State of Oregon Department of Environmental Quality

Written Comments Part 1

Clean Fuels Program Expansion 2022 Rulemaking

This document is a compilation of written comments received during the public comment period for the Clean Fuels Program Expansion 2022 Rulemaking. The comment period opened on June 29, 2022 and closed at 4 p.m. on July 21, 2022. Only comments received before the deadline are included in this document.

3Degrees 407 Sansome St., 4th floor
San Francisco, CA 94111

July 21, 2022

Cory Ann Wind
Oregon Department of Environmental Quality (DEQ)
700 NE Multnomah Street, Suite 600
Portland, OR 97232
Submitted electronically via CFP.2022@deq.state.or.us

RE: 3Degrees Group, Inc.'s Comments in Response to DEQ June 2022 Notice of Proposed Rulemaking: Clean Fuels Program Expansion 2022 Rulemaking

Dear Cory Ann Wind,

3Degrees submits the following comments in response to the June 29, 2022 Notice of Proposed Rulemaking for the Clean Fuels Program ("CFP") Expansion 2022 Rulemaking. 3Degrees has appreciated the opportunity to work with the DEQ and other CFP stakeholders as part of the rulemaking advisory committee throughout the first half of 2022 to inform the development of a strong CFP that maximizes climate, public health, and economic benefits.

About 3Degrees

3Degrees is a certified B Corporation with deep expertise in greenhouse gas accounting, environmental markets, renewable energy and carbon project development, transportation decarbonization solutions, and utility renewable energy programs. We are active in clean fuels programs in multiple jurisdictions and work with organizations to leverage these programs to enable transportation decarbonization. Specifically, 3Degrees is one of the largest participants in California's Low Carbon Fuel Standard by registered FSE and we are pioneering new vehicle-fuel applications in Oregon.

Comments

1- 3Degrees supports streamlining the designated reporting entity provisions and clarifying that the aggregator inherits the priority and any other preferential treatment of the designator. However, we recommend that DEQ revise the process for reporting when the aggregator's authorization has been withdrawn.

3Degrees supports DEQ's revisions to remove the reference to 'designating an aggregator' from the description of individual credit generation opportunities under 340-253-0330 and creating a standalone section, 340-253-0100 (3), that clarifies that any registered party may designate an aggregator to act on its behalf. This revision aligns the program's rules around entities that can designate an aggregator.

We are also supportive of the language DEQ has included that clearly states that, along with inheriting the designator's obligations under the program, the aggregator also inherits the priority and any other preferential treatment of the designator. The entity with the first right to credits is meant to align with who is closest to the decision-making related to supplying

low-carbon transportation fuels. Allowing the designated aggregator to take on the credit generator's privileges and requirements allows these entities to benefit from the program even if they do not have the resources to manage program participation themselves or might not otherwise be able to participate directly.

We recommend that DEQ revise its proposed process for aggregator transitions as outlined in 340-253-0100(3)(c) to only require notification from the designator, rather than from both the designator and the aggregator. We are concerned that, lacking an incentive to provide such notice to DEQ, the aggregator whose authorization has been withdrawn may not act in a timely manner, which may prevent the designator from being able to continue to participate in the program. The designator's FSE, facilities, credit generation rights, etc. that were managed by the outgoing aggregator should transition to the designator or a new aggregator, as directed by the designator.

2- 3Degrees supports establishing a new EER for electric ground service equipment ("eGSE").

3Degrees supports the addition of an EER for electric airport ground support equipment ("eGSE") to the regulation so as to further incentivize airports to transition to electric options.

3- 3Degrees supports requiring electronic tracking for environmental attributes associated with renewable natural gas (340-253-0400).

3Degrees is supportive of requiring that RNG attributes be tracked in an electronic tracking system. Renewable electricity and carbon markets have both shown the important role that electronic tracking systems can play in compliance accounting and reporting. Tracking systems have a number of benefits in terms of program implementation. Since the market for RNG is national, a single, standardized tracking system best serves the development of the market.

4- 3Degrees continues to be concerned about the Green-e® requirements for biogas-derived electricity and recommends that DEQ make revisions to the rule that allow it to act swiftly if Green-e®'s eligibility rules change.

3Degrees strongly urges DEQ to use this rulemaking to address the conflict that will arise if the Green-e® program moves forward during this stakeholder comment period, or in the future, to disqualify many biogas-derived electricity projects from certification eligibility. We understand that in its most recent draft of v4.0 of the *Green-e Renewable Energy Standard for Canada and the United States* ("Standard") Green-e® has withdrawn the proposal to remove CAFO eligibility from v4.0 of its Standard. However, we understand that Green-e® intends to introduce some limits to CAFOs at an undetermined point in the future. We are concerned that if DEQ does not address this potential conflict during this rulemaking, there will be a period of uncertainty on eligibility between when Green-e® finalizes its rules and when DEQ is able to make amendments to the CFP rules. Even if DEQ moves to re-establish eligibility of these projects after Green-e® revisions have been finalized, there would still be a period of at least a quarter or two where RECs from these projects are ineligible for use under Oregon's CFP.

Given the uncertain eligibility of these facilities under the Green-e® program, 3Degrees recommends that DEQ move forward with revisions to CFP rules that would prevent program disruption if Green-e® revises its eligibility rules. We recommend that DEQ incorporate language that allows DEQ to develop an alternative process for verifying biogas-derived RECs that could be used in the event Green-e® disqualifies RECs that DEQ has deemed CFP-eligible by revising 340-253-0470(5)(a) to say:

> *RECs retired in order to claim a carbon intensity other than the statewide mix or utility-specific mix must be certified by the Green-e Program under the Green-e Renewable Energy Standard for Canada and the United States version 3.5, or by a certification system approved by DEQ as being substantially equivalent, or by an alternative system DEQ may develop for biogas-derived electricity.*

Any alternative process DEQ develops should consider the existing third-party verification requirements for pathways under the CFP and the information that DEQ receives in WREGIS retirement reports.

DEQ would also need to update 340-253-0640(2)(e) and 340-253-0670(2)(i) to clarify that alternatives to Green-e® certification exist under the program, as follows:

> 340-253-0640(2)(e): *Any entity that claims a carbon intensity using paragraph (2)(d)(A), and is required to receive Green-e certification for RECs by OAR 340-235-0470, must annually submit proof of completion of final verification or a validation statement from the Green-e Program for the RECs used to generate incremental credits. Failure to submit such proof is grounds for DEQ to invalidate any incremental credits issued to the entity under the procedures of OAR 340-253-0670;*
>
> 340-253-0670(2)(i): Failure to submit a Green-e certification for RECs used to claim a carbon intensity other than the statewide or a utility-specific mix if required under OAR 340-253-0470(5).

Tying biogas-derived electricity eligibility to only the Green-e® standard while the eligibility of projects that use waste from CAFOs as a feedstock is under consideration will create uncertainty in the CFP market. This uncertainty will stall investments in these projects until Green-e® has finalized its rule updates, and potentially afterwards while DEQ updates its rules.

5- 3Degrees recommends DEQ clarify or make amendments to the following sections:

- Under 340-253-0330 “Credit Generators: Providers of Electricity”, we are supportive of the addition of language in (3)(a) clarifying that for non-residential charging the owner of the charging equipment has priority, and that the network service provider for an electric vehicle supply equipment network may only generate credits “until and unless” the owner registers. We would like to confirm that if the charging equipment owner designates an aggregator, the aggregator takes on this priority credit generation position as well. We believe the language under 340-253-0100(3) achieves this outcome but wish to confirm.

- Under 340-253-0330 “Credit Generators: Providers of Electricity”, we request clarification on the meaning of “detailed usage and charging data” under section (5) regarding the credit generator provisions for electric forklifts. We are not clear on whether this means that in the case that the forklift is operated by a person other than the owner, the owner may only generate credits if they have actual charging data. Alternatively, this could mean that the owner can generate credits if they have the details required for the use of the estimation methodology allowed for forklifts. We recommend that DEQ clarify “detailed usage and charging data” in the rule directly.

Thank you for your consideration of these comments. Please do not hesitate to reach out if further information or feedback on these topics would be useful.

Sincerely,

/s/ Maya Kelty

Maya Kelty
Director, Regulatory Affairs

Airlines for America®
We Connect the World

July 21, 2022

Submitted via email to: CFP.2022@deq.oregon.gov

Oregon DEQ
Attn: Cory-Ann Wind
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

Re: Airlines for America® Comments on the Clean Fuels Program Expansion 2022 Proposed Rule

Dear Cory-Ann:

Airlines for America® (A4A), the trade association for the leading U.S. passenger and cargo airlines,[1] appreciates the opportunity to comment on the Oregon Department of Environmental Quality's (ODEQ) Clean Fuels Program (CFP) Expansion 2022 Notice of Proposed Rulemaking (Proposed Rule), which ODEQ published on June 29, 2022.[2]

A4A supports the Proposed Rule. Before elaborating on our support in Part II below, we first provide background on A4A's longstanding commitment to environmental sustainability and the development and deployment of sustainable aviation fuel (SAF), or what ODEQ refers to under the CFP as alternative jet fuel (AJF).

I. Background

The U.S. airline industry has a strong climate record and a continuing commitment to further reduce its climate impact. Between 1978 and 2021, the U.S. airlines improved their fuel efficiency by more than 135 percent, saving over 5.5 billion metric tons of carbon dioxide (CO_2) – equivalent to taking more than 28 million cars off the road on average *in each of those years*.[3] Similarly, since 1975, even as we quintupled the number of passengers served in the U.S., we have reduced the number of people exposed to significant levels of aircraft noise by 94 percent. The U.S. airlines have continually demonstrated their ability to contribute to the nation's economic productivity, while improving their environmental performance.

This environmental record is not happenstance, but the result of a relentless commitment to driving and deploying technology, operations, infrastructure, and SAF advances to provide safe and vital air transport as efficiently as possible within the constraints of the air traffic

[1] A4A's members are Alaska Airlines, Inc.; American Airlines Group Inc.; Atlas Air, Inc.; Delta Air Lines, Inc.; Federal Express Corporation; Hawaiian Airlines, Inc.; JetBlue Airways Corp.; Southwest Airlines Co.; United Airlines Holdings, Inc.; and United Parcel Service Co. Air Canada, Inc. is an associate member.

[2] Available at https://www.oregon.gov/deq/rulemaking/Documents/cfp2022pnp.pdf.

[3] Data from the Bureau of Transportation Statistics confirm that U.S. airlines improved their fuel- and CO_2-emissions efficiency by 40 percent from 2000 to 2021.

management system. Indeed, for the past several decades, airlines have dramatically improved their fuel efficiency and reduced their CO_2 and other emissions by investing billions in fuel-saving aircraft and engines, innovative technologies like winglets (which improve aerodynamics), and cutting-edge route-optimization software.

We are committed to addressing and further reducing our industry's greenhouse gas (GHG) emissions. On March 30, 2021, A4A, together with our member carriers, pledged to work across the aviation industry and with government leaders in a positive partnership to achieve net-zero carbon emissions by 2050 (2050 NZC Goal).[4] This pledge continues our longstanding commitment to embracing our responsibility to address climate change and reduce commercial aviation's GHG emissions footprint.[5]

Achieving the 2050 NZC Goal will require continuing the pursuit of an "all of the above" strategy that includes realizing improvements in the efficiency of our operations (including through improvements to the nation's air traffic control system) and in technology, especially aircraft and aircraft engines. Most importantly, however, consistent analyses show that reaching our 2050 NZC Goal will require access to tremendous quantities of SAF. Put simply, net-zero carbon emissions cannot be achieved unless the production and availability of SAF grows exponentially. Thus, at the same time that A4A and our carriers adopted the 2050 NZC Goal, we also pledged to work with governments and other stakeholders toward a rapid expansion of the production and deployment of commercially viable SAF to make 2 billion gallons available to U.S. aircraft operators in 2030. On September 9, 2021, as a complement to the federal government's announcement of actions to foster a sustainable aviation industry, including the SAF Grand Challenge and other steps to "ensure cleaner air in and around airports,"[6] A4A and our members increased the A4A SAF "challenge goal" by an additional 50 percent, calling for 3 billion gallons of cost-competitive SAF to be available to U.S aircraft operators in 2030.[7] Notably, this SAF challenge goal and the 2050 NZC Goal represent collective minimums, and some A4A members have established even more ambitious goals.

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[4] *See* https://www.airlines.org/news/major-u-s-airlines-commit-to-net-zero-carbon-emissions-by-2050/. In announcing our members' commitment to net-zero carbon emissions by 2050, we made clear that the commitment extended not only to emissions from our aircraft while in flight, but also to emissions associated with our activities and operations on the ground. *See A4A Climate Change Commitment and Flight Path – Innovative Industry and Government Action to Achieve Net-Zero Carbon Emissions*, at 5 (Mar. 30, 2021), available at https://www.airlines.org/wp-content/uploads/2021/05/A4A-Climate-Change-Commitment-Flight-Path-to-Net-Zero-FINAL-3-30-21.pdf. On October 4, 2021, the International Air Transport Association and its member airlines followed suit by also committing to achieve net-zero carbon emissions by 2050. *See* https://www.iata.org/en/pressroom/2021-releases/2021-10-04-03/.

