



Low Carbon Fuel Standard Regulation and Hydrogen

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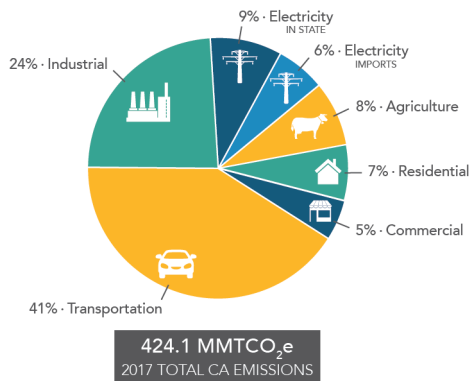
Manager of Zero Emission Truck and Bus Section



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Low Carbon Fuel Standard (LCFS)

California's primary program to promote alternative fuel use in the transportation sector

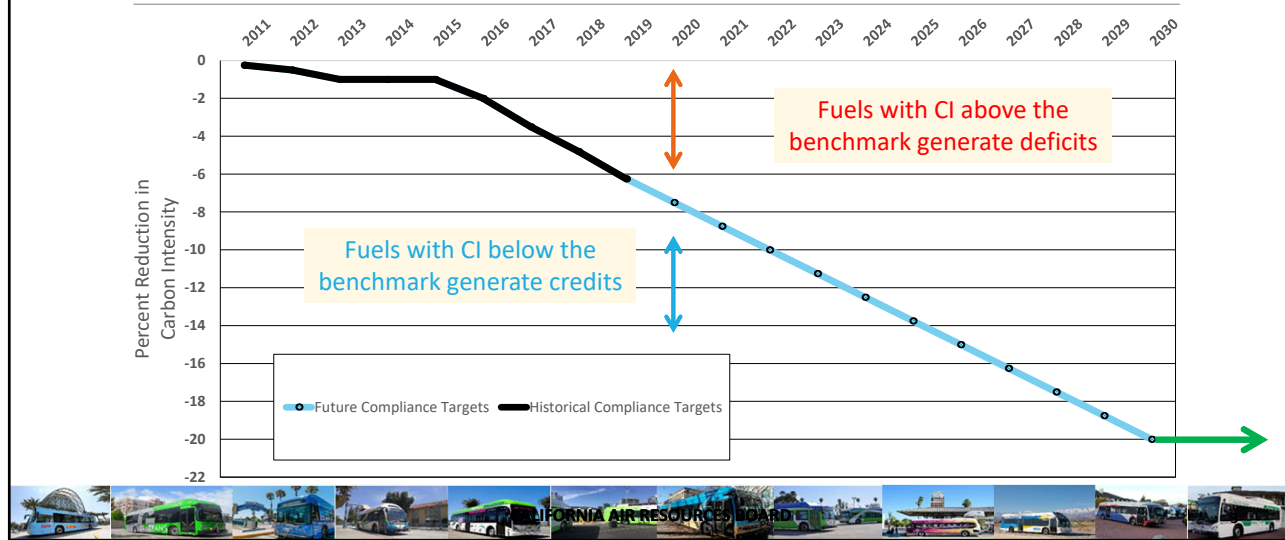


- Reduce carbon intensity of transportation fuels
- Transform and diversify fuel pool
- Reduce petroleum dependency
- Reduce emissions of criteria pollutants and toxics
- Transportation sector accounts for ~50% of State's GHG inventory when industrial emissions from refining and oil production are included



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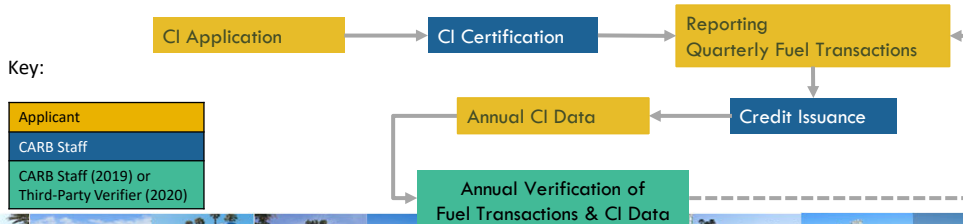
Targets Through 2030 (And Beyond)



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Fuel Pathway Based Crediting

- All transportation fuels have a certified carbon intensity (CI)
 - Lookup Table: Simplest pathways, including gasoline and diesel; CI is predetermined by CARB
 - Tier 1: For the most common low carbon fuels; use a Simplified CI Calculator to determine CI
 - Tier 2: For innovative, next generation fuel pathways, including fuel pathways with carbon capture and sequestration, use the full CA-GREET 3.0 model
- Credits are calculated based on CI of the fuel, EER of the vehicle-fuel combination, and the quantity of fuel that is transacted in each quarter



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Roles of Hydrogen within the LCFS

- Fuel Pathways
 - Hydrogen as a transportation fuel
 - Hydrogen used to produce a low-carbon fuel
- Refinery Hydrogen Refinery Credit Program
- Hydrogen Refueling Infrastructure



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Hydrogen Reporting within the LCFS

