



Low Carbon Fuel Standard (LCFS) Program for Transit Agencies

August 4, 2026

Housekeeping

- This webinar is being recorded
- Recording and related materials will be available on the [ICT-Meetings & Workshops](#) webpage.
- All attendees have been muted
- The Q&A function is enabled
- Questions will be answered at the end of each section



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Please state your name and affiliation before asking a question or making a comment

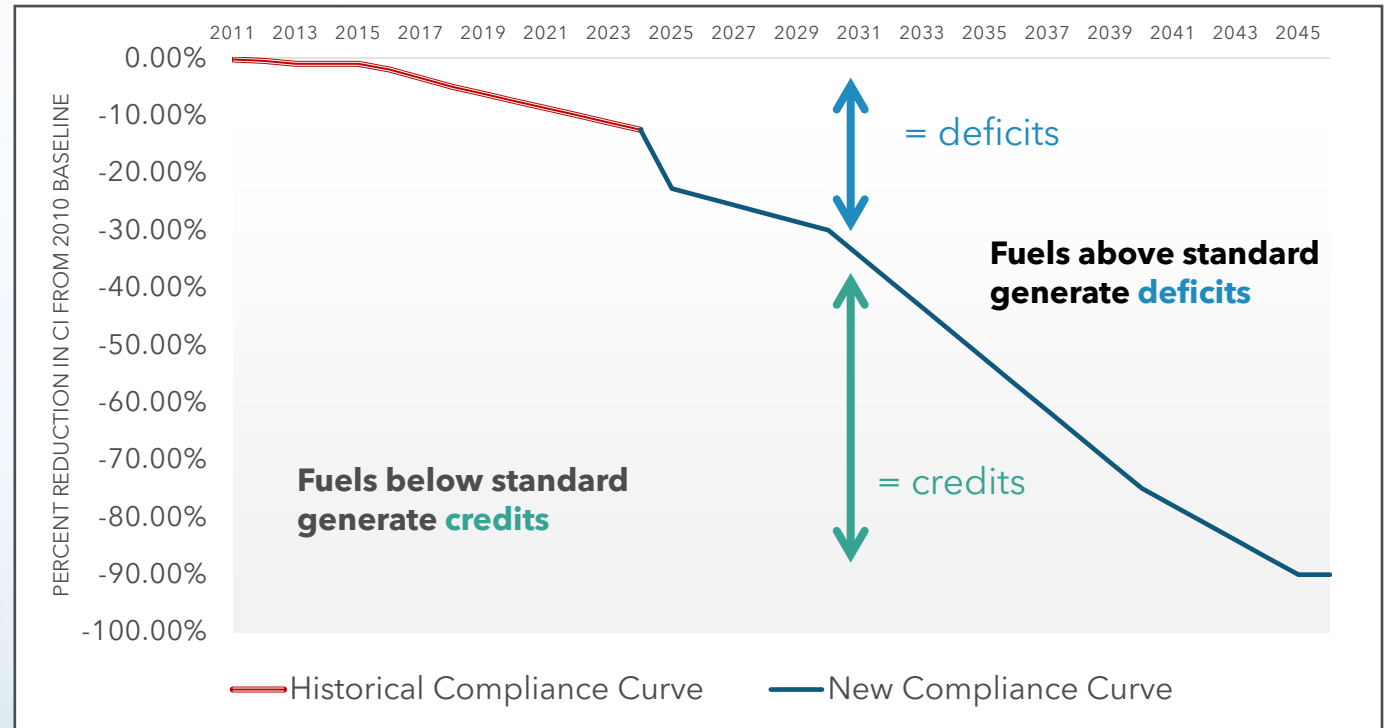
Key Topics

- Background
 - Basic LCFS framework and benefits
 - Carbon intensity and life cycle analysis
 - Credit generation opportunities
- Fuel pathways
 - Credit calculation
 - Types of pathways
 - Reporting and verification requirements
- Zero emission vehicle infrastructure
 - Credit calculation
 - Reporting requirements

Background

Basic LCFS Framework

- Sets annual Carbon Intensity (CI) benchmarks for gasoline, diesel, jet fuel, and alternative fuels that replace them
- CI is the measure of greenhouse gas emissions associated with producing, distributing, and consuming a fuel
 - Based on complete life cycle analysis
 - Measured in grams of carbon dioxide equivalent per megajoule (gCO₂e/MJ)