[5] Since 2009, A4A and our members have been active participants in a global aviation coalition. Prior to strengthening our commitment in 2021, we had committed to 1.5 percent annual average fuel efficiency improvements through 2020, with goals to achieve carbon-neutral growth beginning in 2020 and a 50 percent net reduction in CO_2 emissions in 2050, relative to 2005 levels.

[6] *See* https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/09/fact-sheet-biden-administration-advances-the-future-of-sustainable-fuels-in-american-aviation/ and https://www.energy.gov/eere/bioenergy/sustainable-aviation-fuel-grand-challenge.

[7] *See* https://www.airlines.org/news/u-s-airlines-announce-3-billion-gallon-sustainable-aviation-fuel-production-goal/.

Our airlines' efforts to address GHG emissions are designed to reduce their fuel consumption, GHG contribution, and potential climate change impacts responsibly and effectively, while allowing commercial aviation to continue to serve as a key contributor to the U.S., global, Oregon, and local economies. At the same time, we continue to build upon our strong record of reducing conventional air pollutant emissions. Our airlines' primary focus is realizing further fuel efficiency and emissions savings through increasing levels of SAF deployment, modernization and optimization of the air traffic management system, public-private research and development partnerships, and a vast array of additional operational and infrastructure initiatives being undertaken in collaboration with regulators, airports, manufacturers, and other aviation stakeholders.

A4A and our members have been particularly focused on developing low-carbon, sustainable liquid fuel alternatives, understanding that rapid, exponential growth in the deployment of SAF is imperative for the successful decarbonization of commercial aviation. As drop-in fuel made from non-petroleum feedstocks that currently reduces lifecycle GHG emissions by up to 80 percent compared to conventional, petroleum-based jet fuel while also helping to improve local air quality (with even greater GHG emissions reductions possible in the future[8]), SAF is vital to our sector. Unlike the on-road transportation sector (cars, trucks, buses, etc.), energy alternatives like electricity and hydrogen will not be sufficiently advanced in the near- or mid-term to make a meaningful contribution to the decarbonization of the aviation sector by 2050, meaning that commercial aviation will remain reliant on high energy density liquid fuels for years to come.[9]

Fortunately, we are in a position to succeed because we are not just getting started now. A4A and our members have been working diligently for many years to lay the groundwork for the establishment of a commercially viable SAF industry. In 2006, A4A was instrumental in co-founding with the Federal Aviation Administration (FAA) and other aviation organizations the Commercial Aviation Alternative Fuels Initiative (CAAFI®), which seeks to facilitate the development and deployment of SAF.[10] CAAFI has been integral in obtaining the certification of the seven SAF pathways that are recognized under the ASTM International specification for aviation turbine fuel from alternative, non-petroleum sources (i.e., ASTM D7566) as well as the two co-processing pathways recognized under the ASTM D1655 jet fuel specification. Nearly all A4A member carriers, moreover, have entered into offtake agreements over the past decade with SAF producers in a concerted effort to spur the SAF industry and utilize the fuel. More recently, various A4A airlines have entered into SAF arrangements with corporate and cargo customers as another way to help grow the SAF market. It bears noting, too, that A4A was an original proponent and a key supporter of the addition of AJF as a credit-generating fuel under the CFP on a voluntary, opt-in basis, and a strong supporter of the temporary fuel pathway and associated carbon intensity (CI) values that ODEQ approved last year. In sum, A4A and our

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[8] Coupled with other technologies or practices, SAF may one day be emissions-negative on a lifecycle basis, meaning that for each gallon of SAF used in an aircraft, CO_2 is removed from the atmosphere.

[9] *See* Federal Aviation Administration, *United States 2021 Aviation Climate Action Plan*, at 18-19 (Nov. 2021) (*U.S. 2021 Aviation CAP*) ("there is no realistic option that could replace liquid fuels in the commercial aircraft fleet in the coming decades"), available at https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf.

[10] *See* https://caafi.org/.

members have been and remain deeply committed to the development of a commercially viable SAF industry – in Oregon, in the broader Pacific Northwest region, throughout the country, and throughout the world.

We also have long supported improvements to airport infrastructure and modernization of the country's air traffic management system on a business-case basis. For example, electrification of aircraft gates and installation of ground power units and pre-conditioned air units provide access to a clean central heating and cooling system for aircraft while at parking positions. This allows airlines to run aircraft systems on electricity provided to the airport rather than relying on jet fuel-powered aircraft auxiliary power units. In addition, airports may install charging stations that serve electric-powered ground support equipment (eGSE). Improvements to airport power grids ensure the reliability of electric power needed to take advantage of these systems, but even without those improvements, our member carriers have invested millions to replace their traditional, petroleum-fueled GSE with eGSE. An important source of funding for such improvements is the FAA's Voluntary Aviation Low Emissions Program, which makes funds generated by the aviation industry available to airports to support projects that achieve reductions in regulated air pollutants. Moreover, when necessary to improve the efficiency of their operations, airlines also support major infrastructure projects such as upgrades to or reconfigurations of terminals and runway and taxi systems. We also have been supportive for many years of the federal government's effort to upgrade the nation's air traffic management system, known as NextGen, which is comprised of a suite of technologies and procedures to improve efficiencies in managing air traffic and reducing emissions. A4A and its members continue to work cooperatively with the FAA to implement elements of the plan that are supported by a sound business case.

II. Comments on the Proposed Rule

With the above background in mind, A4A, which participated in the informal portion of this rulemaking (i.e., various of the workshops and Rulemaking Advisory Committee meetings), expresses its support for the Proposed Rule.[11]

In particular, with respect to eGSE, we support the language in proposed 340-253-0040(50), which would define the term "electric ground support equipment" to include, but not be limited to, pushbacks, belt loaders, and baggage tractors, as well as proposed 340-253-0330(9) and the proposed addition (in Table 7 of 340-253-8010) of an energy economy ratio of 3.2 for eGSE. While the charging equipment owner – usually the airport – would have the ability to generate credits for the electricity used by eGSE, we understand that those credits may be shared with the eGSE owner via a contractual or other revenue-sharing arrangement (e.g., a provision in a lease between the airport and airline).

Regarding the proposed targets of a 20% CI reduction by 2030 and 37% by 2035, we again observe that achieving an additional 17% CI reduction over a mere 5-year period is extremely

[11] Our previous comment letters are included in the compilations posted at https://www.oregon.gov/deq/rulemaking/Documents/cfp2022m3Com.pdf and https://www.oregon.gov/deq/rulemaking/Documents/cfpe2022m4Com.pdf.

ambitious.[12] For this reason, we also support ODEQ's proposal "to conduct a review of the [CFP] in 2029" for the purpose of "provid[ing the Environmental Quality Commission with] an update of the program's metrics and recommend[ing] whether additional changes should be made to [CI] targets for 2030 and beyond."[13]

With respect to AJF, we support the CI values that have been proposed in Table 3 of 340-253-8010 for calendar year 2026 and all years thereafter. More specifically, we support ODEQ for having proposed values for AJF that are identical to the proposed values in Table 2 for diesel fuel and diesel substitutes.

Since 2019, AJF has been disadvantaged under the CFP from a credit generation standpoint versus renewable diesel due to the higher CI benchmarks in Table 2 for diesel substitutes.[14] AJF and renewable diesel often are coproduced in the same facility using the same feedstock, and having an equivalent CI benchmark for both fuels would help promote AJF production, which in turn would stimulate additional renewable diesel production given the fuels' coproduction.[15] Currently under the CFP, absolute credit parity between the two alternative fuels is due to take hold in 2025, when each fuel will be measured against the same CI value of 88.87 gCO_2e per MJ.[16]

Again, we support ODEQ's proposal to continue with its current approach by having a level playing field for AJF and renewable diesel in all years after 2025. This demonstrates that Oregon is committed to the decarbonization of the hard-to-decarbonize aviation sector and recognizes the critical role that SAF will play in this effort. Importantly, it also ensures alignment

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[12] We note that proposed 340-253-0000(2) is consistent with the statutory direction provided by the Oregon State Legislature (in ORS 468A.266(2)(a), available at https://www.oregonlegislature.gov/bills_laws/ors/ors468A.html) in that the regulatory provision makes clear that the 20% and 37% reductions would be relative to 2010 levels. Yet ODEQ indicates in the summary portion of the Proposed Rule that the 20% and 37% figures are relative to "2015 levels." *See* Proposed Rule at 6. A4A encourages ODEQ to correct this inconsistency by referring instead in the final rule preamble to 2010 levels.

[13] Proposed Rule at 3.

[14] Assuming the same CI for AJF and renewable diesel, as is the case under the California Low Carbon Fuel Standard Program for World Energy's coproduced fuels (*see, e.g.,* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0268_summary.pdf and https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0168_summary.pdf), the higher benchmarks in Table 2 for diesel substitutes (in years 2019-2024) necessarily means that renewable diesel earns greater credit than AJF under the CFP.

[15] *See* National Renewable Energy Laboratory, "Effect of Additional Incentives for Aviation Biofuels: Results from the Biomass Scenario Model," available at https://ww3.arb.ca.gov/fuels/lcfs/lcfs_meetings/031717nrel_presentation.pdf.

[16] *See* OAR 340-253-8010, Tables 2-3. For all intents and purposes, the CI benchmarks for AJF and diesel substitutes will converge under the CFP in 2024, when the difference between them will be only 0.04 gCO_2e per MJ.

with the California Air Resources Board's Low Carbon Fuel Standard (LCFS) Program, under which there will be credit parity between AJF and renewable diesel starting in 2023.[17]

In fact, A4A encourages ODEQ to accelerate by two years (i.e., move up to 2023 from 2025) the point in time at which credit parity would exist under the CFP between AJF and renewable diesel.[18] This may be accomplished in the final rule by making the 2023 and 2024 values in Table 3 of 340-253-8010 equivalent to the 2023 and 2024 values in Table 2, and would create even stronger alignment between the CFP and the California LCFS Program. If ODEQ does this, and assuming the Washington State Department of Ecology finalizes its recent proposed rule, all three West Coast states would then be fully aligned with regard to the treatment of AJF and renewable diesel – credit parity between the two fuels (again, assuming the same CI score) beginning in 2023.

* * *

Thank you for your consideration of our comments. Please do not hesitate to contact me if you have any questions.

Sincerely yours,

Ira Dassa
Director, Environmental Affairs
idassa@airlines.org

[17] See 17 California Code of Regulations 95484(c)-(d), available at https://govt.westlaw.com/calregs/Document/I88413CAE13FD4ADB86012CCE34231DE3?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default). Notably, the Washington State Department of Ecology has recently proposed to establish credit parity under its own Clean Fuels Program for AJF and renewable diesel beginning in 2023. *See* proposed WAC 173-424-110(8) and proposed Table 2 of WAC 173-424-900 (AJF measured for credit generation purposes against the benchmark for diesel and diesel substitutes), available at https://ecology.wa.gov/Regulations-Permits/Laws-rules-rulemaking/Rulemaking/WAC-173-424-455.

[18] As ODEQ undoubtedly knows, zero gallons of AJF had been fueled into planes in Oregon through the end of 2021. By comparison, almost 44 million gallons of renewable diesel had been imported into the state since the beginning of 2019, when AJF first became a creditable fuel on a voluntary, opt-in basis. *See* https://www.oregon.gov/deq/ghgp/Documents/cfpQ4data2021.xlsx.

Oregon DEQ
Attn: Cory-Ann Wind
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100
Submitted electronically to: CFP.2022@deq.oregon.gov

RE: Clean Fuels Program Expansion 2022 Rulemaking

Dear Ms. Wind,

Anew appreciates this opportunity to provide comments regarding the Clean Fuels Program Expansion 2022 proposed rulemaking dated June 29, 2022.

About Anew

Anew emerged from the February 2022 combination of durational industry leaders Element Markets, LLC and Bluesource, LLC. The company has offices in the U.S., Canada, and Europe, and an environmental commodities portfolio that extends across five continents. Anew is the leading marketer and originator of carbon and environmental credits in North America and has been participating in the OR DEQ program under Element Markets for a number of years.

Comments

340-253-0330 (5) Credit Generators: Providers of Electricity – Electric Forklifts

Anew supports the DEQ proposal that forklift owner is the credit generator, however the added language requiring detailed usage and charging data is ambiguous as to the amount of detail needed. Anew suggests that wording be adjusted to "…the owner may generate the credits from each piece if they have sufficient usage information consistent with credit reporting requirements, otherwise…".

Justification for prioritizing the vehicle owner includes:

1) Supporting the vehicle owner is the most direct means of supporting the capital investment in the equipment and thus the increased adoption of electric material handling across the industry.
2) The vehicle owner has the best tracking of where a given asset is located and avoids the risk that double-counting would occur when an asset is transferred from one location to another or from one operator to another in the case of leased assets.
3) In the case of leased assets, this provides a more efficient means of allowing smaller businesses to benefit from the program. Benefits of the program are typically passed

down to the business owners without them having to participate directly in the program and manage submission on their own for small fleets.

4) Finally, this is consistent with other programs, for example, the California LCFS regulation specifies, “For transportation fuel supplied to electric forklifts, the fleet owner is the fuel reporting entity and the credit generator for electricity supplied to a specified fleet.”

