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Fractional Displacement Crediting Under the LCFS

Issue

The Low Carbon Fuel Standard (LCFS) has successfully reduced GHG emissions from transportation fuels in California. We propose a small but important change to improve the credibility and performance of the LCFS.

As currently designed, the LCFS assumes that each new zero emission vehicle will displace a fossil-fueled one. That was a reasonable assumption in the early years of the program but will become less accurate as the fleet shifts toward zero-emission vehicles. If this increasingly incorrect assumption is retained, it will lead to LCFS credit generation that does not accurately represent emissions impacts.

Fractional Displacement (FD) crediting is a minor, technology-neutral change to the LCFS to enhance its effectiveness by better aligning credit generation with actual emissions impacts. FD crediting strengthens the foundation of the LCFS, and could mitigate market imbalances expected to emerge over the coming decade.

Key Findings

At present, LCFS crediting methods rely on two key assumptions to quantify credits generated by the displacement of fossil fuels due to the use of an advanced technology vehicle (those with an energy economy ratio, EER, greater than 1).

1. The displaced fuel has carbon intensity equal to the LCFS target for that year.
2. The amount of fuel displaced is the same, at all times, and under all market conditions.

The first assumption is appropriate, however the second does not match likely behavior as fleets

transition to advanced technology. When advanced technologies make up a greater fraction of the fleet, each additional vehicle will, on average, displace less petroleum, than the previous; e.g. the five-millionth EV sold in a given market will displace less than the first.

Fractional Displacement (FD) crediting allows for more precise and accurate credit quantification, by representing emissions benefits from lower carbon intensity fuels separately from fuel displacement and adopting assumptions that better align with market conditions expected in the middle and later phases of a fleet's transition to ZEVs. Implementing the FD crediting approach would involve replacing the current LCFS credit quantification equation in § 95486.1 (a) (1) with the one in the box, below.

FD crediting is a technology-neutral way to better match LCFS credit generation with emissions impact. FD splits the current crediting equation into two components, recognizing that they deal with different mechanisms. This allows more carefully considered assumptions to be made about each. FD crediting applies equally to all fuel pathways earning credits using the current LCFS method.

The FD approach is a minimal change from existing methods. The equation presented for FD crediting is mathematically equal to the current one, if the new displacement fraction term is omitted. It builds on the concepts already used in the LCFS.

Changing to FD crediting would mitigate likely future credit imbalances in the LCFS.

The assumptions adopted by the current LCFS quantification method tend to over-estimate displacement of fuel by advanced technology

$$\text{Credits}_i^{XD} (MT) = (CI_{standard}^{XD} - CI_i) \times E_i \times C + (EER^{XD} - 1) \times CI_{standard}^{XD} \times E_i \times F_{displaced}^{XD} \times C$$

CI Term

Displacement Term

Where $CI_{standard}^{XD}$, CI_i , E_i , EER^{XD} , and C are unchanged from their current definition and $F_{displaced}^{XD}$ —“Displacement Fraction”—is the fraction of theoretical displacement to be credited. under the given pathway. Approximated as the fraction of the fleet still using the incumbent, higher-emitting technology (e.g. ICE). For EERs <1, $F_{displaced}^{XD}$ is always equal to 1.

vehicles (like ZEVs) during the middle and late parts of a fleet transition. This can lead to over-generation of LCFS credits, compared to actual emissions, which can drive down credit prices and require regulatory intervention or rapid target increases to compensate. FD crediting helps promote a stable LCFS credit market with a credit price that continues to incentivize the deployment of advanced technology.

FD crediting provides a stronger disincentive against the use of high-carbon fuels in advanced vehicles. The current crediting method allows high-carbon fuels (e.g. fossil-based hydrogen or electricity) to generate credits in advanced technology vehicles even if the fuel has a higher CI than the LCFS target at the time. FD crediting assures that only fuels with lower CI than the target will receive credit.

FD crediting preserves the credit generation potential of advanced technology vehicles due to use of lower-CI fuel. The current approach to crediting over-credits advanced technology vehicles at later stages of a fleet transition, compared to real world impact; e.g. at present e-forklifts provide 7% of compliance credit in the LCFS despite very small fleet size and energy demand. Alternative approaches to addressing this under current credit methods, may require phasing certain technology types completely out of the LCFS, even if they consume fuel with lower CI than current targets.

Changing to FD crediting would make almost no difference in credit generation for the next several years, except for e-forklift pathways. Since advanced technology vehicles represent a minimal fraction of the fleet in all pathways other than e-forklifts, adopting the FD approach would cause a minimal impact on total LCFS credit generation through the 2020's.

FD crediting provides more accurate credit quantification for pathways using carbon-negative fuels. At present, RNG from digesters that receives a negative CI score due to avoided methane credits can be combusted to make electricity, which is used to charge an EV. Under the current LCFS methodology, the avoided methane credit is multiplied to reflect the efficiency of the EV, however this means the amount of avoided methane is multiplied too, leading to over-crediting. The FD approach effectively closes this loophole.

Policy recommendations

Adopting FD crediting at the earliest opportunity better aligns credit generation with actual emissions impacts, preserving and strengthening the core mechanism underpinning the LCFS.

- **FD crediting is appropriate for all pathways that use the current crediting equation in § 95486.1(a)(1) of the LCFS.**
- **Immediate comprehensive application of FD would result in near-term crediting changes only for e-forklifts.** All other vehicle classes have sufficiently low ZEV penetration that immediate change would be minimal.
- **The Displacement Fraction can be approximated as the fraction of fleet using incumbent fossil-based technology.** Other approaches are available and should be considered, however this approach is feasible with current data and represents a clear improvement over present the method.
- **FD crediting can be adopted piece-wise.** Adopting immediately for e-forklifts, addresses potential credit imbalances and allows time for more extensive modeling and policy development prior to program-wide adoption.
- **FD crediting can use significance thresholds or defined schedules for changes to displacement fraction.** These small adjustments can reduce administrative burden and provide a more predictable credit generation trajectory, especially at the start and end of vehicle fleet transitions, with a minimal impact on the accuracy of crediting.

Further reading

This brief summarizes research published in [Improving Credit Quantification Under the LCFS: The Case for a Fractional Displacement Approach](#).

Authorship

This policy brief was prepared by Dr. Colin Murphy.