Status of LCFS Benefits for Transit Agencies

- Over **\$360 million** in credit value generated by transit agencies from 2011-2025
- In 2025 alone:
 - \$34 million for transits
 - > \$1 million for zero-emission buses

Fuel Type	CI Score	Approx. Value*
Hydrogen	-150	\$2.20/kg
	150	\$0.04/kg
Electricity	0	\$0.09/kWh
	81 (Grid CI)	\$0.07/kWh

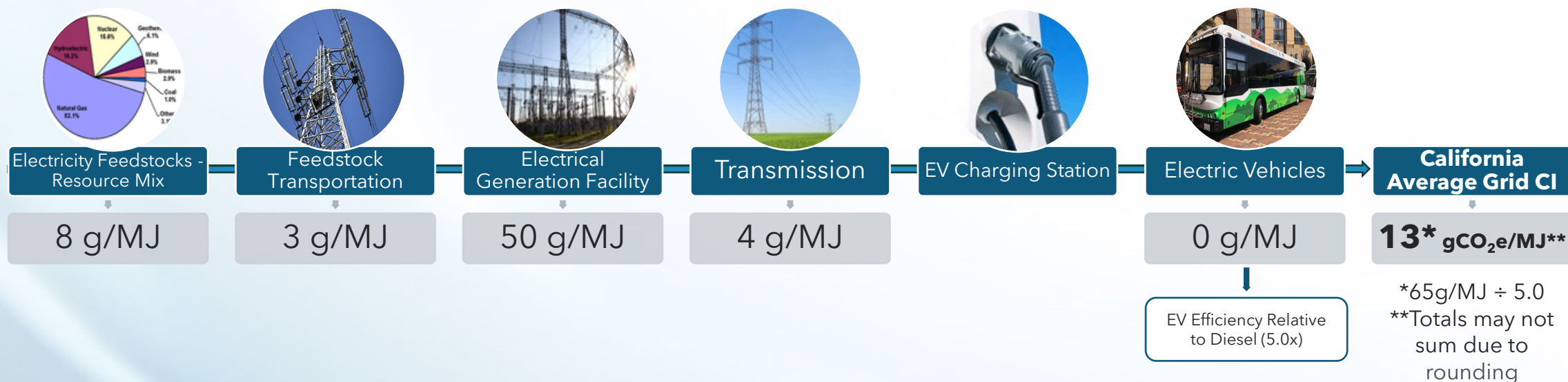
** Values shown assume a \$60 credit price under the 2025 CI benchmark, and are approximated based on historic program data*

Energy Economy Ratio

- The energy economy ratio (EER) represents the efficiency of a particular fuel-vehicle combination as compared to a reference fossil-based fuel
- Specific EERs are determined by CARB for each type of electric vehicle or equipment
- New equipment types not covered in Table 5 of the LCFS regulation can apply for a [Tier 2 EER-adjusted Pathway](#)

Fuel-Vehicle Combination	EER
Battery electric bus	5.0
Hydrogen fuel cell electric bus	1.9

Example Fuel Life Cycle for Heavy-Duty Vehicles: Grid Electricity



Example Fuel Life Cycle for Heavy-Duty Vehicles: Hydrogen from Landfill Methane



Example Fuel Life Cycle for Heavy-Duty Vehicles: Hydrogen from Dairy Methane



Credit Generation Opportunities

- **Fuel Pathway-Based Crediting**

- Providers of low carbon fuels used in California transportation generate credits by obtaining a certified CI and reporting transaction quantities quarterly
- Credits are calculated relative to the annual CI benchmarks

- **Zero-Emission Vehicle Infrastructure (Capacity-Based) Crediting**

- Hydrogen refueling infrastructure (HRI) and fast charging infrastructure (FCI)
- Credits are determined based on the capacity of the station to provide fuel when fully utilized, less the quantity of fuel that is dispensed and credited through fuel pathways

- **Project-Based Crediting**

- Projects include emission-reducing actions at refineries and crude oil facilities, including through carbon capture technology, and direct air capture projects
- Project operators generate credits by determining the GHG emission reductions (in metric tons)

2025 Updates to the Regulation

- All fixed guideway systems are now eligible for full LCFS crediting, without regard to which systems were in place when the LCFS took effect
- New infrastructure crediting programs for heavy-duty hydrogen refueling infrastructure (HRI) and DC fast charging infrastructure (FCI)
- New verification requirements for fuel cell vehicle (FCV) refueling, electric vehicle (EV) charging, and fixed guideway electricity fueling

