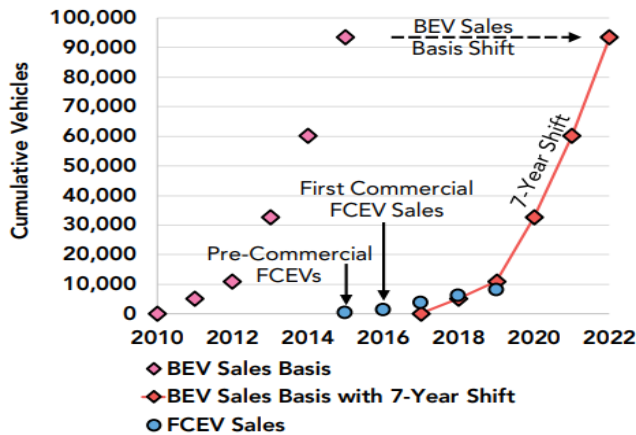


CA ZEV Policy – HYDROGEN

“California’s Assembly Bill 8 (2013 Clean Transportation Reauthorization) has been a central driving force in the development of an in-state hydrogen fueling network for light-duty Fuel Cell Electric Vehicles (FCEVs)¹”

– California Air Resources Board

FIGURE ES 5: ANALYSIS OF HISTORICAL FCEV AND BEV EARLY-MARKET DEPLOYMENT RATES



In its 2020 Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Development, the Air Resources Board found the adoption rates of light-duty fuel cell vehicles is on par with the early battery electric vehicle market.

Fuel cell electric vehicles were first broadly available to California consumers in 2016 and are currently in the earliest adoption phase.² Today there are more than 9,000 light-duty fuel cell electric vehicles on the road and 46 hydrogen stations in operation. The ARB’s Mobile Source Strategy estimates 25% of light-duty ZEVs will be fuel cells based on “a subset of the vehicle market that will still require frequent and fast refueling, particularly in larger vehicle classes”.³

A poll, conducted by David Binder Research in San Francisco for the California Hydrogen Coalition, found that:

- 56% of those not interested in a zero-emission vehicle indicated interest for a “zero emission vehicle which can be refueled in 3-5 minutes at a local gas station.”
- 3 out of 4 (or 74%) of those polled are favorable on fuel cell electric vehicles.
- Public support for fuel cell electric vehicles is based primarily on quick refueling times (71%), larger vehicle capacity (65%) and vehicle range (58%).
- 83% of those polled who own a zero-emission vehicle also own a gasoline vehicle. Two vehicles are not a practical option for all households and this demonstrates the value proposition of a zero-emission technology that aligns closely with the advantages of gasoline vehicles.

¹ Page 6, [Hydrogen Station Network Self-Sufficiency Analysis per Assembly Bill 8](#)

² Page XX, [2020 Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Development](#)

³ p 87, April 23, 2021 revised draft of the [ARB 2020 Mobile Source Strategy](#)

Background

The Clean Transportation Program was created by the Legislature in 2008 with the goal of providing funding to develop and deploy innovative technologies that transform California’s fuel and vehicle types to help attain the state’s climate change policies. The emphasis of this program “shall be to develop and deploy technology and alternative and renewable fuels in the marketplace, without adopting any one preferred fuel or technology.” To date, program investments have largely prioritized charging infrastructure.

