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Todd R. Campbell
Vice President Public Policy & Regulatory Affairs

October 6, 2017

Mr. Sam Wade
Chief, Transportations Fuels Branch
California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Clean Energy's Comments in Response to September 22, 2017 LCFS Workshop and Draft Regulation

Dear Mr. Wade,

Clean Energy appreciates the opportunity to submit comments in response to the draft regulatory amendment language to the Low Carbon Fuel Standard (LCFS) as well as the September 22, 2017 rulemaking workshop. Clean Energy has provided years of unwavering support to the LCFS program. Our company's and the broader NGV and RNG industries' commitment to deliver low carbon renewable natural gas (RNG) throughout California's natural gas fueling infrastructure has been instrumental in reducing greenhouse gas emissions in the transportation sector and keeping California on pace to meet its overall climate change goals.

Overarching Comments on the Draft Regulatory Amendment Language and Process

Unfortunately upon review, we believe ARB's new provisions in the draft LCFS regulatory amendment language will impede the growth of RNG production and the NGV industry as a whole. The LCFS was built upon a concept of fuel neutrality, with the ultimate goal to reduce the carbon intensity of California's transportation fuels as a whole. Instead of promoting the fuel and technology neutral concept, the draft amendments appear to provide inequitable regulatory advantages to electric vehicle (EV) applications at the expense of other low carbon fuels, especially RNG. Such built-in inequalities could affect the integrity of the LCFS program and can jeopardize the future availability of low carbon fuel to California transportation markets.

As further described below, Clean Energy is also troubled by the proposed regulatory amendment process. Two weeks is not a sufficient timeframe for stakeholders to properly comment on both the draft amendment language and the workshop held on September 22nd. There have been considerable changes made in the draft language that will require detailed review by stakeholders and we fear the expedited process set by ARB may not allow this to happen. Furthermore, ARB still has not released a full version of the modified GREET 3.0 for stakeholder review. All stakeholders should be allotted an appropriate and sufficient amount of time (up to two months, if possible) to review all materials related to the current regulatory package, in their full and synergistic context. This is essential to enable Clean Energy and other stakeholders to respond in a credible, accurate and thoughtful manner.

Updated Energy Economy Ratio Values for EV and FCV Applications

Clean Energy supports an accurate accounting of the relative efficiencies of all technologies in the LCFS program. The Energy Economy Ratio (EER) assigned to each technology has a significant impact on the credits generated within the program, as well as competition amongst the technologies for market share. Despite these implications, ARB is proposing to only amend EER values assigned to EV applications, while maintaining the same EERs for other fuel applications.

Furthermore, ARB is proposing to eliminate the EER classification for EV buses and trucks and classify all heavy-duty EV types under a single EER. This means that the currently codified EER for EV trucks nearly doubles, when there has been no substantive truck data to support this. Truck and transit duty cycles are very different, entailing different weights and driving patterns. They should not be grouped into one category.

Clean Energy has significant concerns with the technical accuracy of the analysis conducted by the Advanced Clean Trucks group to date. In particular, the use of chassis dynamometer data for heavy-duty EVs neglects the potentially substantial energy demands associated with heating, ventilation, and cooling systems. Internal combustion engines generate significant amounts of waste heat that are typically used to supplement HVAC heating demands. By contrast, EVs must typically supply all of the heat demand through heat pumps and resistance heaters. These demands can be substantial, relative to the average propulsion energy demand of the vehicle. While the revised analysis by the Advanced Clean Trucks Group (dated September 2017) notes that the NREL study of Foothill Transit's fleet provides an "apples-to-apples" comparison of in-use energy consumption, this comparison is based on only two days of operation by CNG buses on the same routes that the EV buses typically serve. This short period is not sufficient to reasonably characterize the relative energy consumption rates between the two technologies or adequately capture the impact of HVAC loads, particularly when the EV bus data is averaged over much longer periods.

It is also important to note that the Foothill EV buses are inherently restricted to being operated on Foothill's shortest route (the 16-mile Line 291). This is a direct result of the low energy density provided by today's storage batteries. Conversely, the greater energy storage capabilities of Foothill's CNG buses enable them to be "randomly dispatched on all routes." Clearly, the cited Foothill Transit case actually constitutes a strictly one-sided comparison that is not "apples to apples," since – unlike the CNG buses – the electric buses are not able to operate across the full range of duty cycles and bus routes. If they were capable of full-scale operation, that could entail much-more-intense energy demands associated with HVAC operations.