Fuel Pathways

Fuel Pathway-Based Crediting

- Lookup Table
 - Simplest pathways, including gasoline, diesel, compressed natural gas (CNG), and **electricity**
 - CI is predetermined by CARB - values found in Table 7-1 of the LCFS regulation
- Tier 1
 - For the most common low-carbon fuels, including **hydrogen**
 - Uses a Simplified CI Calculator to determine CI, available on LCFS website
- Tier 2
 - For innovative, next-generation fuel pathways, including pathways using carbon capture and sequestration (CCS)
 - Uses full CA-GREET 4.0 model

Calculating Fuel Pathway Credits

Simplified Equation

LCFS credits = (annual CI target - low-carbon fuel CI) * fuel quantity

Key Variables

1. Carbon intensity (CI) of fuel
2. Energy Economy Ratio
3. Fuel quantity used per quarter

Calculating Fuel Pathway Credits (cont.)

$$Credits_i^{XD} = (CI_{standard}^{XD} - CI_{reported}^{XD}) \times E_{displaced}^{XD} \times C$$

The **CI benchmark** for the relevant conventional fuel and year

The adjusted **CI of the alternative fuel**, calculated as a function of the life cycle assessment and EER

The **quantity of conventional fuel displaced**, calculated as a function of energy density, EER, and total alternative fuel volume

Electricity Provisions

- Many types of battery electric vehicles and off-road electric equipment are eligible to generate credits
- Carbon intensity of California's average grid electricity is updated annually
- Low- and Zero-CI Electricity
 - Zero-CI electricity may be supplied through contracts and retirement of RECs
 - Low-CI electricity: source(s) of electricity that is non-zero and below average grid (biogas, biomass, geothermal) may be determined through a Tier 2 pathway application

Hydrogen Provisions

- Tier 1 pathways for hydrogen produced in California (via steam methane reformation or electrolysis) are available to streamline participation
 - Renewable hydrogen pathways require evidence of renewable inputs
 - Unique or innovative pathways may use a Tier 2 pathway application to determine CI
- Eligibility of dispensed hydrogen:
 - Beginning in 2030, 80% of dispensed hydrogen must be either renewable or produced using carbon capture and sequestration
 - Beginning in 2035, hydrogen produced with fossil gas is ineligible for credits*

Optional Book-and-Claim Opportunities

- “Book-and-claim” refers to an indirect accounting system that allows entities to earn fuel pathway credits for matching environmental attributes separately from a physical product
- Low-CI Hydrogen
 - Match dispensed hydrogen to low-CI hydrogen injected into a dedicated hydrogen pipeline
- Low-CI Electricity
 - Match dispensed electricity to low-CI electricity supplied to the grid
- Biomethane
 - Match dispensed fossil natural gas to biomethane injected into the common carrier natural gas pipeline

Temporary Pathways

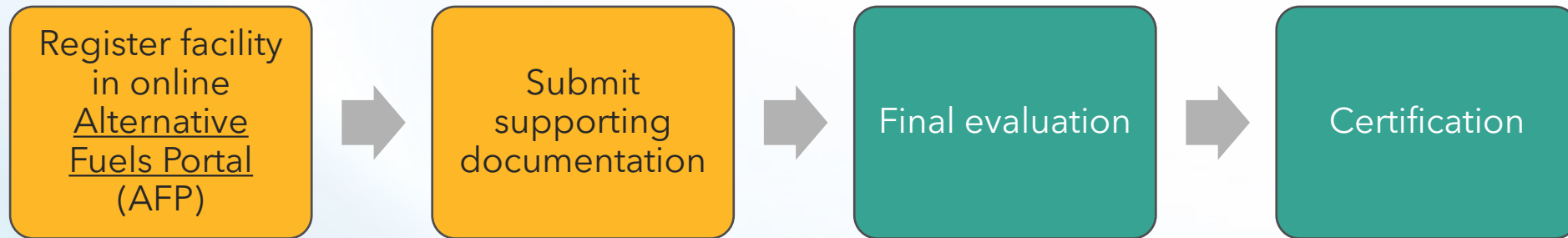
- Available for selected feedstock and fuel combinations:
 - Fuels associated with facilities that have produced a finished fuel for less than 3 consecutive months
 - Fuels associated with facilities that have processed a new feedstock that cannot be reported under a certified pathway
- Petitions to use a temporary pathway must be submitted through the Alternative Fuels Portal (AFP)
- Allows entities to earn credits while their Tier 1 or Tier 2 applications are being evaluated
 - Temporary pathways may be approved for up to two consecutive quarters at a time