**Figure ES-1: Clean Transportation Program Funding by Fuel Type as of March 1, 2019
(in Millions)**

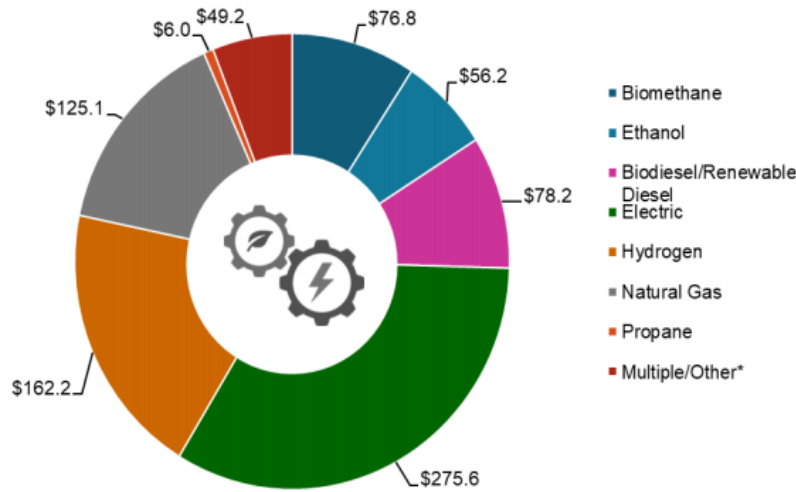


Figure 1 2019-2020 Investment Plan Update for the Clean Transportation Program

Table 5: Investment Plan Allocations for FY 2020-2021 and Subsequent Fiscal Years (in Millions)

Category	Funded Activity	2020-2021	2021-2022	2022-2023	2023	Total
Zero-Emission Vehicles and Infrastructure	Light-Duty Electric Vehicle Charging Infrastructure and eMobility	\$41.7	\$30.2	\$10.0	-	\$81.9
Zero-Emission Vehicles and Infrastructure	Light-Duty Electric Vehicle Charging Infrastructure and eMobility	\$51.0*	-	-	-	\$51.0
Zero-Emission Vehicles and Infrastructure	Medium- and Heavy-Duty Zero-Emission Vehicles and Infrastructure	\$20.0	\$30.0	\$52.2	\$27.6	\$129.8
Zero-Emission Vehicles and Infrastructure	Public Hydrogen Fueling Infrastructure	\$20.0	\$20.0	\$20.0	\$10.0**	\$70.0

Table 1- 2020-2021 Investment Plan Update for the Clean Transportation Program⁵

⁴ Page 2, [2019-2020 Investment Plan Update for the Clean Transportation Program](#)

⁵ Page 27, [2020-2023 Investment Plan Update for the Clean Transportation Program](#)

Since the program's inception in 2008 and through its sunset in 2023, the Clean Transportation Program will have provided a total of \$252 million for the development of predominately light-duty hydrogen fueling infrastructure.⁶ This investment is a direct result of the 2013 reauthorization of the Clean Transportation Program which required 20% of program dollars be allocated "until there are at least 100 publicly available hydrogen-fueling stations in operation in California." Executive Order B-48-18 essentially increased that target to 200 fueling stations.

This has resulted in:

- \$284M in private sector investment for the development of 179 hydrogen stations by 2027.⁷
 - Includes 13 stations to serve heavy-duty fuel cell electric vehicles by 2023⁸.
- A subsidy rate of 37% for hydrogen as opposed to 64% for charging.⁹
- Station costs have halved while station capacity has doubled.¹⁰
- With policy mechanisms like the Low Carbon Fuel Standard, 90% of hydrogen fuel dispensed today is renewable.¹¹
- Fuel costs have decreased from \$16 per kilogram in 2018 to as low as \$12 per kilogram in 2020.
- Fifty-two percent of disadvantaged community residents live within a 15-minute drive of an open retail or planned station.¹²
- Hydrogen nozzles provide ten times the level of energy transfer per minute compared to the best DCFC connector at around 5% of the public cost per installed kW.
- Our *first* dedicated renewable hydrogen fuel production facility will open in 2022, providing 30 tons of fuel per day – an amount that can fuel 42,000 fuel cell vehicles.
- Hyundai increasing production volumes year over year. The 2021 Hyundai NEXO is being offered with a starting MSRP of \$58,935 and are paired with generous incentives and a fuel card for up to \$15,000 hydrogen fuel card.
- Toyota increasing new vehicle production volumes ten-fold in 2021. The second-generation Toyota Mirais introduced in 2021 have a starting MSRP of \$49,500 and are paired with generous incentives and a fuel card for up to \$15,000.
- Toyota's first-generation Mirai fuel cell electric vehicles are available for approximately \$11,000-15,000, including a fuel card up \$15,000.
- Honda leasing its fuel cell electric vehicles for \$379 a month.
- BMW introducing its hydrogen-fueled, sport-utility X5 in late 2022.

