February 20, 2024

The Honorable Liane M. Randolph
Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

(Comment submitted electronically)

RE: H Cycle's Recommendations to Leverage the Low Carbon Fuel Standard Program to Accelerate Achievement of SB 1383 Diversion, Reduce Methane Emissions, Rapidly Scale Distributed Hydrogen and Attract Federal Funding to California

Dear Chair Randolph,

H Cycle, LLC ("H Cycle") is pleased to submit comments pertaining to the California Air Resources Board's ("CARB") proposed amendments to the Low Carbon Fuel Standard ("LCFS Proposal" or "Proposal"). We support CARB's LCFS program as it sends a powerful market signal to decarbonize the transportation sector, is performance based, and provides long-term policy stability that supports investment. However, we respectfully encourage CARB to take advantage of this LCFS rulemaking to make regulatory changes that incentivize deployment of low carbon intensity ("Low-CI") waste-to-hydrogen production facilities that can simultaneously catalyze more organics diversion, reduce emissions of the short-lived climate pollutant ("SLCP") methane, create a distributed hydrogen production network and drive federal dollars to California to accelerate hydrogen production expansion.

LCFS Recommendations

H Cycle has identified three modifications to the LCFS Proposal that will increase organics diversion, decrease methane emissions, accelerate development of distributed hydrogen production, and attract federal funding:

1. CARB should respond to the Little Hoover Commission's findings regarding the State's current failure to meet SB 1383 organic diversion targets by modifying LCFS regulations to support SB 1383 implementation by recognizing real-world methane emission reductions achieved by diverting additional organic waste from landfills to produce hydrogen. This recommended action also supports the goals outlined in the Advanced Clean Fleets Rule that will require availability of renewable hydrogen derived from waste feedstocks to supply the eventual zero emission fleets.

2. Given the massive scale of hydrogen ambition established by the 2022 Scoping Plan and the minimal hydrogen demand that exists from fuel cell electric vehicles ("FCEVs"), CARB should extend the eligibility of electricity book-and-claim to Low-CI hydrogen that is used in the production of an alternative fuel. Related to

this, due to the importance of attracting federal funding to California including Inflation Reduction Act ("IRA") funds for Low-CI hydrogen, CARB should more closely align LCFS electricity book-and-claim accounting requirements with IRA Section 45V's utilization of environmental attribute certificates ("EACs"). This alignment would provide hydrogen producers with the flexibility to source Low-CI power utilizing Power Purchase Agreements ("PPAs") and/or unbundled Renewable Energy Certificates ("RECs").

3. CARB should clarify its intent under proposed LCFS §95488.8(i)(1)(C)(2) as this proposed provision states, "The pathway holder or the project operator must be the first contracted entity for procuring the low-CI electricity." Prior to adoption of the LCFS Proposal, CARB should revise the language to clearly indicate what is meant by the phrase "first contracted entity" and ensure that this provision does not establish an impossible condition in California or other markets.

The Critical Nature of Low-CI Hydrogen

The 2022 Scoping Plan recognized the critical role that new technologies and low carbon intensity ("Low-CI") hydrogen must play in California's drive to carbon neutrality and emphasized the need to identify and remove market and implementation barriers that impede California's transition away from fossil fuels:

> *We must avoid making choices that will lead to stranded assets and incorporate new technologies that emerge over time. Importantly, given the pace at which we must transition away from fossil fuels, we absolutely must identify and address market and implementation barriers to be successful. The scale of transition includes adding four times the solar and wind capacity by 2045 and about 1,700 times the amount of current hydrogen supply.*[1]

In addition to charting a course away from fossil fuels and toward massive hydrogen expansion, the 2022 Scoping Plan also identified the challenge of relying solely on electrolytic hydrogen to achieve California's goals. The Draft Scoping Plan included an estimate that 40 GW of solar capacity would be required to support only electrolysis to produce all hydrogen in the Proposed Scenario. The Final Scoping Plan substantially reduced the anticipated on-grid solar capacity down to 10 GW. This reduction was necessary due to a high degree of uncertainty as to whether this level of on-grid solar capacity expansion was feasible. The solution reached in the Final Scoping Plan was to integrate steam methane reformation of biomethane and biomass gasification with carbon capture and sequestration to produce hydrogen, along with off-grid solar.[2] As discussed in the following section of this comment, H Cycle's new technology is uniquely situated to produce additional and particularly beneficial hydrogen for California from landfill diversion on a distributed scale while at the same time reducing methane emissions.

[1] California Air Resources Board, 2022 Final Scoping Plan, at p. 9.
[2] Id. at p. 88-89, and footnote 151.

H Cycle is the Leading Company in Organic/Biogenic Waste-to-Hydrogen

H Cycle is a California company based in Concord that was founded in 2021. H Cycle is a developer of low-cost, low-carbon hydrogen production facilities that deploy an advanced waste-to-hydrogen thermal conversion technology. H Cycle is currently developing multiple projects in California. H Cycle facilities will be capable of utilizing a diverse composition of waste feedstocks including post-separated organic fractions of municipal solid waste, agricultural residues, and woody biomass from wildfire risk reduction projects to produce Low-CI hydrogen. The successful development of these projects will reduce methane emissions from landfill disposal and other waste streams and facilitate achievement of California's waste diversion targets under Senate Bill 1383 ("SB 1383"). The H Cycle process delivers Low-CI hydrogen that can be used as a fuel for decarbonizing hard-to-abate sectors such as low-carbon fuel production, heavy-duty trucking, and sustainable aviation. H Cycle is excited to work with CARB and local communities to deploy our solution and support the State in meeting its climate, sustainability and air quality goals.

H Cycle is the first company to have received a favorable Article 2 determination from CalRecycle. The Short-Lived Climate Pollutants Waste Reduction Regulations ("SB 1383 Regulations") identify specific technologies that constitute recovery of organic waste and other technologies that are categorized as landfill disposal.[3] If a technology or activity is not specifically identified in either subsection (a) or (b) of 14 CCR Section 18983.1, an interested party may request CalRecycle to perform an evaluation of its technology to determine if it constitutes a reduction in landfill disposal, in accordance with the Article 2 requirements.[4] For a technology or recovery process to constitute a reduction in landfill disposal, it must reduce the physical presence of organic waste in landfills and reduce greenhouse gas ("GHG") emissions. Pursuant to the CalRecycle and CARB evaluation process, H Cycle's technology was determined to exceed the benchmark ERF for composting and also met other SB 1383 Requirements and was therefore determined to be "a reduction in landfill disposal" by CalRecycle on January 11, 2024.[5] See Attached Exhibit A for the H Cycle Article 2 determination.

H CYCLE'S ANALYSIS AND RECOMMENDATIONS

Recommendation 1:
CARB should utilize the findings and recommendations of the Little Hoover Commission regarding the current statewide shortfall and inability to meet organic diversion targets under SB 1383 to inform its LCFS regulatory amendments and to take remedial action to reduce methane emissions from organics that continue to be landfilled in the State.

