CALIFORNIA
Governor's Office of Business
and Economic Development

Thank You!

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