Summary of Available Fuel Pathways

Fuel Type	Lookup Table	Tier 1	Tier 2	Temporary
Hydrogen	No	Yes - use Tier 1 Calculator for Hydrogen	Yes	Yes - see Table 8 of the LCFS regulation
Electricity	Yes - grid and zero-Cl electricity	No	Yes - low-Cl electricity	Yes - low-Cl electricity

[Current Fuel Pathways](#)

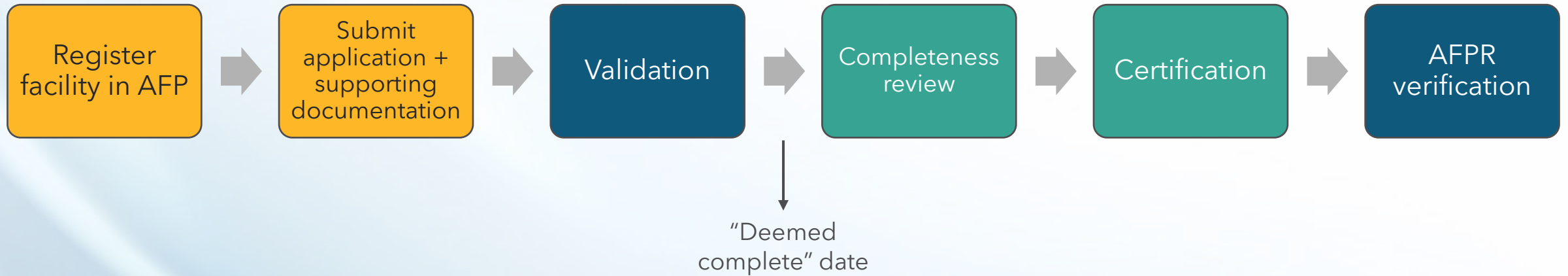
Applying for Lookup Table Pathways



Applicant
CARB Staff

Contact: lcfspathways@arb.ca.gov

Applying for Tier 1 Pathways



Applicant
CARB Staff
Third-Party Verifier

Contact: lcfspathways@arb.ca.gov

Tier 1 CI Calculator for Hydrogen

Key inputs:

- Production method: steam methane reformation (SMR) vs. electrolysis
- Feedstock for SMR
- Process energy
- Book-and-Claim

[illegible]

LCFS Tier 1 Calculators

Fuel Pathway Reporting and Verification

Reporting Requirements

Report Name	Who Should Submit	Where to Submit	Contents	Deadline
Quarterly Fuel Transactions Report (QFTR)	Fuel reporting entities	LRT	<ul style="list-style-type: none"> Quantities of fuel dispensed by each FSE where applicable Additional fuel-specific requirements 	By the end of the following quarter
Annual Fuel Pathways Report (AFPR)	Most fuel pathway holders	AFP	<ul style="list-style-type: none"> Tier 1 CI Calculator, CA-GREET4.0 model, or records/invoices Additional pathway-specific requirements 	By March 31 of the following year
Annual Compliance Report	Fuel reporting entities	LRT	<ul style="list-style-type: none"> Aggregated data from QFTRs Summary of credits/deficits Credit proceeds report for electricity crediting 	By April 30 of the following year

Quarterly Reporting Requirements

- Fuel reporting entities are required to submit a Quarterly Fuel Transactions Report (QFTR)
- Deadline for submitting a QFTR is the end of the following quarter (ex. the 2026Q3 QFTR is due by the end of 2026Q4)
- Reporting requirements are specific to fuel types:
 - For non-residential EV charging, must include quantity of electricity used per FSE
 - Low-CI electricity requires additional documentation
 - For hydrogen, must include quantity of hydrogen fuel dispensed per FSE

Annual Reporting Requirements

- Most fuel pathway holders are required to submit an Annual Fuel Pathway Report (AFPR)
 - Certain Lookup Table pathways (ex. grid electricity) are exempt from this requirement
 - The AFPR must include:
 - The certified version of the Tier 1 CI Calculator or the CA-GREET 4.0 model updated with the most recent two calendar years of operational data for Tier 1 pathways
 - Invoices or metering records to support reported quantities of renewable or low-CI inputs for Lookup Table pathways
 - Additional pathway-specific components, such as attestation letters or records of retired RECs
 - The AFPR must be submitted to the AFP no later than March 31 of each year
- Contact: LCFSAnnualReport@arb.ca.gov or LRTAdmin@arb.ca.gov

Annual Reporting Requirements (cont.)