Discussion:
The Little Hoover Commission is an independent state oversight agency. By statute, the Commission is a bipartisan board composed of five public members appointed by the governor,

[3] Recovery at 14 CCR Section 18983.1(b); landfill disposal at 14 CCR Section 18983.1(a).
[4] 14 CCR Section 18983.2.
[5] See CalRecycle, "Public Notice: Consideration of a Technology Determination for H Cycle Pursuant to Article 2 of the SB 1383 Regulations," at https://www2.calrecycle.ca.gov/PublicNotices/Details/5287, "Request for Action," download available at https://www2.calrecycle.ca.gov/PublicNotices/Documents/15520.

four public members appointed by the Legislature, two senators and two assemblymembers. When the Commission was established in 1962, the Legislature declared its purpose to be:

> "… promoting economy, efficiency and improved services in the transaction of the public business (…) and in making the operation of all state departments, agencies and instrumentalities, and all expenditures of public funds, more directly responsive to the wishes of the people as expressed by their elected representatives…"[6]

In its letter presenting the report entitled "Reducing California's Landfill Methane Emissions: SB 1383 Implementation," to Governor Newsom and to members of the California Senate and Assembly, Chair Pedro Nava emphasized the following:

> *Combatting climate change is perhaps the defining issue of our era, and California has long been a leader in that fight. In 2016, the state enacted a landmark reform in this area by passing SB 1383, which required the state to reduce the amount of organic material deposited into landfills. The stakes could not be higher. As it decomposes, organic material produces methane, which is extraordinarily efficient at trapping heat and contributing to climate change. In the effort to constrain climate change, no short-term step is as important as reducing methane emissions. The livability of our planet depends on it.*
>
> *Yet California is falling short of its goals. The state missed its 2020 target, and is poised to miss its 2025 goal. Local governments – the front-line warriors in this fight – are struggling to implement the state's program.*
> *(…)*
> *The recommendations in this report present a critical opportunity to advance California's fight against climate change. We hope and believe you will consider this report in that light – as a plea to fix what is wrong in the pursuit of a noble and critical challenge.*[7]

The Little Hoover Commission 1383 report noted that the State completely failed to meet its target in 2020 of a 50% reduction below 2014 levels in that the amount of organic waste sent to landfills in 2020 actually increased by one million tons over the 2014 baseline. The report forecast that the 2025 target of a 75% reduction is unattainable and estimated that the State will fall short of the target by approximately 8 million tons per year.[8] (For reference, this would be the equivalent of approximately 54 one-unit H Cycle facilities. H Cycle is permitting its first one-unit facility in the City of Pittsburg.) The 2025 forecast in the report was based on CalRecycle's analysis of the amount of organic waste that would be received in 2025 and the testimony of CalRecycle's leadership to the Commission. The CalRecycle analysis found that the state would only have sufficient composting, anaerobic digestion, co-digestion, biomass electricity and mulching facilities to process 10 of the 18 million tons that would need to be processed by these types of facilities in 2025.[9]

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[6] Little Hoover Commission, "Reducing California's Landfill Methane Emissions: SB 1383 Implementation (Report #274, June 2023), at p. 2, available at https://lhc.ca.gov/sites/lhc.ca.gov/files/Reports/274/Report%20274.pdf

[7] Id. at p. 4.

[8] Id. at p. 5.

[9] Id. at p. 10; citing at Little Hoover 1383 Report to footnote 11: CalRecycle, "Analysis of the Progress Toward the SB 1383 Organic Waste Reduction Goals" (August 18, 2020). p. 7-15. https://www2.calrecycle.ca.gov/Publications/Download/1589.

The Little Hoover 1383 report recommended that the State implement a temporary pause on SB 1383 and take a series of steps during the temporary pause to the get the organics diversion policy on track. The report noted that more than 100 local jurisdictions have sought an extension of the deadline for compliance.[10] The report examined Low-CI hydrogen and found that Low-CI hydrogen is not sufficiently commercialized in California to be deployed at scale or to play a significant role in meeting the SB 1383 target for 2025 and stated as follows:

> *Work on future use of hydrogen in California should and will continue. In 2022, the Legislature passed a bill requiring that by June 2024 the California Air Resources Board evaluate "the development, deployment, and use of hydrogen." But while low- carbon hydrogen has promising implications for the future, it would be unrealistic and unreasonable to expect even the state government to meet the procurement requirements with hydrogen by 2025 given the factors noted above. Presenting it as a feasible alternative for local governments to have in place by 2025 is setting them up to fail.*[11]

Given the centrality of hydrogen's role in the 2022 Scoping Plan and California's strategy to achieve carbon neutrality by 2045, CARB should take this LCFS rulemaking opportunity to accelerate technologies like H Cycle's that can both help California achieve the methane reduction goals that underlie SB 1383 and expand its Low-CI hydrogen production capacity. Because of the severe failure and current inability of the State to meet SB 1383 organics diversion targets, CARB should deviate from its standard approach to LCFS lifecycle analysis that utilizes California legal requirements to serve as baseline for analysis. The tremendous shortfall that has already occurred in landfill diversion of organics necessitates a different approach so that California's most potent transportation program can be leveraged to help reduce methane emissions immediately. The following proposed regulatory changes would institute a short-term program designed specifically to accelerate landfill diversion and commercialize technologies that can enable California to solve its methane crisis. To fulfill its obligations under SB 1383 and other statutes, CARB must acknowledge the reality that California is currently not capable of diverting 75% of organics from landfills for the litany of reasons detailed in the Little Hoover 1383 report that has caused over 100 jurisdictions to request compliance extensions.

Summary of Recommended LCFS Amendments under H Cycle Recommendation 1

CARB should make a number of targeted amendments to the LCFS Proposal to address the landfill methane crisis facing the State:

A. Modify §95488.9(f) to authorize a technology that produces a transportation fuel determined by CalRecycle and CARB to meet the Article 2 standard to simultaneously receive a qualifying LCFS pathway score under the LCFS with a pathway CI score that is aligned with the Article 2 determination.

B. Modify §95488.9(f) so that new technologies can continue to receive LCFS pathway scores that are consistent with Article 2 determinations until California attains the SB 1383 statewide organics diversion target of 75%.

[10] Id.
[11] Id. at p. 14-15.

C. Modify §95488.9(f) such that subsequent to California attaining the SB 1383 statewide organics diversion target of 75%, fuel pathways that are based on the diversion of organic waste will receive LCFS fuel pathways based on reductions achieved that are greater than the emissions reduction from composting organic waste (0.30 MTCO2e per short ton organic waste).

H Cycle's proposed approach would be administratively efficient, would enhance the coordination between CalRecycle and CARB in the recognition of technologies that can enable California to bridge the 1383 organics diversion gap and would advance the commercialization of hydrogen. The attached **Exhibit B** provides recommended text to implement this recommendation.