Additionally, the Altoona test data used to calculate EERs for electric buses does not include charger efficiency losses. Based on charging data included in the Altoona reports, charging efficiencies could range from 75 to 90 percent. Because neither CA-GREET 2.0 or the draft CA-GREET 3.0 model include impacts of charging efficiencies in the calculated carbon intensity for

electricity, the charging efficiencies must be incorporated into the EER values for these vehicles. It does not appear that ARB's analysis has appropriately accounted for the impacts of charging efficiency.

Finally, Clean Energy notes that the report relied upon by ARB to develop EERs for electric drayage trucks (a 2015 chassis dynamometer study of Transpower electric trucks by UC Riverside) is not a sufficient basis upon which to modify the EER for this class of vehicles. ARB relies upon comparisons made in the report between the energy economy of the Transpower truck and the fuel efficiency of a Class 8 diesel truck that was previously tested by UC Riverside as part of a larger study of emissions from heavy-duty vehicles sponsored by South Coast Air Quality Management District (SCAQMD). The diesel fuel efficiency cited in the Transpower electric truck report uses the least-efficient diesel truck in the SCAQMD study as the basis for estimating the relative efficiency of the electric trucks. Had the UC Riverside researchers used the fuel economy of a different, but comparable, diesel engine in the SCAQMD study, the diesel fuel economy would be substantially higher. Specifically, the Transpower study assumes a baseline diesel fuel economy of 2.69 mpg based on a 2011 Cummins ISX 11.9L engine over a local drayage duty cycle. However, in the same test group, a 2011 Mack MP8 12.8L engine achieved a fuel economy of 4.13 mpg. Consequently, the EER calculated using the least efficient diesel vehicle results in an EER of 6.7 for the EV over the local drayage cycle, or an EER of 4.4 using the higher efficiency diesel vehicle. This change in the calculated EER exceeds 50 percent, yet it is simply based on the choice of baseline vehicle referenced by UCR. Clearly, it is insufficient to use a single, biased set of comparisons provided in the Transpower study as a basis for redefining the EER for Class 8 trucks.

Clean Energy also believes that the research study cited to support the proposed EER amendment is flawed, because it does not reflect the true efficiency of heavy-duty EVs being deployed today. Specifically, ARB is using impractical, overly optimistic assumptions with respect to the future deployment of heavy-duty EV fleets at low-speed duty cycles. These broad assumptions ignore the real-world driving cycles of electric buses and trucks that are being demonstrated today. They disproportionately allow less-efficient EVs to benefit from research conducted only on the most-favorable heavy-duty EV technology, while being operated over the most-favorable duty cycles. It is also important to account for the fact that heavy-duty EVs will typically be recharged at times that are poorly matched with generation and availability of clean renewable electricity.

By contrast, this approach of modeling heavy-duty EV EERs and CIs using best-case scenarios (i.e., the most-advanced technology over the most-optimal duty cycles) has not been allowed in modeling CIs or EERs for heavy-duty NGVs (or other fuel-technology applications). In fact, the EER value for NGVs and the fossil CNG lookup value were determined using the most conservative assumptions and data available.

As previously stated, assignment of EER values has a significant impact on the credits generated in the program. This emphasizes the need for ARB to update all fuel-technology EERs at the same time, including the baseline for gasoline and diesel ICEVs. If ARB opts not to provide the same

evaluations for all technologies in the final draft amendments, it will create a competitive advantage for EVs (doubling the amount of credits generated by EV trucks). This is simply not fair nor consistent with the LCFS program's key premise of fuel neutrality. This is especially the case given that state-of-the-art new NGV technology appears to be providing a better EER than the value ARB is currently assigning it.