- Fuel reporting entities must also submit an Annual Compliance Report
 - The annual compliance report must include:
 - Aggregated information from QFTRs
 - The annual summary of credits/deficits generated by the LRT
 - For electricity credit generators, a summary of efforts and costs associated with the use of credit proceeds to further transportation electrification
 - The annual compliance report must be submitted to the LRT by April 30 of each year
- Contact: LCFSAnnualReport@arb.ca.gov or LRTAdmin@arb.ca.gov

Third-Party Verification Requirements

- LCFS requires annual third-party verification for fuel pathways and reported fuels transactions:
 - Annual Fuel Pathway Reports
 - Quarterly Fuel Transactions Reports (may include electric vehicle charging and hydrogen refueling transactions)
- List of accredited third-party verification bodies is available on the [LCFS Verification website](#)
- Verifiers will review data reports and their inputs, and perform interviews of key personnel to ensure accuracy and completion of the information the reporting entities submitted to CARB
- Fuel reporting entities may defer annual verification of their QFTRs up to two years if they do not generate 6,000 or more credits, or 10,000 or more credits if **hydrogen or electricity** fuel transaction types are reported, and also do not result in 6,000 or more deficits in LRT-CBTS during the prior calendar year.
 - Must verify all prior unverified reports once verification is required or conducted.
- For verification-specific questions, contact: lcfverify@arb.ca.gov

Example Reporting Scenarios

Fuel Pathway Details	Quarterly Reporting Data	Annual Reporting for Verification
Transit is using hydrogen purchased from a supplier with a certified Tier 1 pathway	<ul style="list-style-type: none"> Hydrogen purchase records Records of hydrogen dispensed 	<ul style="list-style-type: none"> Annual Report on Quarterly Transactions Subject to Verification (QFTR)
Transit is using grid electricity with book-and-claim via RECs	<ul style="list-style-type: none"> Records of retired RECs Records of electricity dispensed 	<ul style="list-style-type: none"> Annual Report on Quarterly Transactions Subject to Verification (QFTR) Records of retired RECs
Transit is using grid electricity supplemented with on-site solar	<ul style="list-style-type: none"> Records of electricity dispensed Records of on-site generation 	<ul style="list-style-type: none"> Annual Report on Quarterly Transactions Subject to Verification (QFTR) Records of solar electricity used

Questions



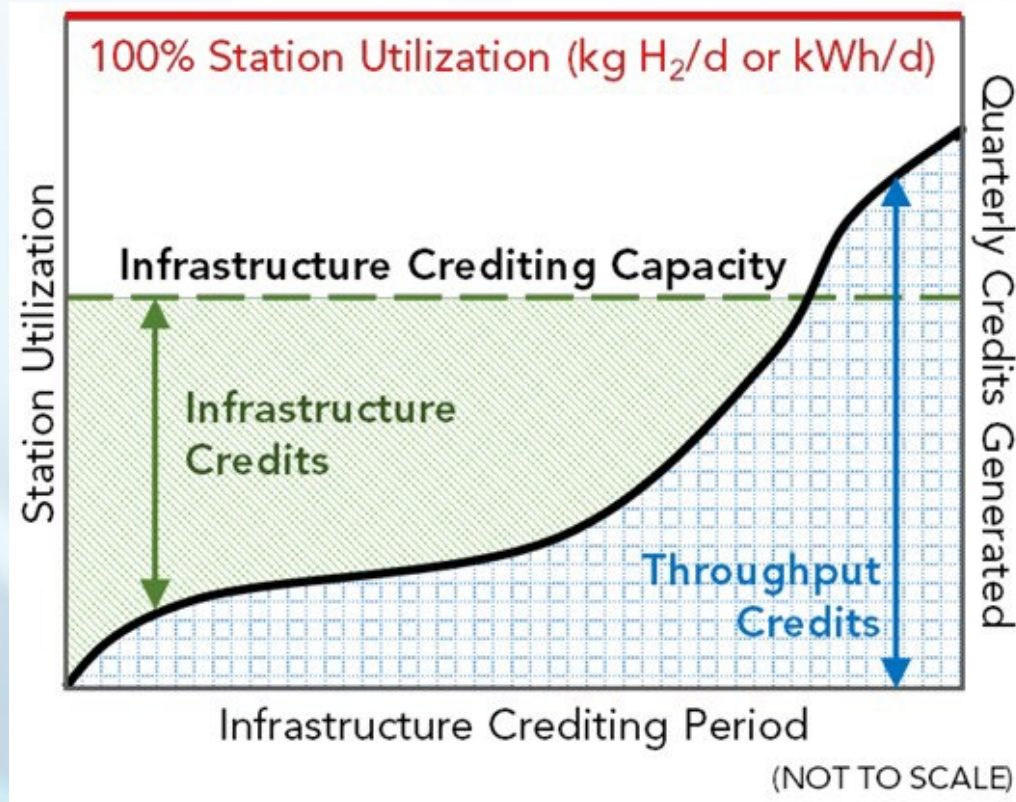
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Zero Emission Vehicle Infrastructure