H Cycle recognizes that the proposed revisions to the LCFS regulation would be exceptions to CARB's general approach to life cycle analysis modeling of carbon intensity reductions which is to only recognize GHG reductions that are additional to legal requirements. However, the findings of CalRecycle and the Little Hoover 1383 report conclusively establish that California is likely to miss its 2025 statewide target *by eight million tons of organics* and that the result of this landfilling of organics in excess of SB 1383 targets is that massive quantities of the powerful SLCP methane will be released into the atmosphere in 2025 and subsequent years. The Little Hoover 1383 report provides compelling evidence of the impact of persistent organics in California landfills in that 30 (of the state's 436) landfills and 2 compositing facilities are super-emitters, have persistent methane plumes, and are the source of almost half of landfill methane emissions.[12]

While consistency is the preferred general rule in regulatory development, there is no valid climate policy reason for CARB not to recognize real-world methane reductions from diverted landfill organics in its LCFS program that occur before SB 1383 organics diversion targets are achieved. Such SLCP reductions are additional reductions that California and the planet desperately need. If climate change is indeed the kind of existential crisis described in the Scoping Plan and a large body of California statutes, now is the time to leverage the LCFS program to incentivize H Cycle and other developers of technologies that can convert organic wastes into transportation fuels. It is certainly not the time to sunset crediting for qualified Article 2 technologies when municipalities are desperately searching for viable outlets for landfill-diverted organics and H Cycle is the only Article 2 approved technology that exists.

Recommendation 2:
Given the massive scale of hydrogen ambition established by the 2022 Scoping Plan and the extremely small market share of fuel cell electric vehicles ("FCEVs") CARB should extend the eligibility of electricity book-and-claim to Low-CI hydrogen that is used in the production of an alternative fuel. Related to this, due to the importance of attracting federal funding to California including Inflation Reduction Act ("IRA") funds for Low-CI hydrogen, CARB should more closely align LCFS electricity book-and-claim accounting requirements with IRA Section 45V's utilization of environmental attribute certificates ("EACs"). This would include allowing hydrogen producers the flexibility to source Low-CI power utilizing PPAs and/or unbundled RECs.

[12] Id. at p. 23-24.

Discussion:
H Cycle would like to first acknowledge and express its support and appreciation for CARB's decision to expand the eligibility of hydrogen to utilize Low-CI electricity beyond electrolytic hydrogen to Low-CI hydrogen that meets the requirements established by §95488.8(i)(3). We commend CARB for establishing a technology-neutral eligibility standard that recognizes the value of hydrogen derived from biogenic sources, including the derivation of hydrogen from organic waste diverted from landfills.

However, we must also express our concern that in the LCFS Proposal, CARB has severely restricted how hydrogen can be used as a fuel under the LCFS while maintaining eligibility for book-and-claim power sourcing. Under the existing regulations, book-and-claim can be utilized for qualifying hydrogen that is "for transportation purposes (including hydrogen that is used in the production of a transportation fuel)" under existing §95488.8(i)(1). Under the LCFS Proposal, book-and-claim can only be utilized for "hydrogen used as a transportation fuel" under proposed §95488.8(i)(1) and §95488.8(i)(1)(C).

We have raised this issue in discussions with CARB and have been advised that the rationale for the restriction is the concern that there is a limited amount of Low-CI power currently available in California and there are limits to the rate of Low-CI power supply expansion. Due to these concerns regarding Low-CI power scarcity, the LCFS Proposal is intended to ensure sufficient supply of Low-CI power for zero emission vehicles ("ZEVs") including battery-electric vehicles ("BEVs") and FCEVs. We respect this concern but in the current rulemaking, it is our perspective that the restriction to supplying FCEVs will preclude the massive growth of hydrogen supply (1,700x) that CARB is seeking to achieve by 2045 to meet California's climate and air quality goals.

The market reality is that by limiting Low-CI book-and-claim to neat/unblended hydrogen used in FCEVs, CARB has shrunk the addressable hydrogen market demand drastically. In order to develop multiple facilities in California during the 2020's, H Cycle and other hydrogen producers must raise sufficient capital to secure each site, comply with environmental reviews, permit the facility, procure necessary equipment, hire workers and build and commission the facility. The fundamental question from investors is, "What is the anticipated return on investment for the capital provided in the form of equity or debt to the project?" According to the scenario spreadsheet developed by E3 that underlies the 2022 Scoping Plan, in 2024 there will be a very small FCEV sector in California that includes 8,168 light-duty FCEVs; 410 medium-duty FCEVs, 1,230 heavy-duty FCEVs, and 53 FCEV buses.[13]

Returning to the vantage point of the investor, there is likely to be little interest in investing in new hydrogen production facilities that are forced to choose whether:

- To build in remote areas, far-removed from hydrogen demand, in order to co-locate with solar or wind power generation to reduce the CI of their energy input,
- To sell hydrogen only to the very small and distributed FCEV fleet that currently exists in California, or,

[13] See CARB Scoping Plan at p. 189, footnote 332 which provides the underlying information to Figure 4-2, "Transportation fuel mix in 2022, 2030, and 2045 in the Scoping Plan Scenario." The Scoping Plan footnote states, See https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-PATHWAYS-data-E3.xlsx for transportation fuels by year.

- To source grid-mix power that may result in a CI score that reduces their federal IRA 45V incentives and California LCFS crediting.

The same investor is likely to be substantially more interested in investing in a Low-CI facility that has the flexibility to supply hydrogen that is used in the production of an alternative fuel. We note that there is more expansive flexibility in the existing LCFS section 95488.8(i)(1) that allows Low-CI power sourcing for electrolytic hydrogen producers that supply "hydrogen that is used in the production of a transportation fuel." While we recognize that hydrogen supplied to produce transportation fuel extends to hydrogen used in petroleum refineries, we also recognize that CARB is working to phase down the supply of fossil fuels to speed the reduction of both GHG and criteria pollutant emissions.

We therefore limit our recommendation to "hydrogen that is used in the production of an alternative fuel." H Cycle's focus is on decarbonization and thus the company is focused on supplying hydrogen to the low carbon fuel market. This is a diverse and growing market that includes power-to-liquid ("PTL") fuels, renewable diesel and sustainable aviation fuel ("SAF"), and each of them has significant needs for hydrogen inputs to production.

Under existing LCFS provision §95488.8(i)(1)(A)-(B), Low-CI electricity supplied as a transportation fuel, e.g., used to power BEVs, can be sourced flexibly through the use of renewable energy certificates ("RECs") or via a qualifying Green Tariff program. Under these provisions, it is also required that the electricity be supplied to the grid within the same balancing authority as where the EVs are charged or in compliance with CPUC §399.16, that all environmental attributes be retired with limited exceptions, and that the RECs be used within three quarters of when the RECs were generated.

As is currently the case for electrolytic hydrogen that can utilize RECs to obtain Low-CI power, CARB should authorize this same power sourcing structure for Low-CI hydrogen that meets the requirements established by §95488.8(i)(3). Hydrogen producers must necessarily comply with the requirements of IRA Section 45V which, when finalized, will impose strict requirements on power sourcing for Low-CI hydrogen. Due to the substantial value that attaches to 45V crediting for hydrogen producers, and the associated potential inflow of federal funding to the State, CARB should authorize either the use of RECs pursuant to §95488.8(i)(1)(A)-(B), or environmental attribute certificates as authorized under Section 45V.

