

Zero-Emission Vehicle (ZEV) Infrastructure Crediting within the LCFS: How Does it Work?



Transportation Fuels Branch
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Impetus for Infrastructure Credits

- ZEVs and Fueling Infrastructure, a chicken-and-egg problem
 - Consumers may have “range anxiety,” want assurance of refueling availability before buying Zero Emission Vehicles (ZEVs)
 - Industry may be reluctant to build ZEV fueling locations until enough consumers have ZEVs to utilize those stations
- Executive Order [B-48-18](#) established a 2025 goal of:
 - 200 retail hydrogen stations & 10,000 direct current fast chargers
 - Recommended using LCFS to expand ZEV infrastructure
 - Board Resolution [18-17](#) directed staff to develop capacity-based crediting provision for ZEV refueling infrastructure

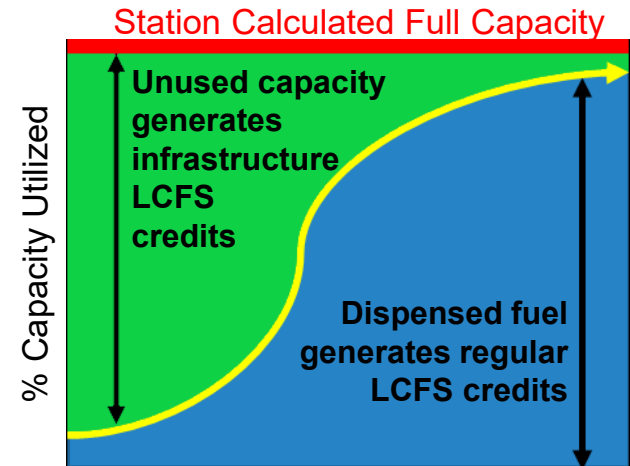


LCFS Infrastructure Credits provide a revenue stream for fueling stations until ZEVs become more commonplace.

Infrastructure Crediting Concept

Incentivize initial build-out of ZEV refueling infrastructure by providing credits when fuel demand is low in early years. A network of fueling stations should increase ZEV adoption.

- Provide low carbon fuel credits based on unused fueling capacity (total capacity – dispensed fuel)
 - HRI: Hydrogen Refueling Infrastructure
 - FCI: DC Fast Charging Infrastructure
- As more ZEVs use the station and the station utilization increases, the site will generate more LCFS fuel credits and fewer infrastructure credits.
- HRI & FCI total credit capacity each $\leq 2.5\%$ of LCFS deficits, calculated quarterly.



Infrastructure Crediting Period
(HRI: 15 yrs max; FCI: 5 yrs max)

Infrastructure Crediting: Eligibility

- Site must be publicly accessible
 - Accessibility less than 24 hours/day reduces site's infrastructure credits
 - HRI: must be connected to the Station Operational Status System (SOSS)¹
- Must accept major credit/debit cards at POS terminal
- Must not be directly related to a CA/Fed settlement or CEQA mitigation measure
- Refueling infrastructure intended for light-duty vehicle refueling stations only
- Fueling Capacity Limits for each Site
 - HRI: 1,200 kg/day Max
 - FCI: 2,500 kW Max (up to 6,000 kW with approval), each charger 50 kW minimum
 - Must have started operating after 1/1/2019
 - Limited FCI credits if only one charger type (CSS, CHAdeMO, Tesla) available at site

Station Status



Online



Limited



Offline



Unknown

¹ SOSS Station Status Dashboard: <https://m.caefcp.org>

Infrastructure Crediting: Application

- Register for an account on the LCFS Reporting Tool (LRT-CBTS)²
- Download a HRI or FCI Application template³
 - User guides will walk you through the application process using screenshots.
 - Owner info, FSE location, capacity, types, expected operations date, site agreement, etc.
- Corrections to application must be complete 180 days from 1st submission.
- Site must become operational within: 12 months after application approval for FCI
24 months after application approval for HRI
- Fuel Supply Equipment (FSE) registered in LRT-CBTS before credits can be generated.
 - HRI FSE: The entire hydrogen station
 - FCI FSE: Each individual charger at the site
- Applications must be submitted on or before 12/31/2025.

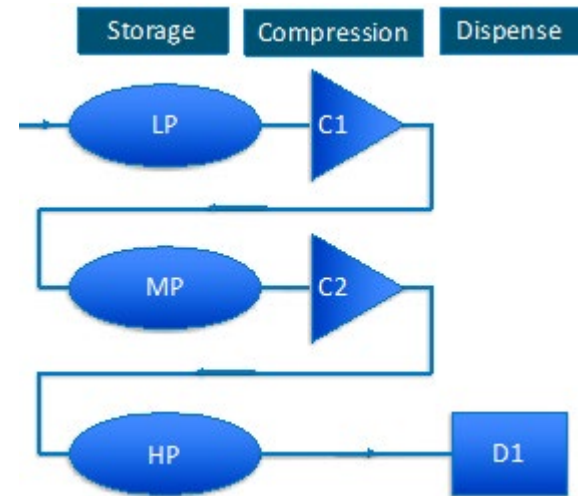
² LCFS Reporting Tool Credit Bank & Transfer System: <https://ssl.arb.ca.gov/lcfsrt/Login.aspx>

³ ZEV Applications and Instructions: <https://ww2.arb.ca.gov/resources/documents/lcfs-zev-infrastructure-crediting>