340-253-0330 (12) Credit Generators: Providers of Electricity – Incremental Aggregator

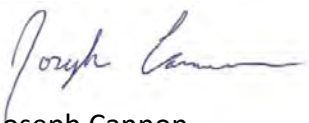
Currently the regulation and rulemaking only allow for the electric utility or an aggregator designated by the utility to generate incremental credits from residential charging. Anew feels that for credits not claimed directly by the utility that the vehicle manufacturer should have the backup position if it has telematic data to provide an accurate reporting of the vehicle usage.

Justification for the vehicle manufacturer’s secondary right to generation includes:

1) This would provide for more accurate reporting of electricity use and avoid risks of double counting or excess credits being generated
2) The funds from these credits would be available for vehicle incentives lowering the acquisition costs of the vehicles which is one of the primarily hurdles to increased EV adoption.
3) Finally, this would be similar to the CA LCFS program.

Thank you for the opportunity to provide comments on the proposed rulemaking and for considerations of the feedback provided. We look forward to continued discussion of the program expansion and participation in the program on behalf of our clients.

Sincerely,



Joseph Cannon
VP, Environmental Products
Anew Climate, LLC

From:	Tracy Farwell
To:	Kathleen George; FELDON Leah * DEQ; Colin McConnaha; CFP2022 * DEQ
Subject:	There is no evidence Oregon"s CFP produces any Marginal Abatement of Carbon
Date:	Wednesday, July 20, 2022 11:00:32 PM
Attachments:	CF Expansion 20 July 2022.pdf

Rather than expand a program that produces carbon emissions and issues credits for more carbon emissions, Oregon is better served by auditing the Clean Fuels Program first to identify whether it is a net benefit to Greenhouse Gas containment. This would mean acknowledging best available science. There is no reason to believe that Clean Fuels reduce Oregon's net carbon emissions that currently exceed every goal legislated since 1990.

Better Energy LLC does not invoice for its work products. The enclosure is offered as supporting analysis that answers the question, is there any merit to Clean Fuels Program Expansion? Merits have not been found, and evidence reported here indicates no real attainment in reducing carbon emissions.

Tracy Farwell
Better Energy LLC
Enclosure

20 July 2022

TO: EQC, DEQ

SUBJECT: Extending ANY Clean Fuels Program is the wrong answer – because of, well, Science. And what it means.

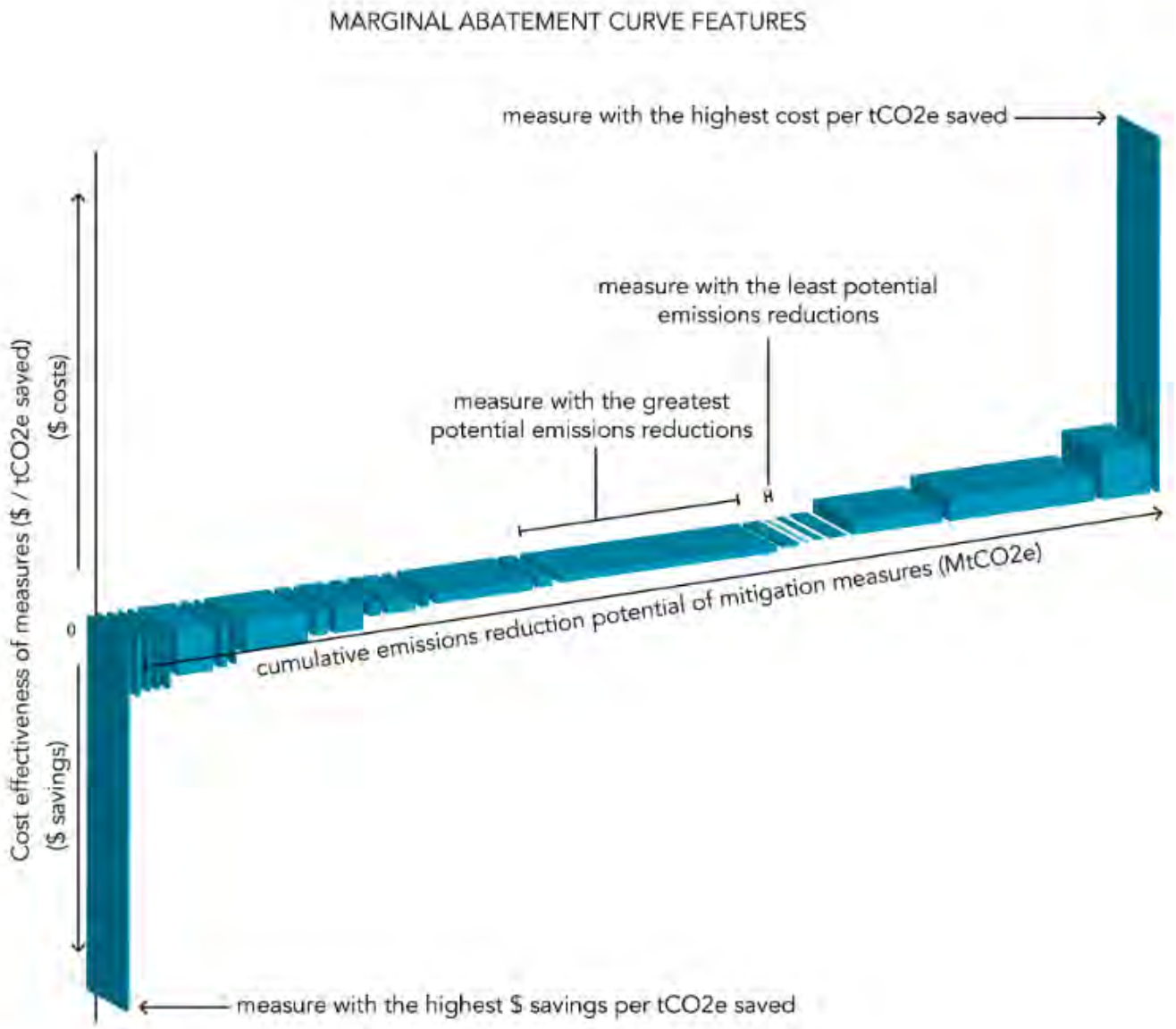
Ask yourself, if excess atmospheric carbon is so destructive for climate and public health, shouldn't you be booking carbon emitted from burning biofuels? Big surprise. Without justification from even the most basic science, the US EPA arbitrarily set rules that carbon emissions from biofuels are not counted, by rule. By rule biofuel combustion emissions = 0.0, not by science. The result is a marketing surprise: you want an alternative to fossil carbon fuel, use this carbon fuel. Don't need no science. Forget about industrial crops adding to food insecurity. Just use this carbon fuel.

The result is simple and terrible. Instead of capturing carbon in industrial crops like soy and corn, and leaving it there, Clean Fuels programs promote the combustion of these biofuels, thus returning the captured carbon BACK to the environment as carbon fuel emissions. Because of "Clean" Fuels, more carbon is emitted than the natural order can reduce. The consequence is that inaction on inexorable carbon emissions is destroying world economies. Insurers and reinsurers know this.
swiss-re-institute-expertise-publication-economics-of-climate-change.pdf

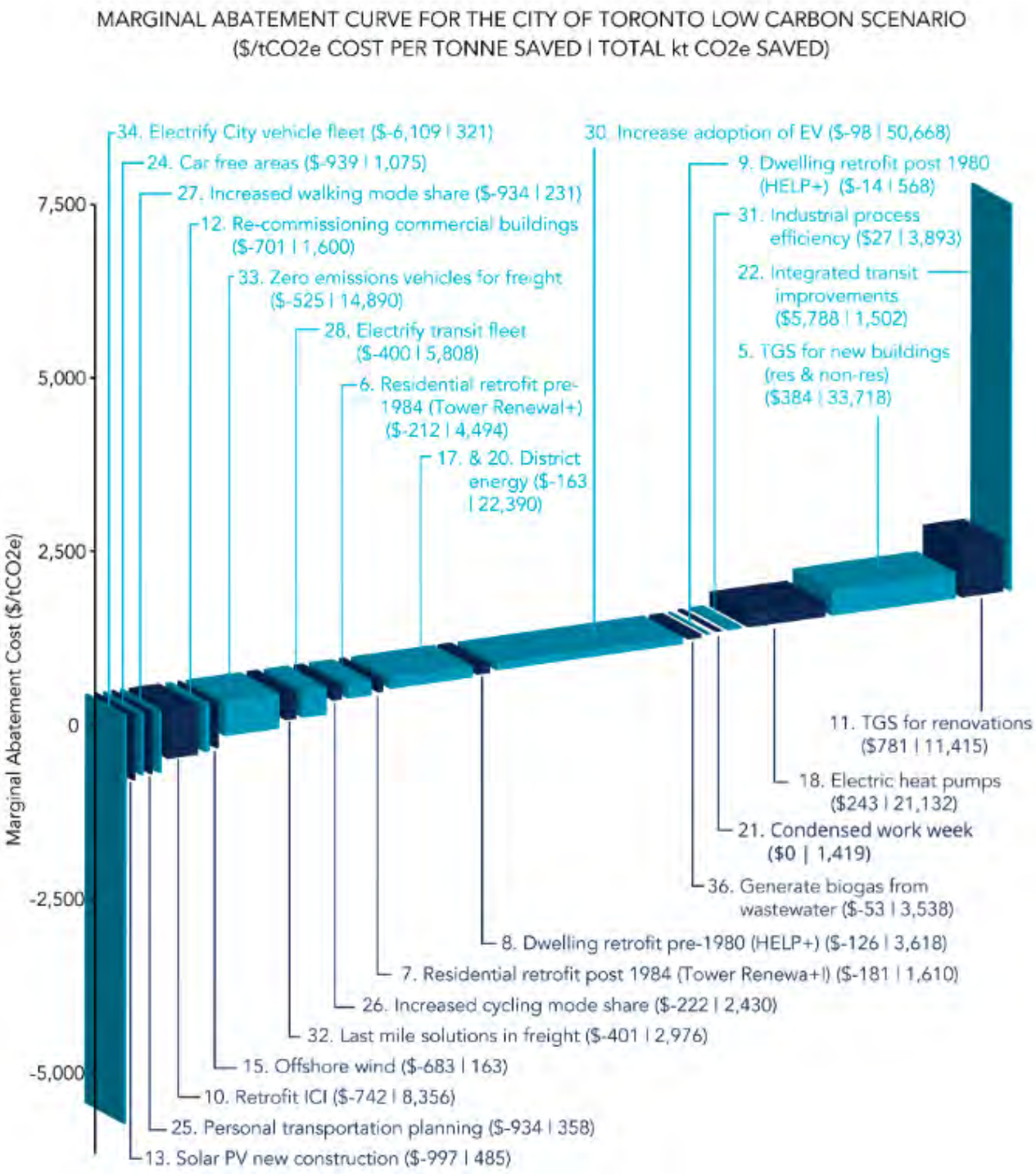
And national and local ones. In determining the revenue impact of proposed legislation dealing with carbon, Ways and Means Committees defer to staff economists who are not required to, and thus do not, factor the cost of inaction. ANY carbon reduction bill thus appears too costly. Can economies be protected from climate breakdown? Not by ignoring ongoing consequences of climate breakdown. Actions to limit risk must be recognized for financial value.

When proposing to extend this program, at least call it what it is: NOT Clean Fuels NOT proven by science. Why even vote on this? None of the Clean Fuels programs have been audited to verify that there is any program benefit from net emissions being reduced. Clean Fuels programs never appear in Marginal Abatement Cost analyses that assesses ability of measures to save or prevent emissions.

After a lot of work assessing the merit of every possible climate action policy, each policy can be ranked between the measure with the highest cost per ton of CO2e saved and the measure with the highest savings per ton of CO2e saved. Measures that do not reduce net carbon don't make the cut.



This format explains the relative cost effectiveness of candidate climate solutions such that limited investment resources can be directed to best value per cost. Solutions that produce the most savings are the best choices and produce actual opportunities for funding other solutions. Any clean fuels program, once audited for cost-effectiveness, could be depicted in this format along with other assessed policies. The following marginal abatement cost (MAC) graphic depicts the policy solutions presented to Toronto leadership for climate action.



As you can see, some solutions are more appealing than others. Referring to #34 Electrify City Vehicle Fleet, the financial savings were computed to be $6,109 per tonne of CO2e. This will produce a budget surplus, making other solutions affordable.

It is worthy of note that Clean Fuels was likely evaluated for cost effectiveness by Toronto financial analysts and found to produce no carbon reduction benefit, so cost effectiveness would be moot. This would explain why it does not appear here.

These MAC financial analysis graphics are fount in Attachment B - Modelling Toronto's Low Carbon Future: Results of Modelling Greenhouse Gas Emissions to 2050 - backgroundfile-103152.pdf
This Attachment applies to the larger Toronto study report. Toronto's Climate Action for a Healthy, Equitable & Prosperous Toronto

Despite the energetic effort reflected in Oregon's Climate Protection Program, the path to prove the Clean Fuels program is an actual asset is arduous and time consuming, no one is apparently on this path, science is lacking, and it's getting late.