Due in large part to international climate agreements, support for the role of hydrogen in energy and transportation skyrocketed in 2020. Now more than 35 countries, all of them climate allies, have launched ambitious hydrogen programs centered around energy and transportation.

⁶ Page 3, [Joint Agency Staff Report on Assembly Bill 8: 2020 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California](#)

⁷ Williams, B, Capitol Matrix Consulting, June 2021, Analysis of Proposed Income Tax Credit for Hydrogen Fueling Infrastructure Development

⁸ Page 3, [Joint Agency Staff Report on Assembly Bill 8: 2020 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California](#)

⁹ Williams, B, Capitol Matrix Consulting, June 2021, Analysis of Proposed Income Tax Credit for Hydrogen Fueling Infrastructure Development

¹⁰ Williams, B, Capitol Matrix Consulting, June 2021, Analysis of Proposed Income Tax Credit for Hydrogen Fueling Infrastructure Development

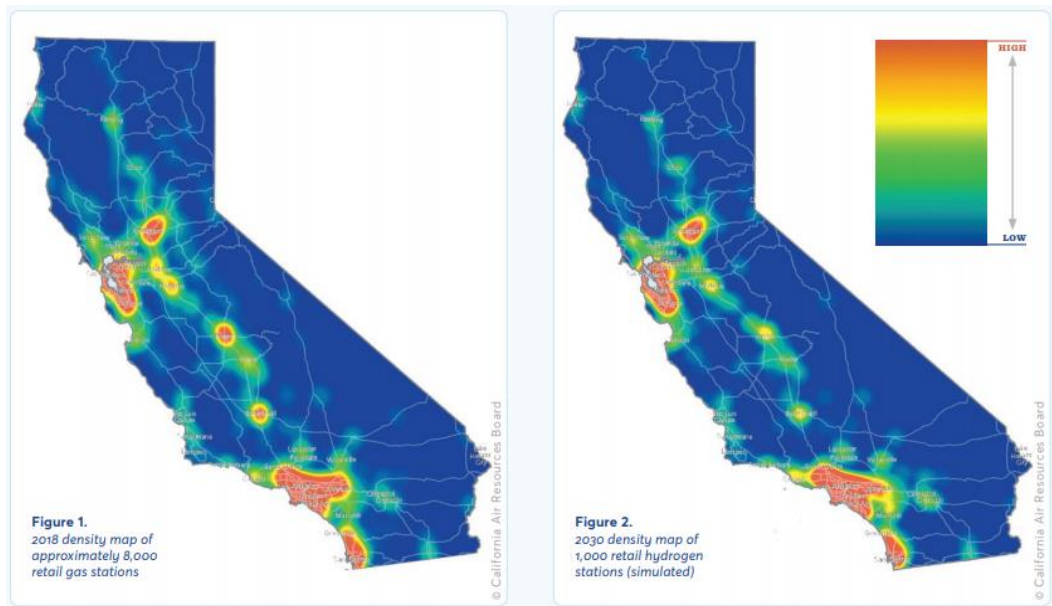
¹¹ Page XXIV, [2020 Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Development](#)

¹² Page 1, [Joint Agency Staff Report on Assembly Bill 8: 2020 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California](#)

Looking Ahead

The 2013 reauthorization included, among other things, a requirement for the CEC and ARB to report annually on the “progress toward establishing a hydrogen-fueling network that provides the coverage and capacity to fuel vehicles requiring hydrogen fuel that are being placed into operation in the state.”¹³