Verification Proposal

Another competitive advantage afforded to battery EV applications is the lack of an annual CI verification requirement. Under the verification proposal, a fuel pathway holder must verify that its actual operating CI is equal to, or less than, the certified CI that is used to generate credits. EV applications are able to generate credits using the California grid mix lookup pathway. All other producers of biofuels must apply for their own specific fuel pathway and be subject to annual CI verification. Invalidation risk is a strong concern for low carbon producers and certified pathway holders. However, under the system that ARB has developed, EV credit generators are immune to this risk and can broadly take advantage of the generic grid lookup pathway.¹

More specifically, LCFS credits are generated quarterly, yet CI verification occurs annually after credits have been generated and possibly monetized. This means that producers will be generating credits before having the operational data necessary to corroborate the certified CI for the given year. This puts all of the credits generated during the period (up to four quarters worth) at risk of invalidation if the operational CI is higher than the certified CI. As a result, credit generators will hold perpetual invalidation risk, which will have significant negative impacts on the LCFS credit market. Conversely, EV credit generators have zero invalidation risk, since use of a lookup value pathway does not require annual CI verification. This allows EV credits to be generated and monetized uninhibited, while bearing no additional cost for CI verification. It also allows EV credit generators to take full advantage of the credits they generate without having to contribute a single allowance to the proposed buffering account (further discussed below). This is a clear competitive advantage for EV fuel applications, as all other fuel-technology pathways are subject to costly (and artificial) invalidation risk in addition to unknown but inevitably significant verification costs.

The rationale that "all EVs use electricity" is not sufficient justification for this change. An EV can use grid power, all renewable power, or a mix of the two; there can be wide ranges in the overall carbon intensity. Verification of EV fuel use (power generation mix) is just as important for program accuracy as verification of gas type for a natural gas vehicle. There is simply no valid reason why verification requirements should differ for certain

¹ For example, heavy-duty EVs charged in LADWP territory get credit for an overall lower CI of the general California grid, even though they receive electricity from a system that today is nearly 40 percent powered by coal (LADWP "Facts & Figures" webpage, as of October 2017).

HDV types, particularly when all fuel-technology pathways can range widely in the greenhouse gas reductions they provide.

Buffer Account and Temporary Fuel Pathway Codes

Clean Energy is very concerned about ARB's proposed buffer account maintained by the Executive Officer. As described, this proposed account sends the wrong message to producers that are significantly investing in low carbon fuel production. It can be viewed as a "taking" from the producer, which sends a very bad policy signal to the low carbon fuel industry. Specifically, the proposal in the draft amendments suggests that when a fuel pathway holder reports and verifies an operational CI that is lower than the certified CI, the incremental credits that "could" have been generated and ultimately assigned to the producer will instead be deposited into the Executive Officer's buffer account. This will be used to protect the integrity of the LCFS market in the instance where invalid or fraudulent credits cannot be recovered. Again, biofuel pathway holders are the only entities subject to this provision since there is no CI verification requirement for the EV pathway using the California grid mix. In essence, biofuel pathway holders who diligently work to improve their operating CI score automatically lose out on any value generated between the lower operating CI and the certified CI. Instead the value is absorbed by ARB to protect the integrity of the LCFS program. While we certainly can understand and appreciate ARB's desire to identify a way to further protect the program's integrity, this is really unfair to a producer, especially if that producer is small or depends upon full credit generation to make the project feasible.

This lost value associated with the delta between operational and certified CIs especially becomes a problem for entities reporting transactions under a temporary fuel pathway. The draft amendments for NGV temporary fuel pathways, for example, are extremely conservative and are in no way indicative of actual biogas or fossil NGV fuel delivered in California. In fact, the temporary pathway CI values appear completely arbitrary and without consideration for the very low volume-weighted CI value exemplified by the current RNG mix in California. Credit generators who are forced to generate credits under these pathways will lose significant value and revenue associated with the delta between the actual operating CI and these abnormally high temporary fuel pathway CIs. Biogas digester pathways will be affected most by this provision considering ARB has eliminated the lookup pathway value for biogas derived from a high solid anaerobic digestion process. This means that any digester project that does not have its own pathway will have to generate LCFS credits on at least one of the temporary biogas to NGV pathways while their actual pathway is under review. This will represent a significant amount of lost revenue considering digester pathways achieve significantly negative carbon intensities (as low as -300 g/MJ or more). If an extremely conservative biomethane TFPC is required for all biomethane including emerging RNG feedstocks and processes (e.g. anaerobic digesters and wastewater treatment), ARB should consider retroactive credit generation for all fuel that generated credits under the TFPC for these pathways. The deletion of the HSAD and wastewater treatment TFPCs, and the lack of an animal

manure TFPC, is a significant amount of lost credit generation and revenue while these pathways are utilizing the proposed TFPCs.