For example, we have this explanation taken from the DEQ Clean Fuels Program landing page:

> HB 2017 (2017) requires DEQ, by no later than April 15 of each year, to calculate the average cost or cost-savings of the Clean Fuels Program per gallon of gasoline (E10) and per gallon of diesel (B5) for the previous year. The approach and values used to calculate the cost of compliance below are conservative. It does not account for the value of CFP credits being used to lower the cost of the low-carbon biofuels being blended into gasoline and diesel for use in Oregon, nor does it capture the value of the credits making other low carbon fuels such as electricity, renewable natural gas or renewable propane cheaper and more affordable to consumers in Oregon. The State Department of Agriculture must provide the formula and results of these calculations to each gas station in Oregon to facilitate compliance by gas station owners or operators with ORS 646.932. DEQ is also required to calculate the total greenhouse gas emissions reductions attributable to the low carbon fuel standards for the preceding calendar year.

Step 1 in determining the MAC metric is to audit whether the net product of program reduces carbon emissions. Rules for computing this result deserve to be shared with the public. If this determination has been made it does not appear to be published here. https://www.oregon.gov/deq/ghgp/cfp/Pages/Annual-Cost.aspx

We believe that the MAC metric is appropriate for guiding urgently needed investments in protecting our degrading climate and stressed economy, and so far we see no attention to this metric in the climate action coalition communities or in Oregon climate policy.

The consequence of lacking these metrics is significant. Although the Oregon numbers on forest carbon sequestration in 2022 have not been published, we have the report on the Amazon Rainforest:

> The deforestation rate in the Amazon rose 11% from the prior record year and alerts hit monthly records four times this year, preliminary government data showed on Friday. Nearly 4,000 square kilometres of forests have been cleared since January.

https://earth.org/deforestation-in-the-amazon-rainforest-hits-record-high-2022/

The first rule of successful management is not argued: If you can't measure it, you can't manage it.

Tracy Farwell, Sustainability Desk, Better Energy LLC

Ed Averill, Climate Justice Analysis, Better Energy LLC

From:	Linda Ganzini
To:	CFP2022 * DEQ
Subject:	Public Comment
Date:	Thursday, July 21, 2022 7:05:14 AM

DEQ Clean Fuels Program Staff,

We are members of the Board of Directors of the Lake Oswego Sustainability Network (LOSN). We write in support of strengthening the Oregon Clean Fuels Standards**. Specifically, we support expanding the carbon intensity reduction targets beyond 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035.**

We are discouraged by the lack of federal leadership in addressing the climate crisis. Therefore, states must continue to push rapidly to reduce greenhouse gas emissions. As evidenced by unrelenting fires and heat waves we must concede that the climate emergency is now, not in the future. International events have underscored our energy vulnerability. If oil remains our primary energy source in transportation, our residents remain at risk for high gas prices—not from environmental legislation which has resulted in only very small fuel cost increases, but from aggression from petrochemical nations.

The current Clean Fuels Standard has been successful since implementation in 2016 and has cut nearly 6 million tons of greenhouse gas pollution. The program is one of the most cost-effective tools to address greenhouse gas emissions from diesel and gasoline used for transportation. Oregon has aggressive climate goals and making the standard more stringent will be necessary to meet them. Additionally, the new targets should be achieved through electrification.

Strengthening the clean fuels standard will also have positive public health and economic benefits. The clean fuels program has sparked new innovations in technology. The program has brought down the cost of low carbon fuels and creates effective financial incentives to decarbonize the transportation sector.

But more stringent standards are crucial to our progress. **Again, we strongly support expanding the carbon intensity reduction targets beyond 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035.**

Respectfully,

Linda Ganzini, Board of Directors, LOSN

Mike Perham, Board of Directors, LOSN

Dorothy Atwood, Board of Directors, LOSN

Stephanie Wagner, Board of Directors, LOSN

Mary Ratcliffe, Board of Directors, LOSN

Duke Castle, Board of Directors, LOSN

Lisa Adatto, Board of Directors, LOSN

Kathleen Wiens, Board of Directors, LOSN

July 21, 2022

Ms. Cory-Ann Wind
Clean Fuels Program Manager
Oregon Department of Environmental Quality
700 NE Multnomah Street
Suite 600
Portland, OR 97232-4100

RE: Oregon Clean Fuels Program Expansion 2022

Dear Ms. Wind,

Cargill appreciates the opportunity to provide comments regarding the Oregon Department of Environment Quality's ("Department") clean fuels program expansion process. Oregon's goal to further the reduction of carbon intensity (CI) in transportation fuels 20% by 2030 from a 2015 baseline, and 37% by 2035 is ambitious; this is an important opportunity to ensure the Department and other state agencies work together with industry and other stakeholders to achieve this important goal.

With a global footprint and presence in major food and ag supply chains around the globe, Cargill is committed to protecting the earth's vital natural resources and reducing its environmental impact. From small family farms to global shipping lanes, Cargill works every day to implement new sustainable practices to reduce our impact on the planet and communities in which we operate. In alignment with our climate commitment, Cargill has adopted a Scope 3 target of reducing greenhouse gas emissions in its global supply chains by 30% per ton of product by 2030. Additionally, Cargill signed on to the CEO climate statement and the We Are Still In coalition to continue supporting the Paris Climate Accord. Throughout our long history, we've seen agriculture play an important role in addressing some of the world's most urgent challenges.

One of the ways Cargill is focused on supporting the clean energy transition is by developing lower carbon renewable fuels derived from a range of options including vegetable oil feedstocks, low-carbon intensity feedstocks such as tallow, used cooking oil, and recovered corn oils. Cargill businesses originate, process, and convert these feedstocks into renewable fuels including biodiesel and ethanol, while working closely with our farmer partners to implement sustainable farming and conservation practices. Additionally, through microbiology and fermentation, Cargill is deploying its wet corn mills across the country to develop alternatives to petroleum-based chemicals and products., further supporting the bioeconomy.

As the Department continues to consider the expansion of its program, Cargill respectfully requests the Department considers adopting the current carbon intensity (CI) models used by Argonne National Lab's Greenhouse Gas and Regulated Emissions and Energy in Transportation (GREET) model or more recent data from the United States Department of Agriculture (USDA).

Additionally, we ask that any CI model reflect recent industry advances including the adoption of voluntary and sustainable farm practices such as the planting of cover crops to improve soil health, no

till/strip till farming, precision agriculture, crop rotation, and other regenerative agriculture practices. Farmers are increasingly adopting these practices across the country to further reduce and sequester carbon.

According to the 2017 Census of Agriculture, cover crop acres increased from 10.3 million acres in 2012 to 15.4 million acres in 2017, and no-till acres increased about 8 million acres above the 2012 census.[1] These practices should be reflected in the CI values for biofuels such as corn ethanol, biodiesel, and renewable diesel derived from row crops and other feedstocks. Additionally, facilities where these fuels are processed have increasingly worked with utility providers to source more green energy for operations, and carbon reductions from green power supplies should be accounted for in renewable fuels pathways. Furthermore, these green power supplies lower the carbon intensity from supply both before and after the meter and the models should recognize this.

For the state to reach its carbon reduction goals, the use of updated and accurate data when determining the CI of biofuels will be critical. For example, recent research indicates that CI for corn ethanol has decreased by ~50% over the past 30 years and is now at a central estimate of ~55 gCO2e/MJ, which is more than 40% lower than conventional gasoline.[2] However, data used in current models significantly overestimates the CI of corn ethanol and all other associated corn-based products, thus limiting their ability to enter certain markets.

Given the number of potential feedstocks available to help Oregon achieve its carbon reduction goals, and proposed timeline to achieve these targets, we also recommend the program incorporate feedstock specific pathways - allowing suppliers and renewable fuel producers to partner and supply low carbon fuels to the program in a more efficient manner.

Finally, Cargill requests the Department to consider dextrose as a critical feedstock for production of biobased, renewable chemicals and products ranging from jet fuel to biodegradable plastics. As a replacement to fossil fuel-derived chemicals and fuels, dextrose can play an important role in reducing the greenhouse gas (GHG) impacts of our nation's chemical manufacturing, energy and transportation sectors in the future. Unfortunately, current biofuel and low carbon fuel policies do not adequately recognize the role that dextrose plays as part of the lifecycle of the corn wet milling process, putting corn-based biobased chemicals, fuels, and products at a significant market disadvantage. This recognition would assist Oregon in not only its GHG reductions in on-road transportation, but in meeting its overall GHG reduction goals.

We appreciate this opportunity to provide the Department with our initial feedback. We standby to be a resource and partner with the state in these efforts into the future.

Sincerely,

Warren Feather
Managing Director
Cargill, Incorporated

[1] https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/usv1.pdf
[2] Melissa J. Scully *et al* 2021 *Environ. Res. Lett* in press https://doi.org/10.1088/1748-9326/abde08

From: Cathy Zheutlin
To: CFP2022 * DEQ
Subject: Public Comment Re Clean Fuels Program
Date: Thursday, July 21, 2022 7:51:08 AM

DEQ Clean Fuels Program Staff,

Thank you for the opportunity to provide comments on DEQ's proposed Clean Fuels Program rules and draft fiscal impact statement. I am writing to express strong support for maximizing climate, public health, community, and local economic benefits by adopting an ambitious Clean Fuels Program (CFP) expansion. In addition, I urge you to amend the draft fiscal impact statement (FIS) to more accurately capture benefits of the Clean Fuels Program.

The Clean Fuels Program is one of Oregon's most important and cost-effective tools to reduce climate pollution from the largest source in Oregon: burning diesel and gasoline for transportation. While we applaud DEQ's proposal to extend and increase the CFP's carbon intensity reduction targets to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035, we see this as the minimum level of ambition that is feasible and which DEQ should strive for.

The latest U.N. Intergovernmental Panel on Climate Change (IPCC) report stated that current policies to limit climate emissions will not be sufficient to avoid catastrophic and irreversible climate impacts. While Oregon has made meaningful progress to address the fossil fuel pollution driving the climate crisis, Oregon is still not on track to achieve our climate goals. Stronger clean fuels targets will help us close this critical gap.

At minimum, DEQ should expand the carbon intensity reduction targets to **go beyond the current proposed 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035**. Strong carbon intensity reduction targets will help move the needle on climate pollution, while improving public health and economic outcomes across Oregon. Cleaner fuels also help increase our energy security and protect Oregonians against harmful oil and gas price fluctuations at the pump: the more we move toward electric vehicles and cleaner fuels made closer to home, the less we have to worry about the price of oil and gas being determined half a world away.

Likewise, I urge DEQ to maximize the clean air, climate, and health benefits of the program, by achieving these new targets through electrification as much as possible, and to prioritize equitable economic outcomes, by encouraging credit-generating utilities to fund affordable and accessible public charging infrastructure in underserved areas such as low-income, BIPOC and rural communities.

In addition, the draft fiscal impact statement (FIS) needs to be amended to more accurately capture the extensive health and jobs benefits of the Clean Fuels Program. The economic benefits identified are extremely *conservative* estimates, whereas the costs of the program are overestimates. For instance, while the program rewards reductions in lifecycle emissions, the FIS doesn't incorporate reductions in co-pollutants beyond the tailpipe. It also doesn't quantify other economic benefits, including job creation, investments, new tax base, waste reduction, and so forth.

In addition, while we appreciate the inclusion of $916 million in benefits when using the federal estimate of the social cost of carbon, this is an extremely conservative estimate, especially when you consider there have already been hundreds of lives lost, thousands of homes and buildings burned, agricultural production losses, lost business days from climate impacts in Oregon in just the last two years alone.

Thank you for your consideration,

Cathy Zheutlin
Peace Films Inc.
www.livingwhiledying.org

July 21, 2022

Cory Ann Wind
Oregon Department of Environmental Quality (DEQ)
700 NE Multnomah Street, Suite 600
Portland, OR 97232-4100

RE: COMMENTS OF CENTER FOR RESOURCE SOLUTIONS (CRS) ON THE CLEAN FUELS PROGRAM ELECTRICITY 2022 NOTICE OF PROPOSED RULEMAKING AND DRAFT RULES

Dear Ms. Wind:

CRS appreciates this opportunity to submit comments on the Clean Fuels Program (CFP) Electricity 2022 Notice of Proposed Rulemaking (NOPR) and Draft Rules dated June 29, 2022 ("Draft Rules"). Our comments pertain to proposed definitions for renewable energy certificates (RECs) in Sec. 340-253-0040, proposed reporting requirements language in 340-253-0600(6), and the value of the Green-e® Energy program.

BACKGROUND ON CRS AND GREEN-E®

CRS is a 501(c)(3) nonprofit organization that creates policy and market solutions to advance sustainable energy. CRS provides technical guidance to policymakers and regulators at different levels on renewable energy policy design, accounting, tracking and verification, market interactions, and consumer protection. CRS also administers the Green-e® programs. For over 20 years, Green-e® has been the leading independent certification for voluntary renewable electricity products in North America. In 2020, Green-e® certified retail sales of over 90 million megawatt-hours (MWh), serving over 1.4 million retail purchasers of Green-e® certified renewable energy, including over 104,000 businesses.[1]

[1] See the 2021 (2020 Data) Green-e® Verification Report here for more information: https://resource-solutions.org/g2021/

Center for Resource Solutions
1012 Torney Ave, 2nd Floor
San Francisco, CA 94129

w : www.resource-solutions.org
p : 415.561.2100

COMMENTS ON JUNE 29, 2022 DRAFT RULES

Sec. 340-253-0040

1. **Please reinstate the full REC (renewable energy credit) definition that was in the May 26, 2022 Draft Rules[2] in Sec. 340-253-0040(105).**

Having a clear REC definition that clarifies that RECs contain the environmental and other nonpower attributes associated with the generation not only helps to strengthen the use of the attribute and avoid double-counting but ensure that the definition aligns with other state and voluntary programs.