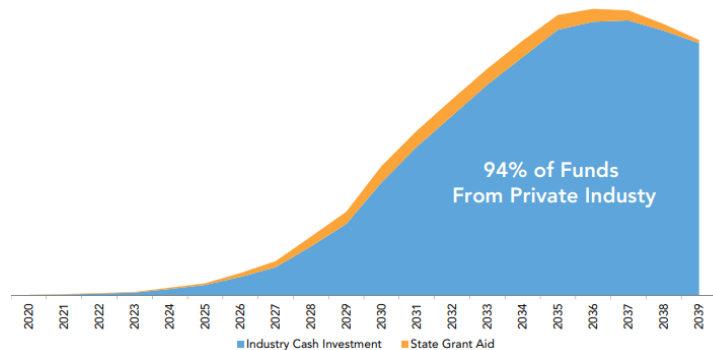
With input and modeling from the CEC, ARB and SCAQMD the California Fuel Cell Partnership presented the case for developing a fuel network for light and medium-duty vehicles utilizing existing fueling infrastructure that would provide fueling coverage for 94% of the geographic state and 97% of disadvantaged communities.¹⁴



On the left is the fuel density of California’s existing 8,000 gas stations as compared to the fueling density of 1,000 strategically located hydrogen stations.

In parallel, the 2013 reauthorization also required the ARB to assess the self-sufficiency of hydrogen fueling infrastructure. It is worth noting, no other emerging clean technology in California has undergone similar review.

The ARB’s *peer reviewed* Hydrogen Station Network Self-Sufficiency Analysis shows that “**hydrogen station self-sufficiency is achievable, within the decade, with [\$300M] additional state support beyond AB 8.**” Even at \$300M of State support, nearly 90% of network development and operations would be funded through private capital.



According to the ARB, “Station network growth that emphasizes rapidly developing economies of scale provides the most effective use of State funds.”

Figure 2 - Illustrative Division of Network Funding Sources¹⁵

¹³ Health and Safety Code 43018.9 (e)(6), Assembly Bill 8 (Perea, Chapter 401, Statutes 2013)

¹⁴ [A California Fuel Cell Revolution: A vision for 2030](#)

¹⁵ Page XIV, [2019 Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Development](#)

In 2021, the California Hydrogen Coalition commissioned a study regarding the economic impact of AB 1312 (Rodriguez) which would have provided an investment tax credit for the development of 1,000 hydrogen stations, renewable hydrogen production and distribution. **Those findings suggest station development could create between 3,000 to 5,000 jobs by 2032.**

Beyond station development, there is a significant increase in jobs when factoring in the requisite fuel production and distribution. These jobs would be high-paying. **As indicated below, the average wage of permanent jobs tied to the operations and maintenance of fueling stations and production facilities would be over \$91,000 per year; jobs tied to station construction would have an annual salary around \$84,000.** These averages compare favorably to the California's economy-wide average of \$71,140 per year.