ZEV Infrastructure Crediting



- Infrastructure crediting provides LCFS credits based on unused fueling capacity (credited capacity - dispensed fuel) of fuel supply equipment (FSE)
- Four categories of infrastructure crediting are available beginning July 1, 2025:
 - Heavy-Duty Hydrogen Refueling Infrastructure (HD-HRI)
 - Heavy-Duty DC Fast Charging Infrastructure (HD-)
 - Light- and Medium-Duty Hydrogen Refueling Infrastructure (LMD-HRI)
 - Light- and Medium-Duty DC Fast Charging Infrastructure (LMD-)
- As station utilization increases, the site will generate more LCFS credits for dispensed fuel and fewer infrastructure credits
- Total capacity for each program category is capped at 2.5% of LCFS deficits, calculated quarterly

HD-HRI Credit Calculation for a Station

$$Credits^*_{HD-HRI} =$$

$$\underbrace{(CI_{standard}^{diesel} \times EER^{diesel} - CI_{HRI}^{**}) \times E_{H2} \times C}_{\text{HRI credits per kg of hydrogen:}} \times \underbrace{(Cap_{HD-HRI} \times N \times UT - H2_{disp})}_{\text{kg of hydrogen covered by HRI:}}$$

HRI credits per kg of hydrogen:

calculated as the difference between the diesel benchmark and hydrogen fleet carbon intensity**, adjusted for EER

kg of hydrogen covered by HRI:

calculated as the station's HRI capacity guaranteed for the quarter, adjusted by the uptime of the station and less the hydrogen dispensed by the station during the quarter.

* 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.

** The weighted average CI of all hydrogen dispensed by the agency. If hydrogen fleet carbon intensity is less than 0 gCO₂e/MJ for the quarter, 0 will be used for CI_{HRI} instead.

Criteria for New HRI Sites

Station Type	Hydrogen Refueling Infrastructure
All Stations	<ul style="list-style-type: none"> • Must be connected to the Station Operational Status System (SOSS) • Public stations must accept major credit/debit cards at point of service terminal • Must not be directly related to a CA/Federal settlement or California Environmental Quality Act (CEQA) mitigation measure • Must not have been permitted to operate on/before 01/01/2022 • Dispensed hydrogen must have a CI ≤ 150 gCO₂e/MJ before 01/01/2030 and ≤ 90 gCO₂e/MJ thereafter • Dispensed hydrogen must be $\geq 40\%$ renewable content until 2030 and $\geq 80\%$ thereafter
Heavy-Duty	<ul style="list-style-type: none"> • Application must be received on/before 12/31/2035 • Must accommodate Class 8 HDVs • Up to 6,000 kg/day refueling capacity • Shared site: 62.5% crediting factor; must be < 5 miles of any Alt. Fuel Corridor or on/next to existing truck overnight parking or funded by government competitive grant program • Private site: 31.5% crediting factor