The expansion of low-CI power would facilitate California's receipt of federal funds that are available through the Inflation Reduction Act, Bipartisan Infrastructure Law, and other federal programs. These funding opportunities hinge upon CARB's continuing to enable the sourcing of Low-CI Power via RECs. If CARB instead limits Low-CI Power sourcing to neat hydrogen supplied to FCEVs, H Cycle will be required to source grid-mix power. The sourcing of grid mix power will substantially increase the H Cycle's CI score and correspondingly reduce H Cycle's ability to generate LCFS credits. Without the additional value derived from LCFS credits, H Cycle will have a more difficult time siting its facilities in California where permitting requirements cause substantial expense and time delays, and it is generally more expensive to site and operate a facility.

Recommendation 3:
CARB should clarify its intent under proposed LCFS §95488.8(i)(1)(C)(2) as this proposed provision states, "The pathway holder or the project operator must be the first contracted entity for procuring the low-CI electricity." Prior to adoption of the LCFS Proposal, CARB should revise the language to clearly indicate what is meant by the phrase "first contracted entity" and ensure that this provision does not establish an impossible condition in California or other markets.

Discussion:

CARB should clarify its intent under §95488.8(i)(1)(C)(2*)* regarding the use of PPAs for bundled Low-CI power sourcing for hydrogen production, with regard to the "first contracted entity" requirement, because California law does not allow "direct access" for manufacturers as end-use retail customers to procure competitive wholesale power supplies.[14] Other than direct hard-wiring of power supplies, entering into PPAs to source Low-CI power indirectly via community choice aggregators ("CCAs") or other load-serving entities represent hydrogen producers' only authorized opportunity to source Low-CI power from renewable generators at a competitive cost, versus procuring grid power from their utility plus unbundled RECs at enormous cost. If CARB's intent is to allow hydrogen producers to access this lower-cost, Low-CI power and thereby promote the development of more hydrogen production in the State, then the language should be modified to remove the first contracted entity requirement, so hydrogen producers can contract indirectly via CCAs and other load-serving entities to arrange such Low-CI power supplies.

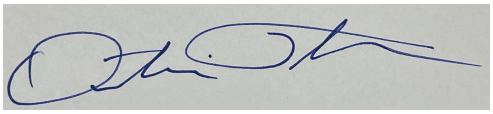
[14] See DIVISION 1. REGULATION OF PUBLIC UTILITIES [201 - 3297] *(Division 1 enacted by Stats. 1951, Ch. 764.);* PART 1. PUBLIC UTILITIES ACT [201 - 2120]; *(Part 1 enacted by Stats. 1951, Ch. 764.) CHAPTER 2.3. Electrical Restructuring [330 - 400.3] (Chapter 2.3 added by Stats. 1996, Ch. 854, Sec. 10.); ARTICLE 6. Requirements for the Public Utilities Commission [360 - 380.5] (Article 6 added by Stats. 1996, Ch. 854, Sec. 10.).*

Conclusion

Non-electrolytic hydrogen technologies and pathways have the potential to be a meaningful contributor to the State's and CARB's goals in the latest LCFS Proposal, and H Cycle believes the foregoing recommendations are strongly needed to ensure the projects have a fair shot at being financially viable to make such contributions. Supporting waste-to-hydrogen as a technology and commercial pathway, brings many benefits including a) supporting the State's current law in SB 1383; b) supporting the adoption of ZEVs in the CARB's Advanced Clean Fleets rules; c) achieving local air emissions reductions of NOx, particulate matter, etc. as a result of ZEV displacement of fossil-fueled vehicles; and d) job growth and investment tax base from new facilities. The LCFS Program and policies in the LCFS Proposal will play a key role in securing these benefits.

We appreciate the opportunity to submit these comments, and are available for further discussions on these important issues.

Sincerely,



Quentin Foster
VP, Policy and Government Affairs

EXHIBIT A

REQUEST FOR ACTION

To: Rachel Machi Wagoner
Director

From: Cara Morgan
Deputy Director, Materials Management and Local Assistance Division

Request Date: December 8, 2023

Decision Subject: Consideration of a Technology Determination for H Cycle Pursuant to Article 2 of the SB 1383 Regulations

Action By: January 16, 2024

Summary of Request

This Request for Action presents staff's analysis of a technology determination application pursuant to Article 2 of the SB 1383 Regulations (14 CCR Section 18983.2.), conducted in consultation with the California Air Resources Board (CARB). Action is needed to (1) determine whether the proposed technology, submitted by H Cycle and described below, constitutes a reduction in landfill disposal by reducing the physical presence of organic waste in landfills and reducing greenhouse gas (GHG) emissions and (2) to determine whether to publish a description of H Cycle's proposed technology on CalRecycle's website.

Background

The Short-Lived Climate Pollutants Waste Reduction Regulations (SB 1383 Regulations) identify specific activities and technologies that constitute recovery of organic waste (14 CCR Section 18983.1 (b)) and others that are considered landfill disposal (14 CCR Section 18983.1 (a)). If a technology or activity is not specifically identified in either subsection (a) or (b) of 14 CCR Section 18983.1, an interested party may request CalRecycle to perform an evaluation of its technology to determine if it constitutes a reduction in landfill disposal, in accordance with the Article 2 requirements (14 CCR Section 18983.2.).

For a technology or recovery process to constitute a reduction in landfill disposal, it must reduce the physical presence of organic waste in landfills and reduce greenhouse gas (GHG) emissions. To meet the requirements under Article 2 (14 CCR Section 18983.2 (a)(3)), the permanent lifecycle GHG emission reductions of a proposed technology or process must be equal to or greater than the emission reductions from composting organic waste (0.30 metric tons of carbon dioxide equivalents ($MTCO_2e$) per short ton organic waste), referred to herein as the "benchmark." The methodology used to calculate the permanent lifecycle GHG emission reductions from composting organic waste (or benchmark) is set out in Section 19883.2 and described in CARB's Calculation of the Lifecycle Greenhouse Gas Emission Reduction Benchmark for the Organic Waste Reductions Regulation.

To conduct the required lifecycle analysis of a technology or process, CalRecycle, in consultation with CARB staff, evaluates its GHG emission impacts as described in 14 CCR Section18983.2 (a)(1)-(a)(3). An applicant must submit a complete set of assumptions, data, and other information that is sufficient to estimate the GHG emissions and permanent lifecycle GHG emission reductions of their technology or process. CalRecycle staff, in consultation with CARB, must evaluate the information submitted in an application within 30 days of receipt and inform the applicant whether the application is complete. Upon receiving all required information and deeming an application complete, CalRecycle and CARB staff conduct an evaluation of the technology or process and determine, within 180 days, if it will permanently reduce GHG emissions by at least 0.30 $MTCO_2e$ per short ton of organic waste. As authorized by 14 CCR Section 18983.2 (a)(1)(I), CalRecycle may request additional information to clarify and validate the information provided in an application. If CalRecycle determines that a proposed technology or process constitutes a reduction in landfill disposal, Section 18983.2 (b) mandates that a description of the operation be posted on CalRecycle's website.