Reinstating the REC definition also adds clarity and consistency to the CFP. Sec. 340-253-0600(6)(a) of the CFP states that "A registered party reporting any fuel claimed in the CFP using a book and claim accounting method must retire RTCs or RECs that embody the full environmental attributes of that fuel in an electronic tracking system approved by DEQ." Since this section requires that RECs embody their full environmental attributes, it would benefit the standard to have this language embodied more clearly in the REC definition, as it was in the previous version of the Draft Rules.

CRS recommends reinserting the following definition as Sec. 340-253-0040(105):
"(105) "Renewable energy certificate" or "REC" means a unique representation of the environmental, economic, and social benefits associated with the generation of electricity from renewable energy sources. One certificate is created in association with the generation of one megawatt-hour (MWh) of renewable electricity."

Sec. 340-253-0600(6)(a)-(6)(b)(B)

2. CRS supports the requirements that the environmental attributes embodied by RECs "must not have been used or claimed in any other program or jurisdiction" and that "a fuel pathway holder using directly delivered renewable electricity… keep attestations from each upstream party collectively demonstrating that such holder has exclusive right to use those environmental attributes" which "include documentation that shows: (A) The entity claiming the environmental attributes for renewable electricity, biogas or biomethane in the CFP must have the exclusive right to claim the environmental attributes associated with the use of that fuel; and 293 (B) The environmental attributes have not been used or claimed in any other program or jurisdictions with the exception of the federal RFS and any reporting required under OAR chapter 340, divisions 215 and 271. To be validly used in compliance with this division, any such claims under the federal RFS or OAR chapter 340, divisions 215 and 271 must

[2] https://www.oregon.gov/deq/rulemaking/Documents/cfp2022m4Rules.pdf

be made for the same use and volume of biomethane or its derivatives as it is being claimed for in the CFP."

These reporting requirements help to guarantee the quality of the standard by explicitly prohibiting double-counting and/or the separation of any of the environmental benefits from the attributes. By requiring documentation of the exclusive right to ownership of the attributes, the CFP reduces the risk that any attributes are reported or claimed in programs other than those specifically identified by the CFP. This ensures the full value of the attributes is realized by the CFP and furthers the state's achievement of its GHG emissions reductions goals.

Sec. 340-253-0470

CRS expresses its support for the requirements related to "Green-e certification for RECs used to claim a carbon intensity other than the statewide or a utility-specific mix under OAR 340-253-0470(5)."

The Green-e® program provides verification of renewable energy transactions relying, in part, on robust tracking systems like WREGIS, which use verified static and dynamic generation data to issue, track and retire serialized RECs to prevent double issuance, double transfer, and double retirement. The Green-e® program requires an annual audit of sales against the Green-e® Standard and retirement information in WREGIS, to ensure that WREGIS certificates meet the Green-e® Standard and were not double sold. The Green-e® program also requires an audit of REC sales to protect against double selling. The Green-e® program includes resource- and product-specific requirements beyond what DEQ is proposing, to provide additional quality and sustainability assurances. The Green-e® program also prevents instances of double claiming, verifying that there are no other renewable energy usage claims being made on either the RECs or underlying electricity. Requiring Green-e certification for RECs ensures that those RECs contain all the environmental benefits necessary for claiming a carbon intensity other than the statewide or a utility-specific mix.

Sincerely,

_____/s/_____
Lucas Grimes
Manager, Policy

ChargePoint, Inc.
254 East Hacienda Avenue | Campbell, CA 95008 USA
+1.408.841.4500 or US toll-free +1.877.370.3802

July 20, 2022

Oregon Department of Environmental Quality
700 NE Moltnomah St, Suite 600
Portland, OR 97232

ChargePoint Comments on the June 2022 Clean Fuels Program (CFP) Notice of Proposed Rulemaking

ChargePoint would like to thank the Department of Environmental Quality (DEQ) for the opportunity to provide comments on the June 29, 2022 Proposed Clean Fuels Program Expansion Rulemaking (Proposed Rule). ChargePoint strongly supports the expansion of the CFP and is committed to continuing to build out an electric vehicle (EV) charging network in support of Oregon's climate and zero emission vehicle goals.

ChargePoint is one of the world's largest EV charging networks and solution providers with more than 180,000 Level 2 and direct current fast charging (DCFC) stations on its network. ChargePoint designs, manufacturers, and sells networked charging stations and works with major employers, municipalities, utilities, fleet operators, real estate developers, and individual drivers to deploy and operate charging stations across North America and Europe to enable the electrification of transportation.

ChargePoint supports DEQ's proposal for a 37% carbon intensity target in 2035

ChargePoint supports the proposed 37% carbon intensity (CI) targets in 2035 and commends DEQ for its leadership in this area. If finalized, this target would represent the most ambitious CI target among North American clean fuels programs, setting the bar for other jurisdictions to follow. With EV sales in the US nearly doubling year-over-year in 2021[1] and this trend set to continue, the time is now for governments to lean into electrification and deep decarbonization to achieve long-term climate goals. The proposed 37% CI target sends the message to the market to invest in and bring more, cleaner fuels to Oregon. On the electrification side, this program change will accelerate investment in EVs and charging by sending a long-term market signal that the CFP will be there to support these investments.

ChargePoint supports the owner first, network service operator second approach to non-residential electricity crediting

We support the proposed hierarchy for on-road non-residential electricity crediting to give station owners first claim to credits but allow network service providers to claim credits up until station owners opt-in to the program. This is a logical approach and will minimize stranded credits in the market, while most efficiently allocating the credit value to those investing in the charging network. It will also more efficiently enable network service operators to incorporate the value of CFP credits into charging contracts to bring down the cost of charging and/or deploy more charging stations.

Advance crediting provision

ChargePoint supports the final Advance Crediting provisions in the Proposed Rule to keep the eligible entities as is and extend advance crediting to clean fuel infrastructure; however, we suggest amending section 340-253-1100(2)(F) to *not* restrict advance crediting on direct current fast charging (DCFC) to projects receiving funds under the National Electric Vehicle Infrastructure (NEVI) program. We suggest DEQ make advance crediting

[1] Bloomberg New Energy Finance 1Q 2022 Electrified Transport Market Outlook

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agnostic to NEVI funding to enable the advance crediting mechanism to plug gaps and fund projects that may not be eligible for outside funding. This could lead to more overall station deployment. There may also be practical difficulties in restricting advance crediting to DCFC infrastructure receiving NEVI funds, since the application for advance credits requires "a detailed estimate of the potential credit generation that will result from the project". The NEVI program is targeting highway corridor projects that will largely serve long-distance EV drivers; as such, project owners may not be able to estimate potential credit generation from a project with a high level of confidence, at least in the early years of the program. This uncertainty could lead to rejected applications or station owners not applying altogether, which could strand advance credits. Removing the NEVI requirement removes this risk and will allocate advance credits where they may be needed more.

Thank you and we look forward to continued participation in the CFP and future rulemakings.

Sincerely,

Evan Neyland
Senior Manager, Carbon Markets

July 21, 2022

Ms. Cory Ann Wind, Clean Fuels Program Manager
Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, OR 97232-4100

Submitted electronically

RE: Clean Fuel Program Expansion Formal Comments

Ms. Wind:

Chevron Renewable Energy Group is an international producer of lower carbon intensity fuels that utilizes a global integrated procurement, distribution, and logistics network to operate 11 biorefineries in the U.S. and Europe. In 2021, Chevron Renewable Energy Group produced 480 million gallons of renewable fuels resulting in 4.1 million metric tons of carbon reduction to help lead the energy transition to a lower-carbon future.

The opportunity to serve on the Rule Advisory Committee and engage in thoughtful conversation was appreciated and constructive. Several areas in this proposed rule address items we raised in our informal comments and meetings. We are grateful for clarification in the exemption definitions, focus on $0/credit transactions versus asking for contracts for every credit transfer, and post verification credits for improvements of greater than 1 CI point.

Chevron Renewable Energy Group sees the proposed compliance curve as a progressive, albeit an aggressive, step to grow the Clean Fuel Program in Oregon. If implemented, Chevron Renewable Energy Group can help contribute to the success of this reduction effort due to our growth in renewable fuel production. However, to achieve this aggressive goal, we urge the Department of Environmental Quality ("DEQ") to maintain precautionary mitigation measures that enable the program to operate effectively with relief measures if unexpected issues arise as the reduction targets increase.

There are areas we strongly encourage DEQ to look at in future rulemakings to ensure renewable fuel producers are utilizing all options to reduce the carbon intensity of the fuel. These areas are book and claim for renewable natural gas ("RNG") as a process input and implementing a consistent method for measuring Indirect Land Use Change ("ILUC").

Once DEQ has experience with book and claim for RNG to hydrogen as a transportation fuel, expanding this option to RNG as an energy source, RNG to hydrogen as a process input in renewable diesel, and RNG to renewable methanol for biodiesel production is a logical next step. Adding these options can help foster lower carbon fuels and production inputs, allowing our

production facilities to utilize the lowest carbon intensity inputs possible to meet the goals of this program.

Chevron Renewable Energy Group also urges DEQ to review the OR-GREET model and to establish a consistent application of ILUC. We specifically support updating the canola and soybean ILUC penalties by utilizing the newest science from Argonne Laboratories for all ILUC applications. ILUC should be addressed to improve the carbon intensities of these fuels and rectify the inconsistency of using Argonne's model for corn ethanol's ILUC score and not for soy and canola biodiesel.

Again, Chevron Renewable Energy Group appreciates the opportunity to discuss this rule and our ability to shape its direction over the last few months.

Respectfully,

Curtis Powers, Manager, Compliance Supply Chain Management
Chevron Renewable Energy Group

Kent Hartwig, Director, Corporate Affairs and Development
Chevron Renewable Energy Group

Clean Fuels
ALLIANCE AMERICA

July 21, 2022

Ms. Cory Ann Wind, Clean Fuels Program Manager
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

Re: Comments on Clean Fuel Program Expansion 2022

Dear Ms. Wind:

Thank you for the opportunity to provide comments on the expansion of the Oregon Clean Fuel Program (CFP) through the current rulemaking. Clean Fuels Alliance America[1] (Clean Fuels) generally supports the expansion and strongly encourages DEQ to implement deeper and accelerated carbon intensity (CI) reduction targets as expeditiously as feasible. Clean Fuels reiterates and incorporates by reference our June 10, 2022, comment letter; we also support and incorporate by reference the June 8, 2022, comments submitted by our member, Renewable Energy Group, and other comments you may have received since then from our members.

<u>The CFP should target a 30% CI reduction target by 2030 and 37% by 2035</u>

We applaud DEQ's bold leadership in pursuing a 37% CI reduction target by 2035, but we also believe a steeper 2030 target of 30% is feasible and would encourage DEQ to implement such a standard. This would be in line with the proposal from California Air Resources Board (CARB) staff, who recently held a workshop in which they solicited comments on a 30% CI reduction target by 2030.[2]

[1] Clean Fuels (formerly National Biodiesel Board) is the U.S. trade association representing the biodiesel, renewable diesel, and sustainable aviation fuel (SAF) industries. Our members include farmers, fuel producers, marketers, and technology developers. Our recent name change reflects the expansion and evolution of our industry to include members involved in the entire supply chains for biodiesel, renewable diesel, SAF, and other low carbon fuels. Biodiesel, renewable diesel, and SAF are made from the same waste and co-product fats, oils, and grease feedstocks, such as used cooking oil, animal tallow, distillers corn oil, and surplus co-products from soybean and canola production.

[2] CARB staff also solicited comments for a 25% target in that same timeframe, but their ongoing Scoping Plan Update process and modeling clearly shows the need to establish the most aggressive carbon reduction targets as feasible. See slide 11, https://ww2.arb.ca.gov/sites/default/files/2022-07/LCFSWorkshop_Presentation.pdf.

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cleanfuels.org

The indirect land use change (ILUC) carbon scores for soy and canola should be updated expeditiously to reflect current science

With respect to ILUC penalties for soy and canola, we are disappointed with but understand DEQ's decision to not update the OR-GREET accounting tool or otherwise address ILUC in this rulemaking. However, we strongly urge DEQ to update expeditiously the soybean and canola ILUC penalties with the latest scientific work published by Argonne National Laboratory, the gold standard in the science of lifecycle assessments. The ILUC penalties currently used by California do not reflect real world observational data developed since CARB's 2015 rulemaking, which itself was based on data that are now over a decade old. Oregon's current practice of using the Argonne model for assessing corn ethanol's ILUC score – but not for soy and canola biodiesel – is not just scientifically and methodologically inconsistent, it results in an artificial distortion of the decarbonization signal that is at the heart of the CFP. As DEQ has clearly stated, the state will have "continued demand for low-carbon liquid fuels for decades." With biodiesel and renewable diesel forecasted by DEQ to provide up to 59%[3] and 54%[4] of the CFP carbon reductions in 2021 and 2022, respectively – and these reductions occurring in the most difficult to decarbonize sectors – it is imperative that the state's carbon scoring system reflect a level playing field by employing the most current science for all fuels subject to the rule.