Infrastructure Crediting: Capacity Evaluation

- The fueling capacity of the fueling supply equipment (FSE) is calculated to determine the potential of each station.
 - HRI: Uses NREL HySCapE⁴ model to determine capacity based on station characteristics, with a few standard inputs:
 - Chevron-Friday demand profile and fill conditions.
 - Mass flow fueling rate: 1 kg/min
 - Time between fills: 255 seconds
 - Hourly distribution: Even
 - Vehicle storage volume: 126 liters
 - Storage level to trigger delivery: 30 percent
 - FCI: Daily capacity, Cap_{FCI}^i (kWh/day) for each charger is a function of charger nameplate power rating, P_{FCI}^i (kW):

$$Cap_{FCI}^i = 43 \times (P_{FCI}^i)^{0.45}$$



Infrastructure Crediting: HRI Locations

HRI station site location must be justified:



- The role(s) the station will play in the H₂ fueling network
- The means by which the station contributes to robust growth of the H₂ fueling network
- Demonstration of potential for consistent, calculable hydrogen demand
- Demonstration that proposed station capacity is appropriate
- Calculation of the projected trajectory of annualized average station utilization
- Demonstration that the proposed station location has been discussed with local authorities

Infrastructure Crediting: Quarterly Reporting

- FSE owners report fuel transactions on a quarterly basis to the LCFS Reporting Tool
 - HRI: Weighted average hydrogen carbon intensity must be less than 150 g/MJ and at least 40% renewable across all stations in the company's network registered in the LCFS.
- Site availability: percentage of eligible hours each FSE was available for fueling/charging during the quarter
 - HRI: station is considered "available" when capable of refueling a vehicle to at least 95% state of charge
- Include cost and revenue data as attachment in quarterly report using instructions and template provided in Guidance 19-02⁵
 - Reported data is treated as business confidential information.



⁵ LCFS Guidance 19-02: https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-02.pdf

Infrastructure Crediting: HRI Credit Calculation

$$Credits_{HRI} = (CI_{standard}^{XD} \times EER - CI_{HRI}) \times E_{H2} \times (Cap_{HRI} \times N \times UT - H2_{disp}) \times C$$

- $CI_{standard}^{XD}$ is the average carbon intensity of gasoline; calculated annually (gCO_2e/MJ)
- EER is 2.5, the Energy Economy Ratio for H_2 fuel cell vehicles, relative to gasoline
- CI_{HRI} is the greater of company-wide weighted average CI for H_2 , or 0 (gCO_2e/MJ)
- E_{H2} is the energy density for H_2 ,
 120.00 MJ/kg
- Cap_{HRI} is the HRI refueling capacity for the station (kg/day)
- N is the number of days in the quarter
- UT is the uptime multiplier for the fraction of time the FSE was available that quarter
- $H2_{disp}$ is the quantity of hydrogen dispensed during the quarter (kg). Must be non-zero.⁶
- C is a conversion factor for mass, 10^{-6} MT/g

⁶ To generate HRI credits, a station must dispense hydrogen for FCEV fueling. If $H2_{disp}$ is zero in a given quarter then HRI credits will not be calculated and issued for that quarter.

Infrastructure Crediting: FCI Credit Calculation

$$Credits_{FCI} = (CI_{standard}^{XD} \times EER - CI_{FCI}) \times C_{Elec} \times (Cap_{FCI}^i \times N \times UT - Elec_{disp}) \times C$$

- $CI_{standard}^{XD}$ is the average carbon intensity of gasoline; calculated annually (g^{CO_2e}/MJ)
- EER is 3.4, the Energy Economy Ratio for electric vehicles, relative to gasoline
- CI_{FCI} is the California average grid electricity carbon intensity; calculated annually (g^{CO_2e}/MJ)
- C_{Elec} is the conversion factor for energy, $3.60^{MJ}/kWh$
- Cap_{FCI}^i is the FCI daily charging capacity for the FSE (kWh/day)
- N is the number of days in the quarter
- UT is the uptime multiplier for the fraction of time the FSE was available that quarter
- $Elec_{disp}$ is the quantity of electricity dispensed during the quarter (kWh). Must be non-zero.⁷
- C is a conversion factor for mass, $10^{-6} MT/g$

⁷To generate FCI credits, a charger must dispense electricity for EV charging. If $Elec_{disp}$ is zero in a given quarter then FCI credits will not be calculated and issued for that quarter.

Infrastructure Crediting: Credit Availability

- Approval of sites can continue when potential HRI and FCI infrastructure credits each are less than 2.5% of total LCFS deficits in the previous quarter⁸
 - Potential infrastructure credits: the number of infrastructure credits that would be generated if all approved HRI or FCI FSEs dispense zero fuel in a quarter.
 - Total LCFS deficits: the number of credit deficits generated by fuel producers & importers.
- Credits generated from dispensed fuel unaffected by infrastructure credit availability
- Crediting period for infrastructure credits:
 - HRI: 15 years from quarter following the application approval
 - FCI: 5 years from quarter following the application approval
 - Accumulated FCI credit value limited to owner's capital cost for each FSE

⁸ See current status of 2.5% limit here: <https://ww2.arb.ca.gov/resources/documents/lcfs-zew-infrastructure-crediting>

Infrastructure Crediting: Questions?

- Low Carbon Fuel Standard Contacts at <https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-contacts>