- Reporting requirements for Hydrogen
 - Hydrogen is currently below a low volume exemption of 3,500 tonnes/year
 - Reported hydrogen is currently 2,600 tonnes/year and will likely cross the threshold by 2025
- The station owner is the default credit generator
 - Entities must report total dispensed fuel on a quarterly basis per station per pathway
 - Entities can designate reporting to a 3rd party



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Key Steps for Generating LCFS Credits for Hydrogen as a Transportation Fuel

Step 1 Establish account in the LCFS Reporting Tool (LRT)

- In the quarter during which the H₂ fueling takes place
- *Example: For Fueling during Q1, register in the LRT by April 3rd. Reporting for Q1 occurs Apr-Jun.*

Step 2 Register Stations for reporting – Fueling Supply Equipment (FSE)

- Ideally by the end of quarter during which fueling takes place
- *Example: For Fueling during Q1, register in the LRT by April 3rd. Reporting for Q1 occurs Apr-Jun.*

Step 3 Identify and apply for a fuel pathway (Carbon Intensity) to use for reporting

- More details described in next slides

Step 4 Complete quarterly reporting for credit issuance

- Data upload deadline (45-day after end of quarter); quarterly report submission deadline (90-days after end of quarter)
- Credits are issued after the reporting deadline
- *Example: For Fueling taking place during Q1, upload data by May 15th and submit final report by June 30th. Credits will be issued on July 1st.*



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Hydrogen Fuel Pathways

- Lookup Table Pathways
 - Steam methane reformation (SMR) based: (1) fossil natural gas; (2) biomethane
 - Electrolytic: (1) CA-Grid; (2) Smart Electrolysis—updated annually; and (3) Zero-CI electricity
- Tier 2 Pathways
 - Current practice



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Table F.3. Summary of CI Results by Life Cycle Stage for Hydrogen Pathways

Fuel Pathway Code:	HYF	HYFL	HYB	HYBL	HYEG	HYER
Process Description:	NG to Gaseous H ₂ from SMR	NG to Liquid H ₂ from SMR	Biomethane to Gaseous H ₂ from SMR	Biomethane to Liquid H ₂ from SMR	Gaseous H ₂ from electrolysis (grid electricity)	Gaseous H ₂ from electrolysis (wind/solar electricity)
NG Recovery	6.07	6.07				
NG Processing	3.31	3.31				
NG or RNG Transport	5.50	5.50	9.47	9.47		
LFG Recovery			0.79	0.79		
LFG Processing			42.74	42.74		
H₂ Production	20.46	21.79	20.46	21.79	153.95	0
Production Non-Combustion	64.09	68.26	7.78	8.29		
Liquefaction		45.28		45.28		
H₂ Transport	7.21	0.74	7.21	0.74		
Gaseous H₂ Compression and Precooling	11.04		11.04		10.51	10.51 ²⁷
Total CI	117.67	150.94	99.48	129.09	164.46	10.51



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Book & Claim Accounting for Hydrogen

- **Biomethane**
 - Demonstrated through detailed contracts
 - Biomethane matched on a 1MMBtu CH₄ to 1MMBtu H₂ equality
 - Hydrogen supplied via biomethane is subject to verification
- **Electrolysis**
 - Demonstrated through REC (renewable energy certificate) retirements in WREGIS (Western Renewable Energy Generation Information System)
 - If Hydrogen is produced outside of California then attributes can be retired in another tracking system
 - REC retirements audited by CARB staff
 - Quantity of RECs required for hydrogen is depending on electrolyzer efficiency



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Estimated LCFS Value for Fuel Cell Electric Vehicles

Application	LCFS Value* (\$/kg)				
	Gaseous H ₂ Fossil Natural Gas SMR	Gaseous H ₂ Landfill Gas SMR	Liquid H ₂ Fossil Natural Gas SMR	Liquid H ₂ Landfill Gas SMR	Electrolytic H ₂ with zero-Cl electricity
Light-duty FCEV (EER 2.5)	\$0.89	\$1.04	\$0.61	\$0.80	\$1.79
Heavy-Duty FCEV (EER 1.9)	\$0.45	\$0.61	\$0.17	\$0.36	\$1.35

*Assuming LCFS credit price of \$70

**Using Lookup Table Values for Fossil SMR and Landfill Gas SMR and electrolytic hydrogen



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Who Can Sell the Credits?

- Once credits are generated they can be sold directly to counterparties, sold through a broker, or transferred to another entity
- Any entity with an active LRT-CBTS (LCFS Reporting Tool-Credit Bank Transfer System) account can sell credits though entities with smaller quantities of credits typically work with a broker
- A broker has to be affiliated with an entity that has a Federal Employer Identification Number (FEIN)
- A broker cannot acquire credits



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Contacts and links

- Questions about account registration and fuel pathways – Jacob.Englander@arb.ca.gov
- Registration and reporting -- <https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-registration-and-reporting>
- Applying for fuel pathways -- <https://ww2.arb.ca.gov/resources/documents/apply-lcfs-fuel-pathway>