Increasing biodiesel, renewable diesel, and SAF volumes is important for reducing GHGs as well as other harmful pollutants

As noted in our previous comments, biodiesel and renewable diesel provide substantial reductions in co-pollutants, especially diesel particulate matter (DPM), in addition to lowering GHGs by up to 86% or more. The recent Trinity Study[5] commissioned by Clean Fuels clearly shows the replacement of petroleum diesel with biodiesel in 27 high-diesel use sites evaluated across the country can reduce cancer incidences by nearly 9500, premature deaths by more than 910 per year, asthma cases by over 456,000 per year, and provide other substantial health benefits, all totaling $7.7 billion annually from avoided health costs.

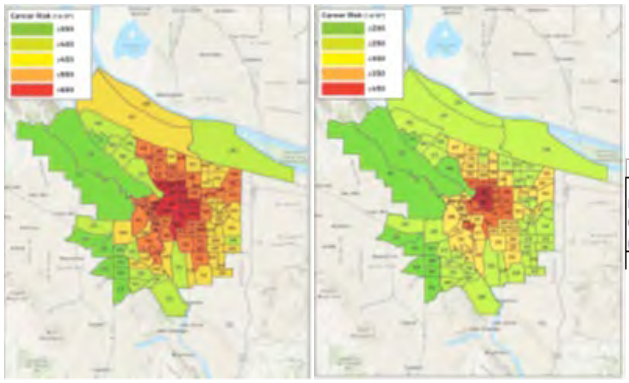
In Portland alone, the Trinity Study shows a switch to biodiesel in older legacy vehicles would decrease diesel PM exposure significantly, reducing nearly 13 premature deaths each year, asthma attacks by over 7,000 each year, and lost workdays by over 1,400 annually, all totaling about $113 million in avoided health costs each year (Fig. 1).[6] To the extent there are other high diesel-use sites in Oregon, we would expect similar public health benefits to accrue at those sites (proportional to the diesel use, local population, and other site-specific conditions).

[3] OR DEQ 2021 Clean Fuels Forecast, at 6.
[4] OR DEQ 2022 Clean Fuels Forecast, at 6.
[5] See https://www.biodiesel.org/news-resources/health-benefits-study, accessed May 25, 2022. [Note the 27 sites includes 15 sites under Phase 2, which was completed in Q2 2022.]
[6] See Phase 1 of the Trinity Study, https://www.biodiesel.org/docs/default-source/trinity-study/trinity-nbb-tranportation-health-risks-review-v1-03.pdf?sfvrsn=ec0f774a_2, accessed May 25, 2022.

Fig. 1. Projected Cancer Risk Reduction and Other Health Benefits by Switching to Biodiesel

B100 BENEFITS: PORTLAND, OR – TRANSPORT

Cancer Risk Pre/Post-Switch to B100 (Up to 83 fewer cases)



Valuation of Reduced Incidence Benefits		
Endpoint	Reduced Incidence	Benefit Value
Premature Mortality	12.7	$110,964,716
Asthma Exacerbation	7,003	$412,460
Minor Restricted Activity Days	8,638	$582,248
Work Loss Days	1,423	$582,248
Total		$112,541,672

Reduction in Health Impacts					
Baseline Cancer Risk (1 in 10^6)	Cancer Risk Reduced to (1 in 10^6)	Change in Cancer Risk (1 in 10^6)	Baseline Tot. Cancer Burden (for study location)	Tot. Cancer Burden (for study location)	Change in Cancer Burden (for study location)
651	363	288 (44%)	189	106	83 (44%)

Clean Fuels ALLIANCE AMERICA

Source: https://www.biodiesel.org/docs/default-source/trinity-study/trinity-nbb-tranportation-health-risks-review-v1-03.pdf?sfvrsn=ec0f774a_2.

These benefits are especially important for disadvantaged and EJ communities, many of which are located at or near sites that still use high levels of petroleum diesel. At these sites, there are significant numbers of legacy vehicles that can benefit from the reduced DPM emissions which biomass-based diesel provides. And these sustainable diesel replacements would benefit even the more modern, 2007 and newer engines by reducing their GHG emissions and particle loading of the diesel particulate filters, thereby improving their longevity and maintenance.

Finally, it's important to note the key role renewable diesel and biodiesel are playing in displacing petroleum diesel, keeping the anthropogenic carbon emissions associated with fossil fuels like petroleum diesel from further exacerbating the climate crisis. In California and Oregon, these sustainable diesel replacements are projected to displace over 1.3 billion gallons[7] of petroleum diesel in 2021 alone.

Conclusion

As noted above, the ILUC penalties for soy and canola serve as significant barriers to deeper deployment of biodiesel, renewable diesel, and SAF in the most difficult to decarbonize sectors (heavy duty on- and off-road, marine, rail, and aviation). Thus, to maximize the GHG and public health benefits of biodiesel, renewable diesel, and SAF, it is imperative that DEQ address the ILUC penalties and implement the other enhancements identified in REG's comments

[7] LCFS Dashboard and CFP Clean Fuels Forecasts, op cit.

expeditiously so these benefits can accrue for all Oregon residents, especially those in environmental justice communities who are being exposed to high level of diesel PM from the use of fossil fuels.

We appreciate the leadership you and your staff have shown and your willingness to consider stakeholder input, including but not limited to the establishment of the Rulemaking Advisory Committee (RAC). We have enjoyed our strong partnership over the years and look forward to the state implementing the most robust carbon intensity reduction targets on the West Coast. To that end, we look forward to working with you and your staff to update and enhance the program further as noted above.

Sincerely,

Floyd Vergara, Esq., P.E.
Director of State Governmental Affairs
Clean Fuels Alliance America

CleanFuture, Inc.
P.O. Box 23813
Portland, OR 97281-3813
office: +1 503 427-1968

July 21, 2022

Cory-Ann Wind
Oregon Clean Fuels Program Manager
Oregon Department of Environmental Quality
800 NE Oregon Street
Portland, OR 97232
Comment Submitted via email to CFP.2022@deq.state.or.us

RE: Comments on CFP 2022 Expansion

Dear Ms. Wind,

CleanFuture, Inc. ("CleanFuture) appreciates the opportunity to provide feedback on the proposed revisions to the Clean Fuels Program ("CFP") regulation. These comments are in response to the Notice of Proposed Rulemaking published on June 29, 2022. CleanFuture is a leading environmental company that has worked for over a decade to electrify and improve the efficiency of a wide range of vehicle fleets. CleanFuture, Inc. has built a strong platform connecting clean vehicle fleet customers with low carbon fuels (electricity and other fuels), particularly zero and sub-zero CI fuels, serving both on the supply and demand side in multiple programs and jurisdictions. CleanFuture is pleased to provide these comments:

Establishment of average carbon intensity targets of 20% in 2030 and 37% in 2035.

CleanFuture is supportive of the carbon intensity targets in the notice of proposed rulemaking.

Designate the owner of the forklift to generate the credits for electric forklifts.

CleanFuture agrees that the forklift owner is the appropriate entity eligible to generate credits in electric forklifts. The fleet owner is the entity who has made the large upfront investment in acquiring the fleet of electric forklifts.

We recommend the following language:

> (5) Electric Forklifts. For electricity used to power forklifts, the forklift fleet owner may generate the credits. If the forklift is being operated by a person other than the owner, the owner may generate the credits if they have ~~detailed~~ documented usage ~~and charging data~~, otherwise the operator of the forklift may generate the credits.

Hydrogen for advance credits must meet a maximum carbon intensity of 117 gCO2e/MJ.

CleanFuture suggests for advance credits on hydrogen that DEQ must be conservative and instead issue credits at typical carbon intensities for hydrogen produced from fossil fuels. While this results in fewer advance credits assigned from the higher carbon intensities, the incentive still exists for advanced credit generators on hydrogen to procure renewable hydrogen to more quickly payback the advance credits and then reduce operating costs with higher crediting from lower CI hydrogen from non-fossil fuels (and in turn creates more incentive for hydrogen from non-fossil fuels). Otherwise if DEQ issues advance credits at low CI values for hydrogen and if eligible advanced credit generators can only procure hydrogen derived from fossil fuels then DEQ must adjust for credit deficiencies.

Review of the Clean Fuels Program in 2029

CleanFuture is supportive of a formal program review and update to the Environmental Quality Commission in 2029.

Recommended Revisions to Requirements for Biogas-derived Electricity

CleanFuture recommends that DEQ remove the requirement for RECs to be certified to the Green-e Energy Standard for renewable electricity from biogas-derived electricity generators. Throughout the CFP Electricity Expansion 2021 CleanFuture identified numerous constraints and uncertainties to renewable electricity generating projects from imposing the Green-e Energy standard to biogas-derived electricity facilities, as well as certain other incompatibilities during implementation.

More broadly CleanFuture recommends that biogas electricity projects be exempt from Green-e certification because if that same biogas was to be upgraded and cleaned to become biomethane for pipeline injection and claimed as a vehicle fuel, then DEQ imposes no similar requirement for the M-RETs Thermal Renewable Thermal Certificates (RTC) to be certified to the Green-e Renewable Fuel Standard even with the DEQ's implementation RTC in the proposed rule. Yet if that same biogas is transformed into electricity and used as a vehicle fuel then DEQ requires the Green-e Energy certification on the renewable energy credits (RECs). What is DEQ's rationale for imposing differing requirements on biogas whether produced from wastewater treatment, landfill gas, food waste or other organics, or animal waste, the biomethane is treated more favorably than biogas-derived electricity in the CFP regulation?

A separate yet related issue was brought up during CFP rulemaking where the proposed draft Green-e Energy Standard draft version 4.0 contains that same language to exclude biogas electricity from animal wastes and certain other feedstocks. Once CRS adopts the new v4.0 language for the Green-e Energy Standard then earlier biogas electricity project investments become stranded and ineligible to participate in Oregon's Clean Fuels Program. This interrupts CFP credit generation from existing projects and creates uncertainty and will stall the CFP market for new projects while DEQ updates its rules

Other requirements in the CFP regulation require Green-e certification for biogas electricity to meet a "New Date" requirement for biogas to electricity projects, where no such date requirements exist for projects upgrading biogas to biomethane for RNG fuel. Biogas electricity projects require continued eligibility beyond the 15-year window to cover ongoing operations and maintenance (O&M) costs to continue capturing and converting methane into useful energy for transportation fuel. If biogas electricity facilities have no such ability to cover operating costs they will likely be retired early or be mothballed, a situation that could cause a return to venting the biogas which is a step backwards for Oregon's efforts to control methane emissions.

Biogas-to-biomethane and biogas-to-electricity both offer an important avoided methane emissions benefit; this benefit should be equally realized for both pathway types. DEQ's efficiency adjustment factor could result in Low-CI Electricity projects ceasing to operate once their PPAs run out, and/or encouraging these projects to shift away from electricity generation to instead deliver RNG to combustion vehicles. The "adjustment factor" for biogas electricity[1] prioritizes the value for biogas to RNG projects as it is, the Green-e certification and the New Date all similarly favor RNG over electricity projects.

If DEQ's goal is to prioritize and favor biomethane pipeline injection projects over biogas-derived electricity projects, then this goal should be more clearly articulated.

Recommendation on Electricity (Shore Power) in Ocean Going Vessels

CleanFuture suggests that DEQ's revised definition for eligibility of Ocean Going Vessels excludes numerous vessels using shore power electricity in place of diesel fuel, which should have the ability to generate credits for switching from diesel fuel to electricity while at berth. DEQ's new definition excludes many vessels which may meet none of DEQ's new criteria for overall length, gross tonnage, or propulsion technology (of which propulsion technology has no bearing for shore power as onboard electricity is typically generated from fuel-burning auxiliary engines instead of propulsions engines). The propulsion criterion is limiting and ignores other common types of marine propulsion technologies such as steam turbine and gas turbine engines (all burning oil or diesel but without cylinders). For example, cruise ships and naval ships typically use gas turbine propulsion systems, not internal combustion engines. In addition, most ships have multiple auxiliary generators to provide electrical power that may or may not be connected to the propulsion system. These fossil fuel generators become the power source when a ship is cold ironed and not on shore power.

A specific example of a vessel recently berthed in Oregon which would be non-conforming to DEQ's new definition is the USNS Sea Fighter which would fail to meet DEQ's new definition

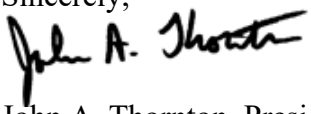
[1] https://www.oregon.gov/deq/ghgp/Documents/BiogasElectricity.pdf imposes a 50% efficiency benchmark for biogas if made into electricity in a stationary generator and conveyed to vehicle use, in alignment with CARB https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-06.pdf , yet there is no similar efficiency adjustment for biomethane if combusted in a vehicle.

because of insufficient length (262 feet) and inadequate gross tonnage (1,600 tons), combined with a different propulsion technology (combined diesel or gas turbine).[2]

CleanFuture submitted a pathway application for a Tier 2 EER-adjusted pathway under OAR 340-253-0460 for other vessels using shore power electricity instead of diesel fuel at the invitation of DEQ staff during rulemaking that would otherwise be non-conforming with the proposed new language. We are still awaiting staff's review of CleanFuture's EER-adjusted pathway application.