Applicability of the Article 2 Technology Determination

Under the SB 1383 regulations, jurisdictions are required to provide organic waste collection services to all residents and businesses to divert these materials away from landfills and to recycling and recovery activities such as composting, anaerobic digestion, animal feed, and land application. The regulations provide a pathway for processes that are not specified in the SB 1383 regulations, to be deemed a reduction in landfill disposal. An Article 2 technology determination allows a facility to count as a reduction in landfill disposal for purposes of the SB 1383 Regulations if it can show it achieves the required GHG emission reductions. The Article 2 technology determination is not a guarantee that a project can be built or meets other requirements of state or federal law. Further,

i) The Article 2 technology determination is not an endorsement of a technology or process. The determination is solely an evaluation of the lifecycle GHG emission impacts of a proposed operation, technology, or process using the methods and assumptions described in 14 CCR Section 18983.2.
ii) An Article 2 technology determination made by the department pursuant to 14 CCR Section 18983.2 is a factual determination and does not constitute a permit or a permit approval. Further, although a technology or process may constitute a reduction in landfill disposal under the criteria set out in Section 18983.2, the operation must still comply with all other statutory and regulatory requirements. A technology or process deemed to constitute a reduction in landfill disposal pursuant to Article 2 may still be considered landfill disposal under other laws, such as AB 939 (PRC Section 40120.1).
iii) An Article 2 technology determination does not serve any role in the permit approval process.
iv) An Article 2 technology determination is made on the basis of the information presented in the Article 2 application and clarifying information submitted at the request of the department. The determination is limited to the specific activities, operations, and assumptions presented in the Article 2 application. If the technology, activities, operations, or processes differ

from the application as described in herein and on the department's website, the determination is not applicable.

a. If a facility is found to be operating in a manner that differs from the description posted on the department's website and is not otherwise engaged in one of the activities specified in 14 CCR 18983.1(b), any organic waste processed by the facility does not constitute a reduction in landfill disposal.

Applicant: H Cycle

H Cycle is a developer that intends to build and operate multiple facilities in California to produce hydrogen from organic waste. H Cycle previously applied for an Article 2 technology determination in 2022. The previous application lacked information specifying the operational controls that would prevent a facility using H Cycle's technology from deviating from the feedstock scenarios and other operating assumptions, which could impact whether it permanently reduces greenhouse gas emissions by at least 0.30 MTCO2e per short ton of organic waste. Because CalRecycle is required to make a determination upon a "proposed operation," and requires operational controls demonstrating how a proposed technology will operate in practice to permanently reduce GHG emissions, CalRecycle found that the application did not sufficiently demonstrate permanent reductions in greenhouse gas emissions to warrant a finding that the operation described constituted a reduction in landfill disposal. Subsequently, H Cycle submitted an application on July 17, 2023, which included operational controls and monitoring and verification procedures to verify the greenhouse gas emission reductions are achieved.

Staff Analysis

Application Review Process

CalRecycle received an Article 2 application from H Cycle on July 17, 2023. In accordance with Section 18983.2 (a)(2), staff reviewed the application, in consultation with CARB, and performed a completeness review. After reviewing the application, in consultation with CARB, CalRecycle determined that it was complete at its August 15, 2023, Monthly Public Meeting. CalRecycle notified H Cycle of the completeness finding.

CalRecycle and CARB staff reviewed all the information and calculations provided by the applicant and confirmed that, under the specific processes and assumptions identified in H Cycle's application, the permanent lifecycle GHG emission reductions are equal to or greater than the emission reductions from composting organic waste (0.30 $MTCO_2e$/short ton organic waste). CalRecycle and CARB reviewed the methodology utilized to determine the emission reduction factor (ERF) of H Cycle's proposed process under the three feedstock scenarios described below. H Cycle provided key performance data based on its preliminary engineering design, which provides data on heat and mass balances, utility needs, product yields, and other key metrics utilized to calculate the life cycle greenhouse gas (GHG) emissions from the waste processing and hydrogen production process, the avoided fugitive methane emissions from landfilling, avoided emissions due to hydrogen production (i.e., the GHG emissions that do not occur because a conventional fossil fuel is replaced by waste-derived hydrogen), and emissions due to transportation. Below is CARB's technical summary.

Summary of Hydrogen Production Process

H Cycle's application proposed that facilities utilizing its technology will convert approximately 85,000 to 133,000 short tons per year of organic waste from material recovery facilities (MRFs) into hydrogen using Omni Conversion Technologies' thermal conversion process, a sour-gas-shift reactor, and a pressure swing adsorption system. The hydrogen is intended for use at refineries or in fuel cell electric vehicles. The process described in the application is organized into four units: the feedstock preparation unit, the waste conversion unit, the hydrogen production plant, and a utility and water unit.

At the feedstock preparation unit, the material is shredded; most inert materials and plastics are removed using manual sorting, screening, magnetic and eddy current separators and air classifier; and the material is dried to 10 percent moisture content using steam from a boiler and heat recovered from the process. At the waste conversion unit, the prepared feedstock will be transformed into syngas using a non-combustive thermal conversion process. The syngas (a mixture of primarily hydrogen, carbon monoxide, and some methane) goes through a second high-temperature conversion step to maximize yield. Particles are removed from the syngas and converted to a non-hazardous slag, which can be used as a recycled product or disposed.

The syngas is finally sent through a series of cleaning and scrubbing steps to remove chlorine and nitrogen species and remaining solids. The syngas is then compressed and fed into the hydrogen production unit, which uses a sour-gas-shift reactor where steam reacts with syngas forming a hydrogen-rich gas and converting carbon monoxide to carbon dioxide. The resulting gas is treated to remove sulfur species and purified in a pressure-swing adsorption system to generate hydrogen gas of at least 99.97 percent purity, the International Standards Organization (ISO) specification level for use in a hydrogen fuel cell.

A utility and water unit comprised of oxygen production, steam generation, and wastewater treatment supports various stages of the process. Condensate wastewater from the plant is cleaned and disposed to the local sewer. Offgas is recycled and combusted in a boiler equipped with emissions controls to generate additional steam for use on-site.

Feedstock Scenarios

H Cycle developed three illustrative feedstock scenarios, based on characterization and lab sampling of specific sources collected from MRFs. The three scenarios differ primarily by moisture content of the organic waste, which in turn impacts process energy demand. For each feedstock scenario, the application provides the quantity of each waste type, as-received, as-fed to the process, and the total annual throughput in tons.

1. Low-moisture scenario: the waste feedstock is composed of a mixture of construction and demolition waste and post-MRF non-recyclable fibers (15 percent moisture as-received).
2. Medium-moisture scenario: the waste feedstock is composed of residential black bin organics post primary processing at a MRF or transfer station, further processed by H Cycle to high organic content (39 percent moisture as-received).

3. High-moisture scenario: the waste feedstock is composed of material obtained from a high-diversion organic MRF containing the expected worst-case maximum 9 percent plastic (45 percent moisture as-received).

The life cycle GHG emissions analysis is based on the assumption that the feedstocks processed in H Cycle's projects will fall within the boundaries of these scenarios and do not exceed them in terms of moisture or plastic content.