Criteria for New FCI Sites

Station Type	DC Fast Charging Infrastructure
All Stations	<ul style="list-style-type: none">Public chargers must accept major credit/debit cards at point of service terminalMust not be directly related to a CA/Federal settlement or CEQA mitigation measureMust not have been permitted to operate on/before 01/01/2022Minimum nameplate power rating $\geq$ 50 kW/FSE
Heavy-Duty	<ul style="list-style-type: none">Application must be received on/before 12/31/2035Must accommodate Class 8 HDVs< 5 miles of any Alt. Fuel Corridor or on/next to existing truck overnight parking or funded by government competitive grant programUp to 40 MW/siteShared site: 20% crediting factorPrivate site: 10% crediting factor

Infrastructure Credit Availability

- Approval of sites can continue when potential HD-HRI, HD-FCI, LMD-HRI, and LMD-FCI credits are less (respectively) than 2.5% of total LCFS deficits in the previous quarter
 - Potential infrastructure credits: the number of infrastructure credits that would be generated if all approved FSEs were issued averaged FCI or HRI credits for their capacity
 - Single applicants limited to 1% of total LCFS deficits each for HD- and LMD-HRI and 0.5% of total LCFS deficits each for HD- and LMD- FCI
- Credits generated from dispensed fuel are unaffected by infrastructure credit availability
- Crediting period: 10 years starting in quarter of application approval
 - Accumulated FCI credit value limited to 1.5x owner's capital cost for each FSE

ZEV Infrastructure Crediting Examples

Private HD H2 Fueling Station
5,000 kg/d Capacity, 90% UT
Electrolytic H2: CI = 0 g/MJ

Year	2027	2032
Demand	Ten buses, 250 kg/d	Forty buses 1,000 kg/d
H2 Credits per bus/yr	164	112
HRI Credits per bus/yr	794	34

Ten private 250kW HD chargers.
Grid electricity, 95% Uptime
Grid CI $\approx$ 70 g/MJ

Year	2027	2032
Demand	Ten buses, 3,500 kWh/d	Forty buses, 14,000 kWh/d
Elec. Credits per bus/yr	148	116
FCI Credits per bus/yr	92	0

Applying for Infrastructure Credits

1. Register for an account on the [LCFS Reporting Tool](#) (LRT-CBTS)
2. Download an application template from the [LCFS ZEV Infrastructure Crediting page](#)
 - Templates include instructions for completing the application process
 - Must include owner info, FSE location, capacity, types, expected operation date, evidence that requirements are met, etc.
3. Rejected applications may reapply the following quarter
4. Site must become operational within 24 months of application approval, or risk cancellation
5. FSE must be registered in LRT before credits can be generated

Reporting Requirements

- Fuel reporting entities (or their designees) report fuel transactions and uptime on a quarterly basis in the LRT by FSE where applicable
 - Requirements vary across fuel types
 - An FSE must dispense fuel to earn HRI/FCI credits in any particular quarter
 - Uptime: percentage of eligible hours each FSE was available for fueling/charging during the quarter
 - HRI: station is considered “up” when capable of refueling a vehicle to at least 95% state of charge
- Include cost and revenue data as an attachment in the Annual Compliance Report
 - Reported data to LRT is treated as confidential business information where possible

Conclusion

Buying and Selling Credits

- Credit transactions take place in the LRT
- Entities can **optionally** utilize a broker or an aggregator to facilitate credit trades and reporting
 - Brokers are third-party entities authorized to facilitate credit transfers
 - [List of registered brokers](#) is available on the LCFS website
 - Aggregators are third-party entities that can compile data, report, and facilitate verification on behalf of other entities

Key Takeaways

- The LCFS is designed to gradually lower the greenhouse gases produced by transportation fuels in California
- Under LCFS, low-carbon fuels are rewarded with credits, with the goal of providing an additional revenue stream to incentivize the production and adoption of low-carbon fuels
- Transit agencies can earn credits for:
 - Using electricity and hydrogen in zero-emission buses and fixed guideway systems
 - Operating ZEV infrastructure
- Reach out to CARB staff with any questions

Questions



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Please state your name and affiliation before asking a question or making a comment

Resources

- [Subscribe to CARB program updates](#)
- [LCFS Homepage](#)
- [LCFS Guidance](#)
- [LCFS Credit Proceeds Calculator](#)
- [LCFS Contacts](#):
 - General feedback and questions: LCFSWorkshop@arb.ca.gov
 - LRT and reporting: LRTAdmin@arb.ca.gov
 - Fuel pathways: LCFSPathways@arb.ca.gov