Thank you for this opportunity to submit these comments. Please advise if any further input on these issues would be constructive.

Sincerely,



John A. Thornton, President
CleanFuture, Inc.

[2] https://en.wikipedia.org/wiki/Sea_Fighter_(FSF-1)

From: Karen Harrington
To: CFP2022 * DEQ
Cc: Brian Romer
Subject: Public comments re: Clean Fuels Program draft rules
Date: Wednesday, July 20, 2022 11:16:15 PM

July 19, 2022

DEQ Clean Fuels Program Staff,

Thank you for the opportunity to provide comments on DEQ's proposed Clean Fuels Program rules and draft fiscal impact statement. I am the Co-Chair of the Legislative Committee of Climate Reality Portland and am writing on behalf of Climate Reality. We are writing to express strong support for maximizing climate, public health, community, and local economic benefits by adopting an ambitious Clean Fuels Program (CFP) expansion. We also encourage you to amend the draft fiscal impact statement (FIS) to capture benefits of the Clean Fuels Program more accurately.

The Clean Fuels Program is one of Oregon's most important and cost-effective tools to reduce climate pollution from the largest source in Oregon: burning diesel and gasoline for transportation. While we applaud DEQ's proposal to extend and increase the CFP's carbon intensity reduction targets to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035, the science is clear, these targets do not meet the necessary level of carbon reduction needed to meet Oregon's climate goal of 90% emissions reduction by 2050.

The latest UN Intergovernmental Panel on Climate Change (IPCC) report clearly stated that current policies to limit climate emissions will not be sufficient to avoid catastrophic and irreversible climate impacts. While Oregon has made meaningful progress to address the fossil fuel pollution driving the climate crisis, we are still not on track to achieve our climate goals. Stronger clean fuels targets will help us close this critical gap.

At minimum, DEQ should expand the carbon intensity reduction targets to **go beyond the current proposed 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035**. Strong carbon intensity reduction targets will help reduce climate pollution and improve public health and economic outcomes across Oregon. Cleaner fuels also help increase our energy security and protect Oregonians against harmful oil and gas price fluctuations at the pump. The more we move toward electric vehicles and cleaner fuels made closer to home, the less we will have to worry about the price of oil and gas being determined half a world away.

We urge DEQ to maximize the clean air, climate, and health benefits of the program, by achieving these new targets through electrification as strong as possible, and to prioritize equitable economic outcomes, by encouraging utilities to fund affordable and accessible public charging infrastructure in underserved areas such as low-income, BIPOC and rural communities.

In addition, the draft fiscal impact statement (FIS) needs to be amended to capture the extensive health and jobs benefits of the Clean Fuels Program more accurately. The economic benefits identified are extremely conservative estimates, whereas the costs of the program are overestimates. For example, while the program rewards reductions in lifecycle emissions, the FIS doesn't incorporate reductions in co-pollutants beyond the tailpipe. It also doesn't quantify other economic benefits, including job creation, investments, new tax base, waste reduction, and so forth.

We appreciate the inclusion of $916 million in benefits when using the federal estimate of the social cost of carbon, however this is an extremely conservative estimate, especially when you consider there have already been hundreds of lives lost, thousands of homes and buildings burned, agricultural production losses, and lost business days from climate impacts in Oregon in just the last two years alone.

Thank you for your consideration,

Karen Harrington

Co-Chair Legislative Committee

Climate Reality Portland

Karen Harrington (she, her)
Volunteer
Climate Reality Project, Portland Chapter
https://www.climaterealityproject.org
https://climaterealitypdx.com

1-510-833-0492
West Linn, OR, USA

What a great time to be alive. We have the opportunity to create a sustainable future for our children, our grandchildren, and all future generations. Join me and together we can make the difference!

Clean Fuels Program
Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232

July 21, 2022

RE: Clean Fuels Program Expansion - RAC Meeting #4 Comments

DEQ Clean Fuels Program Staff,

Thank you for the opportunity to provide written comments on the Department of Environmental Quality (DEQ)'s proposed Clean Fuels Program Expansion rules. On behalf of the undersigned organizations, we write to express our strong support for adopting an ambitious Clean Fuels Program expansion, and submit for your consideration our recommendations for strengthening DEQ's proposed draft rule language, fiscal impact statement, and racial equity impact statement.

An ambitious Clean Fuels Program provides not only the opportunity to cut emissions from Oregon's top polluting sector, but to create jobs, improve public health, and enhance the vibrancy and resiliency of Oregon communities. We urge DEQ to maximize these benefits under the program by:

a) Meeting the level of ambition that science demands, by expanding the carbon intensity reduction targets **beyond** 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035;
b) Working to ensure that carbon intensity reduction targets are achieved through electrification as much as possible; and
c) Prioritizing equitable economic outcomes, by encouraging credit-generating utilities to fund affordable and accessible public charging infrastructure in underserved areas such as low-income, BIPOC and rural communities.

In addition, we urge DEQ to amend its draft Fiscal Impact Statement (FIS) for the Clean Fuels Program to more accurately quantify and capture the extensive health and jobs benefits of the program. As currently drafted, the economic benefits identified are extremely conservative estimates, whereas the costs of the program are overestimates.

We offer the following comments to strengthen the proposed rules and draft FIS along these lines. Thank you in advance for your consideration.

I. Draft rules

a) Targets

In recent years, Oregon has unfortunately become the poster child for climate change, making international headlines for our deadly and devastating climate-fueled heat waves, wildfires and drought.

The June 2021 heat dome alone killed more than 100 Oregonians[1]; threatened our state's economic recovery by shuttering small businesses and impacting local tourism[2]; and compounded our ongoing public health crisis by worsening air quality[3] and disproportionately affecting environmental justice communities. Oregon has a responsibility to address its share of this global challenge. It is unconscionable to continue putting the lives and livelihoods of our workers, frontline communities, children and grandchildren at risk; DEQ must use every tool at its disposal to immediately cut the fossil fuel emissions that are destabilizing the climate.

Oregon's climate tragedies are grim visual evidence of what scientific consensus has long concluded. The April 2022 United Nations' Intergovernmental Panel on Climate Change (IPCC) report stated unequivocally that current policies to limit climate emissions will not be sufficient to avoid catastrophic and irreversible climate impacts, only further underscoring the need for urgent action by decision-makers in Oregon to significantly and immediately cut fossil fuel emissions.

DEQ's Clean Fuels Program Expansion provides a crucial opportunity to achieve significant emissions reductions from Oregon's top polluting sector: transportation. By establishing ambitious carbon intensity targets, DEQ will help create jobs in the clean fuels economy, improve public health by reducing harmful co-pollutants from tailpipe emissions, and invest in local communities and economies. Strong carbon intensity reduction targets are essential to the Clean Fuels Program and for moving the needle on climate emissions and co-pollutant reductions in the transportation sector.

While we support DEQ's proposal to extend and increase the CFP's carbon intensity reduction targets to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035, these proposed targets represent the <u>minimum</u> level of ambition that is feasible and which DEQ should strive for.

Adopting stronger carbon intensity targets is not only necessary; it is entirely feasible. While DEQ's proposed targets are the most ambitious of the scenarios modeled in ICF's illustrative compliance scenarios, ICF's modeling assumptions were based in conservative estimates. For instance, Scenario C of ICF's modeling assumed merely compliance with existing policies–namely, SB 1044 and DEQ's medium-duty and heavy-duty electric vehicle standards–and assumed only up to 35% renewable fuels.

However, with the recent adoption of the Clean Truck Rules, the recent influx of significant Infrastructure Investment and Jobs Act funding to advance transportation electrification and public transit, the anticipated adoption of the Advanced Clean Cars II rules requiring 100% electric vehicle sales by 2035 and the City of Portland's expected Renewable Fuels Standard update that will increase the requirement for renewable diesel to nearly 100%, and more, Oregon will more than likely exceed 35% renewable fuels by 2030 and 2035. Additional trends point to increased clean fuels uptake and reduced oil dependency,

[1] https://www.opb.org/article/2021/08/06/oregon-june-heat-wave-deaths-names-revealed-medical-examiner/#:~:text=The%20heatwave%20led%20to%20more,occurring%20in%20the%20Portland%20area.&text=Shandas%20said%20it's%20rare%20%2D%20and,on%20mortality%20during%20a%20heatwave.
[2] https://www.kgw.com/article/news/local/max-lines-businesses-close-due-to-excessive-heat/283-094c46c6-5b2e-4836-9e04-46b6ba6f593d
[3] https://www.oregon.gov/newsroom/pages/NewsDetail.aspx?newsid=64009

including increased telecommuting, more Original Equipment Manufacturers (OEMs) committed to 100% ZEV production[4], and utility programs for increased public and at-home charging.

With these assumptions, a carbon intensity reduction of at least 45% below 2015 levels by 2035 would be easily achievable, and would serve to maximize other benefits achieved under the program, including economic investment, job growth, and improved public health outcomes.

b) Maximize electrification and limit use of RNG as a fuel pathway

As our organizations have expressed in previous comments, to maximize climate emissions reductions, health benefits, and cost-effectiveness, carbon intensity reduction targets can and should be achieved through electrification as much as possible. While an ambitious carbon intensity reduction target serves as the backbone of the Clean Fuels Standard, we also urge DEQ to be thoughtful about the potential fuel pathways that could achieve these targets. Specifically, it is important to note that increased carbon intensity targets do not guarantee any given fuel pathway.

Likewise, in order to maximize emissions reductions and co-benefits under this program, it is critical to ensure that–as the Clean Fuels Standard gets stronger–early investments in the program do not result in perverse long-term consequences. We therefore urge DEQ to be cautious not to reward early emissions reductions that may not achieve meaningful carbon intensity reductions in the future. There may be a lot of competition for RNG throughout the economy, and transportation may not be the highest and best use for these limited molecules.

c) Transitioning fuels from clean to regulated

We urge DEQ to consider assigning fossil-derived hydrogen a higher CI score based on continued evidence that fugitive methane emissions are greater than expected throughout the natural gas life cycle, such that it is considered a regulated fuel. While hydrogen has no tailpipe emissions, if it is produced using natural gas (as is currently the case for 95% of hydrogen), it should not be considered a low-emission fuel,[5] even when accounting for carbon capture. Labeling all hydrogen as a clean fuel may lead to unintended consequences of creating fossil fuel-derived hydrogen infrastructure that will not help us meet our greenhouse gas emission goals.

II. Draft Fiscal Impact Statement

We urge you to amend the draft fiscal impact statement (FIS) to more accurately capture the extensive health and jobs benefits of the Clean Fuels Program. The economic benefits identified are extremely conservative estimates, whereas the costs of the program are overestimates. And even so, the benefits of the proposed rules nearly offset even the highest estimate of compliance costs.

[4]https://www.repairerdrivennews.com/2022/06/09/buick-announces-all-ev-lineup-by-2030-makes-vehicle-connectivity-services-standard-equipment/.
[5]https://www.cesa.org/event/how-green-is-blue-hydrogen/.

For example, $84 to 87M in realized health benefits is a significant underestimate because it doesn't calculate the cumulative benefits. There are higher health benefits in the interim years while older, dirtier diesel engines are still on the road. Further, it doesn't take into account health benefits and cost savings from reductions in other criteria pollutants. While the program rewards reductions in lifecycle emissions, which often reduces co-pollutants, the FIS doesn't quantify reductions in pollutants beyond the tailpipe. It also doesn't quantify other economic benefits - job creation, investments, new tax base, waste reduction, and so forth.

In addition, while we appreciate the inclusion of $916 million in benefits when using the federal estimate of the social cost of carbon, this is an extremely conservative estimate. Climate change is already producing devastating economic impacts in Oregon, and the destruction caused by recent climate-fueled wildfires, droughts, and heat waves have price tags in the billions of dollars. The 2020 Labor Day fires alone destroyed more than 4,000 homes and killed 11 people. The healthcare costs associated with Oregon wildfires are incredibly high; according to an analysis by NRDC, Oregon's 2012 fire season cost the state $2.1 billion in healthcare costs alone.[6] Moreover, the costs associated with wildfires and other climate-fueled disasters are projected to rise dramatically as the climate crisis worsens. According to the World Resources Institute, the annual economic damages from climate change could equate to 10% of US GDP by 2100.[7]

Last summer's unprecedented climate-fueled heatwave—which sent thousands of people to emergency rooms for heat-related illness and killed more than 110 people across the state—further underscored these impacts. Dozens of small businesses were forced to close shop as a result of the extreme temperatures. Just last month, Oregon OSHA issued permanent rules requiring employers to implement protective measures for workers from excessive heat and wildfire smoke. Further, with 63% of Oregon currently experiencing extreme or severe drought conditions,[8] fossil fuel-driven climate change is already threatening Oregon's agricultural and other natural resource sectors.

We strongly urge DEQ to update the FIS to reflect the substantial job and economic benefits of reducing emissions under this program, including job loss prevention, avoided future business closures, reduced health care costs, and sustaining Oregon's natural resource economy.