Based on the as-fed composition, H Cycle used a process model to determine the anticipated throughput of the facility and resulting process energy demand, hydrogen and slag yields for each feedstock scenario. Key inputs and outputs are summarized in Table 1.

Table 1. Key Process Performance Metrics

Input or Output (per short ton of organic waste feedstock)	Feedstock 1 Low Moisture	Feedstock 2 Medium Moisture	Feedstock 3 High Moisture
Natural Gas Input (MMBtu/ton)	0.74	1.44	1.39
Electricity Input (MWh/ton)	0.93	0.63	0.59
Slag Output (kg/ton)	151.60	102.56	145.86
Hydrogen Output (kg/ton)	73.16	47.03	43.76

System Boundary and Emissions

The life cycle GHG emissions analysis includes the emissions reduction from avoided landfill disposal, the emissions reduction due to products displaced by hydrogen (i.e., the GHG emissions that do not occur because a conventional fossil fuel is replaced by waste-derived hydrogen), the process emissions from the waste processing and hydrogen production process, and the emissions due to transportation. Key assumptions, data sources, and calculations are summarized below:

1. Avoided landfill emissions
   H Cycle used the Landfill Emission Reduction Factor Tool developed by CARB to calculate avoided GHG emissions from landfilling each organic waste type. The weighted average was calculated for each feedstock scenario.

2. Avoided product displacement emissions
   H Cycle estimated the avoided GHG emissions that could result from displacing fossil fuels with hydrogen derived from conversion of organic waste. H Cycle estimates 30 percent of the product will be used in heavy-duty fuel cell electric vehicles to displace diesel and the remainder will be used at refineries to displace fossil gas-derived hydrogen.

3. Process emissions
   Energy use included fossil natural gas, grid electricity, and diesel used at the H Cycle facility, and at hydrogen vehicle fueling stations to compress, store, and dispense fuel. Process emissions also included the emissions associated with

the production of material and chemical inputs used at the H Cycle facility (e.g., catalysts, potassium carbonate, activated carbon, and zeolite). Life cycle emission factors were obtained from CA-GREET3.0. Fugitive, leaked, and vented emissions were calculated by assuming one percent of generated methane and carbon monoxide may leak from flanges, valves, or other parts of the processing equipment and emissions during the storage of post-processed waste for up to 3 days in aerobic conditions may be vented. Emissions from conversion of plastics were calculated using the emission factor from the U.S. EPA's Waste Reduction Model (WARM), 2.33 $MTCO_2e$ per short ton.

4. Transportation emissions for slag disposal and hydrogen product delivery
H Cycle assumed a maximum distance of 200 miles per trip for both the disposal of slag material at a landfill or delivery of hydrogen product to an end use. H Cycle calculated the emissions from diesel in heavy-duty trucks to transport slag for disposal in 21-ton capacity trucks and to transport compressed hydrogen to a fueling station or refinery in 0.4-ton capacity tube trailers. Capacity and fuel economy factors used in the calculation are from CA-GREET3.0. Note that the system boundary does not include transport of organic waste from a MRF, under the assumption that the H Cycle facility will be the same distance or nearer to the organic waste supplier than the nearest landfill that would otherwise dispose of the organic waste feedstock.

Example calculation of avoided emissions from product displacement:

$$\text{Displacement} = CCCC_{\text{displaced fuel}} \times EEEEEE \times ww \times CC$$

Where, $CCCC_{\text{dddddddddddddddddd ffffdddd}}$ is the carbon intensity of the conventional fuel, e.g., diesel; $EEEEEE$ is the energy economy ratio, a ratio that represents the efficiency of a fuel as used in a powertrain as compared to a reference fuel; ww is the energy density of hydrogen; and CC is the unit conversion from metric tons (MT) to kilograms (kg) and grams (g) to MT. Values are from CA-GREET3.0. Displacement for hydrogen (H_2) that is used to displace diesel in a heavy-duty electric fuel cell vehicle is given by:

$$\text{Displacement} = 99.76 \frac{\text{g}CCCC_2\text{e}}{\text{MJ}_{\text{diesel}}} \times 1.9 \frac{\text{MJ}_{\text{diesel}}}{\text{MJ}_{\text{H2}}} \times 120 \frac{\text{MJ}_{\text{H2}}}{\text{kg}_{\text{H2}}} \times \frac{1000\ \text{kg}_{\text{H2}}/\text{MJ}_{\text{H2}}}{10^{\,6}\text{g}CCCC_2\text{e}/\text{MT}CCCC_2\text{e}} = 2222.77 \frac{\text{MT}CCCC_2\text{e}}{\text{MT}_{\text{hydrogen}}}$$

A similar calculation is performed to determine displacement for H_2 used in refineries, with $EEEEEE = 1$ and $CCCC_{\text{dddddddddddddddddd ffffdddd}} = 99.4$. Displacement resulting from use of 30% H_2 in vehicles and 70% in refineries is calculated by:

$$\text{Displacement} = (30\% \times 22.7) + (70\% \times 11.9) = \mathbf{1111.22} \frac{\text{MT}CCCC_2\text{e}}{\text{MT}_{\text{hydrogen}}}$$

This factor is then adjusted to the short ton organic waste basis for inclusion in the ERF.

Key Assumptions

- Waste feedstock is prepared within one day of delivery to the H Cycle facility.
- No additional pre-processing steps are required at the MRF or transfer station that supplies organic waste.

- No hazardous waste will be accepted, and organic material as received will have a maximum moisture content of 45 percent.
- Prepared organic feedstock is stored for no more than 3 days and contains no more than 9 percent plastic by mass.
- At least 30 percent of the hydrogen product will be used in fuel cell electric vehicles.
- Slag material will be transported for landfill disposal no more than 200 miles from the conversion facility.
- Hydrogen products will be transported for end use no more than 200 miles.
- Process energy demand does not exceed the values stated in the application.
- Product yields achieved are greater than or equal to the values stated in the application.

Final Emission Reduction Factor

The final ERF was determined by adding (a) the avoided methane emissions from not landfilling the waste and (b) the avoided GHG emissions associated with product displacement, and subtracting both (c) the process emissions and (d) transportation emissions. The resulting ERF reflects the life cycle GHG emissions reduction from processing one short ton of mixed organic waste versus depositing the same amount of material into a landfill. Note that while the total GHG emissions per year are accounted for in these calculations (including fossil CO2 emissions from plastic conversion), they are divided by the tons of organic waste processed only (i.e., excluding tons of plastic and other inert materials), as specified in the regulations.

A summary of the emissions by life cycle stage and final ERF for each feedstock scenario is provided in Table 2.

Table 2. Emission reductions and final ERF for each feedstock scenario, expressed in $MTCO_2e$/short ton of organic waste processed.

Feedstock Scenario	Avoided Landfill (a)	Product Displacement (b)	Process Emissions (c)	Transport Emissions (d)	Final ERF
1	0.20	1.08	(0.45)	(0.06)	**0.78**
2	0.26	0.69	(0.37)	(0.04)	**0.55**
3	0.06	0.65	(0.36)	(0.03)	**0.31**

*See references used for technical analysis below.