Fuel pathway holders must be able to recognize the full value of emissions reductions associated with delivery of fuel to California. ARB plans to update the California grid mix EV pathway every year following the release of grid mix data from the California Energy Commission, which will allow EV pathways to take full credit for their assigned values with no invalidation risk. Further, EV credit generators using the California grid mix pathway are likely over-generating actual values as it does not appear that the LCFS program accounts for time of use of EV charging. While it is true that renewable energy represents an increasing share of the California grid mix, these renewable sources are a small portion of the electricity grid when the majority of EV charging occurs. It is also unclear from CPUC filings that IOU's can accurately track where their power source is generated. All of this means that most EVs are charging with a larger share of non-renewable and more-carbon-intense electricity than otherwise reported in the annual average. The fact that EVs are likely over-generating environmental value and biofuels will be under-generating environmental value is again a competitive advantage for EVs that should not and cannot be allowed under a fuel-neutral LCFS Program.

Fossil CNG and LNG Values Have Been Inflated with Insufficient Justification

Over the last three years the LCFS program has utilized three versions of the GREET model. Each iteration of GREET has made sweeping changes in assumptions that have drastically impacted the CI values of the majority of fuels in the LCFS program. Under the GREET 1.8b model, fossil CNG had a carbon intensity of 67.7 g/MJ and achieved 30% GHG reduction relative to conventional diesel. The CI for fossil CNG has increased in each model from 79.46 g/MJ under GREET 2.0 and now up to 86.57 g/MJ under GREET 3.0 as shown in Table 7 of the draft regulatory text. This represents nearly a 30% increase in just three years. The value of 86.57 g/MJ does differ substantially from the carbon intensity for fossil CNG when you run the draft GREET 3.0 posted on the LCFS website by over 6 g/MJ (approximately 80.09 g/MJ). There has been insufficient documentation posted to justify the carbon intensity values presented in the draft regulatory language.

Interestingly enough, CI's for other fossil fuels have not increased at all over this time period and in fact the conventional diesel CI has decreased slightly under the GREET 3.0 model. Such large increases in the fossil CNG CI are puzzling, especially considering there has not been a corresponding increase in the gasoline or diesel CIs, which are also fossil fuels with similar upstream production emissions. Clean Energy will conduct a thorough analysis to validate this CI, but cannot do so until the full unaltered version of the GREET 3.0 model is released. Any significant changes to CI values should not be placed into a draft rule until stakeholders are provided with a proper amount of time to review and verify all associated calculations and assumptions. Notably, ARB's previous change from CA GREET 1.8b to 2.0 entailed some significant model errors that required a cooperative effort between ARB and stakeholders to correct.

ARB has listed the temporary fossil LNG and LCNG values at 100 g/MJ each, a seemingly arbitrary value that poses an immediate, unnecessary and unfair challenge to our industry. Although it is unlikely that these pathways will ever be utilized, ARB must understand the implications of publishing these abnormally high CIs, particularly in the context of how other fuel-pathway CIs are being handled. While some might play down these values to be only temporary fuel pathways, such unrealistic values effectively communicates to the fuel market that fossil LNG and LCNG emit 10% more GHG emissions (EER adjusted LNG and LCNG) than conventional diesel, which is both false and misleading. The NGV industry has worked tirelessly across California to convert heavy duty diesel trucks to run on clean burning CNG and LNG. ARB's decision to arbitrarily inflate CI values only undermines these efforts by indicating that fossil LNG and LCNG have a CI of 100 g/MJ regardless of these pathways temporary status. In fact, we have seen advocates use similar data in the past as a representative number of NGV technology to show other transportation strategies to be better when it is not the case. We therefore strongly request that these values be revised in the final draft to accurately reflect the current CI of fossil LNG and LCNG in the market.

Clean Energy Verification Proposal

Clean Energy proposes to remove the annual CI verification requirement from the proposed verification program. Instead, ARB should implement an expiration date on all certified pathways not to exceed two years. Upon expiration, the pathway holder must "re-certify" their pathway by submitting the most recent two years of operating data to ARB. During this re-certification process, a site visit to the renewable fuel production facility will be conducted by the verifier (preferably completed during the RFS QAP site visit) and the new CI score will be confirmed.