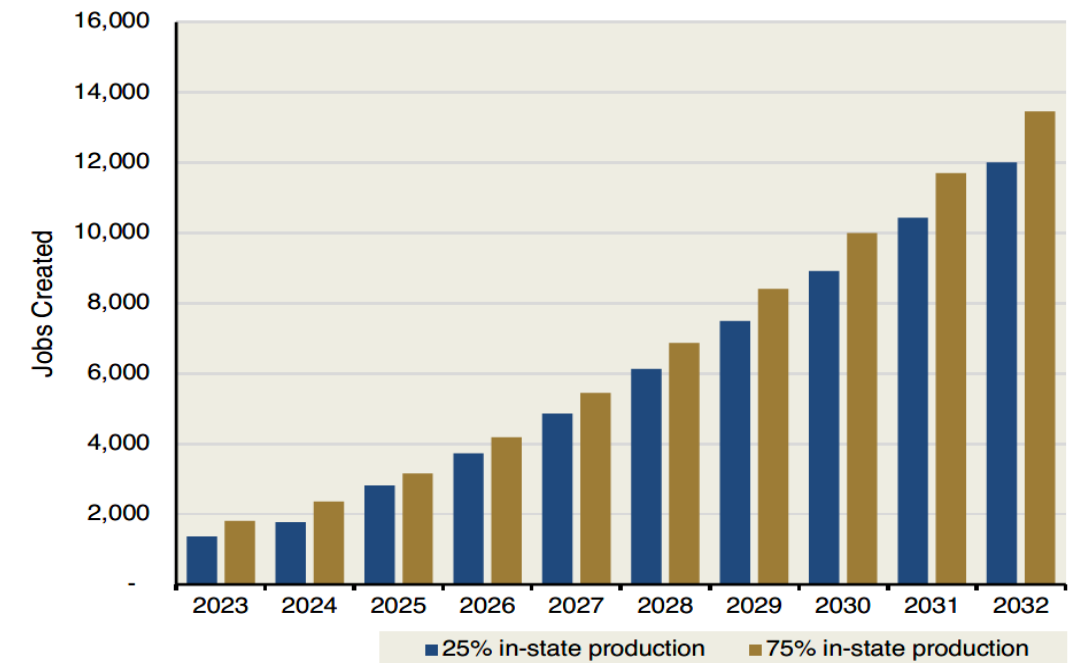


Figure 3 - Permanent California Jobs Created for Operations and Maintenance of Hydrogen Fueling Infrastructure

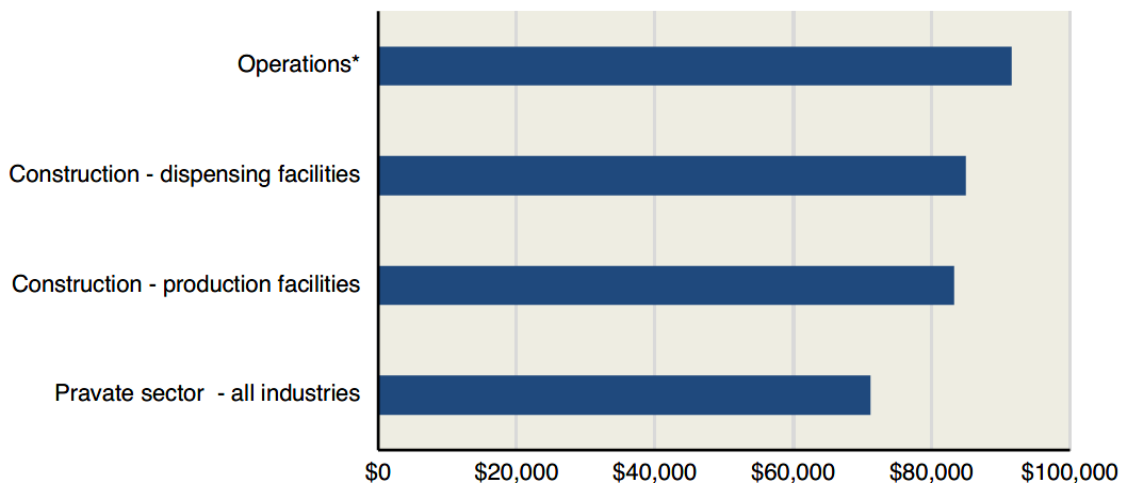


Figure 4 - Average Wage of Jobs Created by Hydrogen Fuel Infrastructure Investment

Today

Today, fuel demands of the vehicles on the road exceed station capacity. Much like charging, infrastructure needs to be in place to drive vehicle sales. The CEC's decision not to invest in hydrogen infrastructure for four and a half years between 2015-2019 has negatively impacted market growth and has led to much frustration amongst drivers.

The 2021-2022 budget (SB 129, Skinner) adopted by the legislature and signed by the Governor on July 12th provides generous incentives for zero emission vehicles and related infrastructure.

As it relates to infrastructure,

- \$84.7M in H2/charging infrastructure for drayage trucks
- \$29.7M in H2/charging infrastructure for transit
- \$19.8M in H2/charging infrastructure for school buses
- \$494M for H2/charging infrastructure for LDV-HDVs
 - Per the CEC's Budget Change Proposal, \$300M of the "ZEV Market Development Strategy" will be directed toward light-duty infrastructure to meet our 2025 goals. Of this approximately \$280M will be directed toward closing the 62,000 charger gap and \$20M will be directed toward closing the 21 station gap for hydrogen refueling.

Under this budget, light-duty hydrogen infrastructure will receive approximately 4% of program dollars.