Monitoring and Verification Procedures

The H Cycle application includes “Feedstock Quality Control” and “Monitoring and Verification” sections that identify operational and contractual controls, recordkeeping and reporting procedures, and methods for CalRecycle to monitor and verify that a facility using the H Cycle technology is continually operating consistent with what is represented in this Article 2 application.

Without the following additional monitoring and verification procedures and controls, CalRecycle cannot validate that the technology described in H Cycle's application will continually achieve the permanent lifecycle reduction in greenhouse gas emissions equal to or greater than 0.30 $MTCO_2e$/short ton of organic waste that therefore constitutes a reduction in landfill disposal. Any finding by CalRecycle that the H Cycle technology as described in the application constitutes a reduction in landfill disposal is contingent upon these monitoring and verification procedures and controls being in place.

1. Conduct waste characterization analyses of each contracted source of municipal solid waste (MSW) feedstock and of as-fed feedstock materials, at least quarterly, using the following protocol:
    a. Collect and photograph 200-pound samples per ASTM[1] D5231 – 92.[2]
    b. Conduct a bulk density test of each sample per ASTM E11090 – 19.[3]
    c. Pass materials through a fine screen (screen size to be consistent with that which is utilized for as-fed feedstocks) and continue hand sorting overs into subcomponent categories listed in (d).
    d. Hand sort each sample into subcomponents categories including but not limited to, yard waste, food waste, paper products, plastics, glass, hazardous waste, and ferrous and non-ferrous metals. Photograph and weigh each subcomponent category and maintain records.
    e. Create laboratory samples for moisture content analysis by recreating a weighted average mixture of the subcomponent categories, properly storing the samples to not allow evaporation of water content prior to testing. The laboratory samples shall be prepared in a manner consistent with the standards of the independent laboratory utilized and shall not contain the fines removed via the fine screen unless fines are included in as-fed feedstock. These samples shall be sent to an accredited ISO/IEC 17025[4][5] laboratory to measure moisture content.
2. Maintain and make available to the department, upon request, records of all slag material and any other co-products or waste produced, including but not limited to residuals removed from feedstocks, liquids produced onsite, hazardous waste outputs, and any constituents removed from the hydrogen gas produced. Records shall include a description and quantity of each material produced, the name of the landfill(s) where each material is disposed, quantity of material transported for any other use, and distance transported for each of these uses.
3. For each quarter in operation when reporting in the Recycling and Disposal Reporting System pursuant to CCR Title 14, Section 18815.1 through 18815.13, upload a document to the Recycling and Disposal Reporting System that includes the following:

[1] ASTM International, formerly known as American Society for Testing and Materials.
[2] ASTM D5231-92(2016), *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste*
[3] ASTM E1109-19, *Standard Test Method for Determining the Bulk Density of Solid Waste Fractions*
[4] International Organization for Standardization/International Electrotechnical Commission: ISO/IEC17025:2017 general requirements for the competence of testing and calibration laboratories.

a. The total quantity of feedstock as-received and the total quantity of feedstock as-fed to the reactor over the quarter.
b. The results of waste characterization and moisture content analyses conducted, including the quantity of plastic contained in the as-fed feedstock.
c. Total utility energy consumption reported in units of kWh/ton of organic waste as-fed.
d. Total natural gas consumption reported in million British thermal units per ton of organic waste as-fed.
e. Description, quantity, disposition, and location of disposition of all slag material and any other co-products or waste produced, including but not limited to residuals removed from feedstocks, liquids produced onsite, and any hazardous waste in as-received feedstock.
f. The total quantity of hydrogen produced, the distance the hydrogen is transported to its destination, and the end use of the hydrogen.

4. The project proponent includes operational aspects to implement monitoring and verification procedures 1, 2 and 3, as identified above in this RFA, in the operating document required for a solid waste facilities permit.
5. Monitoring by the Local Enforcement Agency:
    a. CalRecycle to provide technical assistance to Local Enforcement Agency.
    b. If the operating document is altered, CalRecycle will be notified by the Local Enforcement Agency.
6. H Cycle will participate in CARB's Low Carbon Fuel Standard (LCFS) Program and will be subject to annual reporting to CARB and third party verification of its carbon intensity (CI) score which includes:
    a. Feedstock quantity, moisture content, and amount of plastics contained in the as-fed feedstock materials.
    b. Energy consumption.
    c. Assessment of calibration procedures.
    d. Quantity of produced hydrogen used as transportation fuel.
7. If the facility utilizing the H Cycle technology, as described in the application, is operating outside the parameters identified in this application and RFA averaged over the reporting quarter, the facility shall notify CalRecycle within seven business days of submitting the quarterly RDRS report.

These additional monitoring and verification procedures will enable CalRecycle to validate that the technology as described in the application constitutes a reduction in landfill disposal on an ongoing basis for a specific operation. If these procedures are not followed, any determination that the technology does represent a reduction in landfill disposal will not be applicable as CalRecycle cannot be certain that the requisite GHG reductions are being met to constitute a reduction in landfill disposal. Any waste sent to such a facility likely will be deemed disposal.

Feedback from Interested Parties

As part of CalRecycle's commitment to transparency in decision making and program development, the H Cycle application documents, with confidential and proprietary information redacted, were made available for public review and comment. An email

message was sent via the SB 1383 Short-Lived Climate Pollutants listserv which provided instructions for submitting comments to CalRecycle. The 30-day public comment period was held from August 15, 2023, through September 16, 2023. All comments received are attached to this RFA (see attachments 3-20).

Summary of Staff Analysis

CalRecycle staff, in consultation with CARB, reviewed H Cycle's application and found the permanent lifecycle GHG emissions reduction is equal to or greater than the emissions reduction from composting organic waste (0.30 $MTCO_2e$ per short ton organic waste), and can be determined to be a reduction in landfill disposal under the analysis and methodology prescribed by regulation in 14 CCR Section 18983.2. The additional monitoring and verification procedures and controls identified above will allow CalRecycle to validate that the technology described in H Cycle's application will continually achieve the permanent lifecycle reduction in greenhouse gas emissions equal to or greater than 0.30 $MTCO_2e$/short ton of organic waste that therefore constitutes a reduction in landfill disposal**.**

Options

1. Find that the proposed H Cycle technology is a reduction in landfill disposal because the technology meets the benchmark reduction required by regulations to constitute a reduction in landfill disposal pursuant to 14 CCR Section 18983.2(a)(3). Staff is directed to publish a description of this technology on CalRecycle's website as required by 14 CCR Section 18983.2(b).
2. Find that the proposed H Cycle technology is not a reduction in landfill disposal because it fails to meet the benchmark reduction required by regulations to constitute a reduction in landfill disposal pursuant to 14 CCR Section 18983.2(a)(3).

Action

Based on the information and analysis provided in this Request for Action, including the above-noted monitoring and verification procedures, and as required by section 18983.2, I hereby determine that the proposed H Cycle technology is:

✓ Option 1: A reduction in landfill disposal and direct staff to publish a description of this technology on CalRecycle's website.

☐ Option 2: Not a reduction in landfill disposal.