This method creates a system of mandatory submission of operational data every two years in order to maintain a fuel pathway in the LCFS program. This provides certainty to ARB that pathway holders are generating credits using updated operational data. It also provides a more stable two year timeframe for a pathway holder to use a certified CI without risk of invalidation or delay in credit generation that may now be subject to a "taking" via the proposed buffer account. This proposal not only ensures CI compliance but also it minimizes the scope of verification and keeps costs to LCFS producers low which is in the interest of the LCFS program. Furthermore, this approach ensures that no fuel receives a competitive advantage and each pathway holder is able to recognize the full environmental impact of their fuel delivery.

LCFS Pathway holders should be allowed to use a certified CI for a pre-determined length of time without risk of invalidation, especially considering that the CI is computed using two years of actual operating data. The current (and even proposed) GREET and OPGEE models use data in arrears for calculating emission factors and other assumptions necessary in determining pathway carbon intensities. If the GREET and OPGEE models use data in arrears, then fuel pathway holders should be able to do the same and generate credits for a full two years corresponding with a CI based on two full years of certified operational data. As previously stated, with the

implementation of GREET 3.0 in 2019, this will be the second revision of the GREET model in three years. With respect to biogas pathways, the differences between GREET 1.8b, GREET 2.0, and GREET 3.0 have been significant. Over a short three year time frame, biogas CIs have been subject to changes of 50% or more due to changing methodologies and assumptions in the GREET model. Given the volatility in the GREET model over the years, it would make the most sense to avoid annual CI verifications as it is likely that another significant change can come in the next release of the GREET model which would render previous model assumptions and annual “verification” against these assumptions moot.

ARB Regulatory Amendment Timeline

As noted above, Clean Energy is very concerned about the lack of time ARB has given stakeholders to provide feedback with respect to both the draft amendments and the workshop held on September 22nd. Two weeks is not a sufficient amount of time for stakeholders to provide meaningful feedback on the full draft amendment proposal. There have been considerable changes made with respect to EER values and CIs that warrant a full and in-depth analysis and should not be rushed into a final rulemaking. Furthermore, ARB has yet to release full versions of the GREET 3.0 model or any associated white papers detailing the new assumptions which makes the October 6th comment deadline unreasonable. Without this information stakeholders will not be able to sufficiently analyze changes made in the draft amendment. Clean Energy suggests that ARB hold another workshop after stakeholders have had sufficient time to review all draft regulatory language as well as all information related to GREET 3.0. Clean Energy also urges ARB staff to meet with our industry experts to go over the proposed changes so that we can understand what decisions staff has made to arrive at their conclusions under this draft.

Maintaining the Key Premise of Fuel Neutrality

The LCFS program has been built on the premise of fuel neutrality, to provide equal incentive for any low carbon fuel delivered into California without favoring any one particular fuel or providing competitive advantages. Unfortunately, the draft amendments appear to undermine fuel neutrality by creating several inherent competitive advantages for EV fuel pathways at the expense of biofuels. Such favoritism undermines competition, creates further uncertainty in biofuel investments, and threatens the LCFS program’s ability to deliver upon its goals. Changes in CI values and other key parameters that are this dramatic require industry understanding and acceptance of the methodologies utilized, to maintain the integrity of the LCFS program. Further, this world-leading program demands consistent application across all pathways, including the impacts to power supply as previously stated. Maintaining the integrity of the LCFS program must be the State’s first priority. Creating competitive advantages for one pathway jeopardizes the very integrity ARB is looking to protect. Clean Energy encourages ARB to re-evaluate the draft amendments and heed our suggestions for maintaining a fuel neutral approach.

Conclusions

Clean Energy will continue to support the LCFS. Regrettably, however, we must express strong opposition with the direction and intentions of the program following this latest release of draft amendments. We cannot stress enough that the LCFS program must remain a fuel neutral program without creating competitive advantages among fuels. Significant progress has been made over the years in the LCFS program and we feel such progress is in jeopardy. The best path forward is for ARB staff to revise the draft amendments by removing all competitive advantages for EV fuel pathways. This will ensure the integrity of the program is maintained and guarantees greater success of the program moving forward.

We would like to thank ARB staff for allowing us the opportunity to provide comments and share our concerns about the proposed changes. Please feel free to reach out to us if you have any questions. We would like to set up a meeting immediately between Staff and our experts to better understand ARB's thinking and to review the data used to derive and justify the proposed changes.

Sincerely,

A handwritten signature in black ink, appearing to read 'Todd Campbell', with a stylized, cursive flourish extending to the right.

Todd Campbell
Vice President, Public Policy and Regulatory Affairs
Clean Energy Fuels Corporation