Dated: 1/11/2024

Signed By: Rachel Machi Wagoner, Director

Attachments

Additional information and documents posted to CalRecycle's website can be accessed as indicated below.

1. Public Notice: Consideration of a Technology Determination for H Cycle Pursuant to Article 2 of the SB 1383 Regulations, https://www2.calrecycle.ca.gov/PublicNotices/Details/4942
2. Public Notice: Notice of Completeness Finding for H Cycle's SB 1383 Article 2 Application and 30-Day Public Comment Period, https://www2.calrecycle.ca.gov/PublicNotices/Details/5196

Public Comments: The following comments were received during the 30-day comment period which began on August 16, 2023, and concluded on September 15, 2023.

3. Lapis, N., Californians Against Waste (see attachment for list of 17 co-signers).
4. Adams, T., Green Waste Recovery LLC.
5. Bellafronte, S., City of Pittsburg.
6. Boyer, S., Hyzon Motors.
7. Clifford, G., Athens Services.
8. Edgar, E., Edgar & Associates.
9. Edgar, N., California Compost Coalition.
10. Evola, S., Mt. Diablo Resource Recovery.
11. Fornesi, T., South San Francisco Scavenger Company.
12. Forst, N., R2 Consulting Group, Inc.
13. Gatlin, J., NAACP Harbor Area Branch #1069.
14. Glover, F., Contra Costa County, Board of Supervisors District V.
15. Grayson, T., Assemblymember, 15th Assembly District.
16. Hughes, M., Industrial Association of Contra Costa County.
17. Levin, J., Bioenergy Association of California.
18. Orcutt, M., East Bay Leadership Council.
19. Pardo, V., Resource Recovery Coalition of California.
20. Whitney, B., Contra Costa Building and Construction Trades Council.

References:

1. California Air Resources Board. Calculation of the Lifecycle Greenhouse Gas Emission Reduction Benchmark for the Organic Waste Reductions Regulation (Revised January 2022) https://ww2.arb.ca.gov/sites/default/files/2022-01/Benchmark-Calculation.pdf
2. California Air Resources Board. Landfill Emission Reduction Factor Tool for Section 18983.2. Accessed December 13, 2022 https://ww2.arb.ca.gov/slcp-organic-waste-reduction
3. California Air Resources Board. CA-GREET3.0 Model and Documentation. Accessed December 13, 2022. https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation
4. U.S. Environmental Protection Agency. Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM) Management Practices Chapters, November 2020, Exhibit 5-1. https://www.epa.gov/sites/default/files/2020-12/documents/warm_management_practices_v15_10-29-2020.pdf.

LCFS Proposed Amendments

(…)

§ 95488.9. Special Circumstances for Fuel Pathway Applications.

(…)

(f) Carbon Intensities that Reflect Avoided Methane Emissions from Dairy and Swine Manure or Organic Waste Diverted from Landfill Disposal.

(1) A fuel pathway that utilizes biomethane from dairy cattle or swine manure digestion may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the voluntary capture of methane, provided that:

(A) A biogas control system, or digester, is used to capture biomethane from manure management on dairy cattle and swine farms that would otherwise be vented to the atmosphere as a result of livestock operations from those farms.

(B) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the capture and destruction of biomethane.

(2) Prior to January 1, 2025, a fuel pathway that utilizes an organic material diverted from a landfill may be certified with a CI that reflects the reduction of greenhouse gas emissions determined in the approval of an Article 2 of the SB 1383 Regulations (14 C.C.R. 18983.2) technology determination by CalRecycle conducted in consultation with CARB if the permanent lifecycle GHG emissions reduction is equal to or greater than the emissions reduction from composting organic waste (0.30 $MTCO_2e$ per short ton organic waste).

(3) Until California attains its statewide organics diversion goal of 75% under SB 1383, ~~A~~a fuel pathway that utilizes an organic material may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by the ~~voluntary~~ diversion from decomposition in a landfill and the associated fugitive methane emissions, provided that:

(A) The organic material that is used as a feedstock would otherwise have been disposed of by landfilling~~, and the diversion is additional to any legal requirement for the diversion of organics from landfill disposal~~.

(B) Any degradable carbon that is not converted to fuel is subsequently treated in an aerobic system or otherwise is prevented from release

as fugitive methane. Upon request, the applicant must demonstrate that emissions are not significant beyond the system boundary of the fuel pathway.

(C) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the avoidance or capture and destruction of biomethane in a landfill.

~~(4)~~ Upon a determination that California has attained its statewide organics diversion goal of 75% under SB 1383, ~~A~~ a fuel pathway that utilizes an organic material may be certified with a CI that reflects the reduction of greenhouse gas emissions achieved by ~~the voluntary~~ mandatory diversion ~~to a~~ if the permanent lifecycle GHG emissions reduction is equal to or greater than the emissions reduction from composting organic waste

~~(A) The organic material that is used as a feedstock would otherwise have been disposed of by landfilling, and the diversion is additional to any legal requirement for the diversion of organics from landfill disposal.~~

~~(B) Any degradable carbon that is not converted to fuel is subsequently treated in an aerobic system or otherwise is prevented from release as fugitive methane. Upon request, the applicant must demonstrate that emissions are not significant beyond the system boundary of the fuel pathway.~~

~~(C) The baseline quantity of avoided methane reflected in the CI calculation is additional to any legal requirement for the avoidance or capture and destruction of biomethane.~~

(5) Carbon intensities that reflect avoided methane emissions from dairy and swine manure or organic waste projects are subject to the following requirements for credit generation:

(A) *Crediting Periods.* Avoided methane crediting for dairy and swine manure pathways as described in (f)(1) above, and for landfill-diversion pathways as described in (f)(2) above, is limited to three consecutive 10 years crediting periods, counting from the quarter following Executive Officer approval of the application. The pathway holder must formally request each subsequent crediting period for the project through the LRT-CBTS. The Executive Officer may renew crediting periods for fuel pathways certified before January 1, 2030, for up to three consecutive 10-year crediting periods. For pathways for bio-CNG, bio-LNG, and bio-L-CNG used in CNG vehicles associated with projects that break ground after December 31, 2029, the Executive Officer may only approve avoided methane crediting through December 31, 2040. For pathways for

biomethane used to produce hydrogen that break ground after December 31, 2029, the Executive Officer may only approve avoided methane crediting through December 31, 2045.

(B) Notwithstanding (A) above, in the event that any law, regulation, or legally binding mandate requiring either greenhouse gas emission reductions from manure methane emissions from livestock and dairy projects or diversion of organic material from landfill disposal, comes into effect in California during a project's crediting period, then the project is only eligible to continue to receive LCFS credits for those greenhouse gas emission reductions for the remainder of the project's current crediting period. The project may not request any subsequent crediting periods.

(C) Notwithstanding (A) above, projects that have generated CARB Compliance Offset Credits under the market-based compliance mechanism set forth in title 17, California Code of Regulations Chapter 1, Subchapter 10, article 5 (commencing with section 95800) may apply to receive credits under the LCFS. However, the LCFS crediting period for such projects is aligned with the crediting period for Compliance Offset Credits, and does not reset when the project is certified under the LCFS.

(...)