As DEQ rightfully notes in its FIS, "as more of the state moves away from fossil gasoline and diesel, the impacts from oil price shocks will become more muted, benefiting both consumers and the state." This is because clean fuels, like electricity, have less volatility and therefore are less subject to global swings in gas and oil prices. Stronger carbon intensity targets under the Clean Fuels Program will help protect Oregonians from current gas price volatility and future price fluctuations. The more we can move toward electric vehicles, the less we have to worry about the price of oil and gas being determined half a world away. Electrification and cleaner ways of making those fuels exist right here in Oregon. The Clean Fuels

[6] Vijay Limaye & Juanita Constible, Up in Smoke: Oregon Wildfires Cost Billions in Health Harms (Oct. 2, 2019), https://www.nrdc.org/experts/vijay-limaye/smoke-oregon-wildfires-cost-billions-health-harms.
[7] Joel Jaeger & Devashree Saha, 10 Charts Show the Benefits of U.S. Climate Action, World Resources Inst. (July 28, 2020), https://www.wri.org/insights/10-charts-show-economic-benefits-us-climate-action.
[8] U.S. Drought Monitor map for Oregon, July 15, 2021: https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?OR.

Program will help us deploy those technologies at scale, providing cost-savings, job creation, and healthier living environments for people and families across Oregon.

III. Racial Impact Statement

Finally, we applaud DEQ for including a racial equity impact statement for this rulemaking. As noted in DEQ's statement, transitioning to lower-carbon fuels will have immediate public health benefits and alleviate burdens for impacted communities, by reducing harmful co-pollutants that disproportionately affect Black, Indigenous and People of Color communities and low-income Oregonians.[9] Further, the Clean Fuels Program has the potential to provide significant economic and community benefits through investments in all modes of transportation electrification projects across the state.

The Clean Fuels Program has accelerated the transition to electric vehicles by directing utility generated credits towards projects that support electric school bus purchases, public charging infrastructure, electric bike rebates and more. We urge DEQ to consider these benefits in its racial impact statement, and to further advance equitable transportation electrification by encouraging utilities to fund affordable (cost parity to at-home charging), accessible public charging infrastructure in underserved areas such as low-income, BIPOC and rural communities, as well as projects and programs that support all modes of transportation electrification options. Many lower-income Oregonians without access to at-home charging continue to pay for higher electric vehicle charging even though they should be paying the least.

Thank you for your work and for the consideration of our comments. We look forward to continuing to work with you to ensure a healthy future and a stable climate for all Oregonians through the establishment of a strong Clean Fuels Program.

Sincerely,

Victoria Paykar
Climate Solutions

Jeff Bissonnette
NW Energy Coalition

Nora Apter
Oregon Environmental Council

Jeremy Martin
Union of Concerned Scientists

[9] Oregon Health Authority's recent Climate and Health in Oregon 2020 report underscored that rapidly accelerating climate change is intensifying public health crises in Oregon, hurting communities of color and tribal communities first and worst, and that these health risks will only get worse with continued inaction. https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/CLIMATECHANGE/Documents/2020/Climate%20and%20Health%20in%20Oregon%202020%20-%20Full%20Report.pdf

July 21, 2022
Submitted via email to CFP.2022@deq.oregon.gov

Cory Ann Wind
Oregon Clean Fuels Program Manager
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

RE: Comments on Proposed Rules of the Oregon Clean Fuels Program Expansion 2022 Rulemaking

Dear Ms. Wind,

The Coalition for Renewable Natural Gas (RNG Coalition) [1] submits these comments in response to the *Notice of Proposed Rulemaking* (Notice) published on June 29, 2022, by the Oregon Department of Environmental Quality (DEQ)[2] formalizing the proposed rule amendments (Draft Rules) for the Clean Fuels Program (CFP) Expansion 2022 Rulemaking.[3]

RNG Coalition was pleased to provide input to DEQ in the development of those Draft Rules by actively participating in the Regulatory Advisory Committee (RAC). We thank DEQ for the opportunity to serve on the RAC, listening to our input during that process, and reflecting many of our suggestions in the Draft Rules. The Draft Rules already include well-designed CFP updates that strengthen the program's targets and increase the ability to maximize RNG's contributions to the program's goals. Our written comments below recommend additional possible improvements.

Specifically, we believe sufficient low carbon fuel supply is in development to justify alignment with regional partners and adopting more ambitious targets in the 2030 timeframe. Further strengthening near-term targets would put the state's transportation emissions on a trajectory in line with a net-zero carbon economy by 2050. As we explain below, additional use of RNG could be better leveraged to meet more ambitious goals. For example, one of the few remaining gaps in the CFP rules is a simple method to allow facilities that manufacture liquid fuels to use RNG in place of conventional geologic gas for process energy.[4]

About the RNG Coalition

The RNG Coalition is the trade association for the RNG industry in North America. Our diverse membership is comprised of leading companies across the RNG supply chain, including recycling and waste management companies, renewable energy project developers, engineers, financiers, investors, organized labor, manufacturers, technology and service providers, gas and power marketers, gas and

[1] For more information see: http://www.rngcoalition.com/

[2] https://www.oregon.gov/deq/rulemaking/Documents/cfp2022pnp.pdf

[3] https://www.oregon.gov/deq/rulemaking/Pages/cfp2022.aspx

[4] Currently such actions are not incentivized because liquid fuel facilities cannot be recognized with a lower carbon intensity (CI) score for their RNG use.

power transporters, transportation fleets, fueling stations, law firms, environmental advocates, research organizations, municipalities, universities, and utilities. Together we advocate for the sustainable development, deployment, and utilization of RNG, so that present and future generations have access to domestic, renewable, clean fuel and energy in Oregon and across North America.

The Draft Rules Include Several Program Updates That Will Lower Barriers to RNG Participation

Throughout the RAC portion of the Rulemaking,[5,6,7,8] RNG Coalition made several recommendations to DEQ on how the Draft Rules could be designed to better allow RNG to support Oregon's decarbonization goals through an updated CFP. Table 1 below is a summary of the various recommendations made by RNG Coalition and whether the Draft Rules addresses them.

Table 1. RNG Coalition recommendations to DEQ on CFP Expansion 2022 Rulemaking During the RAC Process

RNG Coalition Recommendations	**Status in Draft Rules**
Adoption of Ambitious Clean Fuels Targets that Align with a Net-Zero GHG Outcome	Included, with room for additional near-term ambition
Encouraging use of electronic registry (e.g., M-RETS) for RNG transactions	Included
Broad shift toward crediting based on demonstrated carbon intensities using full ex-post true-ups	Included
RNG suppliers are best positioned to be credit generator, but the option for contractual flexibility would be helpful	Included
Adding a tier 1 calculator for biogas to electricity pathways	Included
Encouraging broader RNG use, including as process energy at biorefineries	Absent
Eligibility of biogas to electricity projects should be extended indefinitely or the goals of conversion to RNG should be more clearly articulated	Absent

RNG Coalition is pleased to observe that DEQ adopted multiple recommendations we provided during the RAC process. The comments below expand on the positive impact of adopting several of those recommendations in the final rules and answer questions asked by DEQ in the Notice of Proposed Rulemaking.

[5] *RNG Coalition Comments – Clean Fuels Program Expansion Listening Session*, October 20, 2021, pdf pages 10-13. https://www.oregon.gov/deq/rulemaking/Documents/cfp2022lsComments.pdf

[6] *RNG Coalition Comments – Clean Fuels Program Expansion 2022 Reporting Workshop and Rulemaking Advisory Committee Meeting 2*, February 4, 2022, pdf pages 8-11. https://www.oregon.gov/deq/rulemaking/Documents/cfp2022m2Com.pdf

[7] *RNG Coalition Comments – Clean Fuels Program Expansion Pathways Workshop*, March 4, 2022, pdf pages 5-7. https://www.oregon.gov/deq/rulemaking/Documents/cfp2022pwComments.pdf

[8] *RNG Coalition Comments – Clean Fuels Program Expansion 2022 Rulemaking Advisory Committee Meeting 4*, June 9, 2022, pdf pages 29-31. https://www.oregon.gov/deq/rulemaking/Documents/cfpe2022m4Com.pdf

Sector-specific Tradeable Performance Standards Such as the Oregon CFP Have a Strong Track Record of Motivating RNG Buildout

The Notice indicates that DEQ seeks input on "on whether there are other options for achieving the rules' substantive goals while reducing the rules' negative economic impact on business."[9] We believe that Tradeable Performance Standards (TPS) such as the Oregon CFP have proven to be the most effective tools in motivating RNG buildout specifically, and "fuel switching" through clean energy and infrastructure deployment more generally. Because such actions are critical steps toward decarbonizing the supply side of the transportation sector, there are no other policy options that have proven to be as beneficial at motivating clean fuel buildout and minimizing negative economic impacts.

In general, a TPS sets a standard of technology performance but leaves technology choice to the program participants (e.g., clean technology companies and compliance entities). It increases the relative costs of technologies with undesirable greenhouse gas (GHG) performance characteristics and lowers the costs of technologies with desirable GHG characteristics. A Low Carbon Fuel Standard (LCFS) or Clean Fuel Standard, like the Oregon CFP, is the leading transportation "fuel switching" policy which holistically addresses the need to both decarbonize existing transportation modalities and build the infrastructure for the energy carriers of the future.

The CFP continues to be a strong driver for RNG growth. Figure 1 highlights the significant growth in the number of RNG facilities in North America in recent years, which happened in response to various policy signals, including the Oregon CFP. There are now over 250 operational RNG production facilities in North America and over 250 more in construction or that have undergone substantial development.[10] While these are significant near-term milestones, we have only just begun to develop RNG's full potential to deliver GHG reductions. Through the RNG Coalition's Sustainable Methane Abatement & Recycling Timeline (SMART) Initiative, we believe it is possible to sustainably capture and repurpose methane that would otherwise be wasted via flare or escape fugitively into the atmosphere from more than 43,000 organic waste sites in North America by 2050.[11] Continued support from the Oregon CFP will be a key factor in achieving this vision.

[9] Notice of Proposed Rulemaking, pdf page 3.

[10] RNG Coalition, RNG Facilities Database (as of June 30, 2022, accessible from www.rngcoalition.com): https://docs.google.com/spreadsheets/d/1CpLTd1Yya4qQzUpWYtKMUGW1BlMmn-Jrj3uErd8lJ7A/edit#gid=0

[11] We estimate that there are more than 4,400 landfills, 19,000 large farms and 20,000 wastewater treatment and lagoon facilities, food waste and agricultural sites in the US and Canada, where methane emissions naturally occur as organic materials decompose. http://www.rngcoalition.com/renewable-natural-gas-industry-announces-smart-initiative

Figure 1. Number of RNG Facilities in North America over time

DEQ's Proposed Carbon Intensity Targets Will Drive Significant Growth in Alternative Fuel Supply but There Is Room for An Even Stronger Target to Align with Expected Changes in Other Leading Jurisdictions

RNG Coalition commends DEQ for proposing more stringent CFP targets, namely targeting carbon intensity reductions of 20% by 2030 and 37% by 2035 below 2015 levels. The proposed targets represent important enhancements in stringency to the Oregon CFP and are an excellent initial step. However, the Notice states that these targets are "aligned with other low-carbon fuel standards on the West Coast".[12] While the Draft Rule would align with *current* targets in other West Coast programs, the other leading West Coast jurisdictions are also now considering adopting *updated* 2030 targets in their LCFS programs that are significantly more stringent than those proposed in Oregon's Draft Rules. If alignment is truly the goal of this rulemaking, additional stringency should be added in the Final Rule.

The North American jurisdictions leading on climate change—California,[13] Washington,[14] British Columbia, [15] and the Canadian Federal Government[16]—have all implemented, or are in the process of implementing, Clean Fuel Standards as a primary means of decarbonizing their transportation sectors. Due to the success of Oregon's example, more jurisdictions are also considering adopting analogous

[12] Notice, page 6.

[13] https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard

[14] https://ecology.wa.gov/Air-Climate/Climate-change/Reducing-greenhouse-gases/Clean-Fuel-Standard

[15] https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels

[16] https://www.canada.ca/en/environment-climate-change/news/2022/06/government-of-canada-supports-innovation-in-the-fuel-industry-with-final-clean-fuel-regulations.html

programs. For example, Minnesota,[17] New York[18] and New Mexico[19] have proposed legislation to create their own LCFS. With the proposed increased ambition in the Draft Rules, Oregon would retain its position as a leading jurisdiction on climate change and clean fuels, but Oregon could still work closely with regional partners to better harmonize the program's near-term ambition.

In California, the LCFS is responsible for a significant share of in-state GHG reductions in the transportation sector to-date. As shown on the California Air Resources Board's (CARB) "data dashboard" for the program, California currently has an established target of 20% reduction in CI by 2030, based off 2010 levels. Per the 2021 data, California is ahead of schedule to meet that goal.[20] Therefore, CARB has begun to workshop targets that are more ambitious in the 2030 timeframe. On July 7, 2022, CARB hosted a public workshop on the LCFS program.[21] The primary focus of the workshop was on potential changes to the program's carbon-intensity targets. CARB indicated it is studying updating its current 20% carbon intensity reduction target for 2030 (against 2010 levels) to a new target between 25% and 30%. CARB has also signaled the need for such adjustment in the Draft 2022 California Climate Change Scoping Plan.[22]

On June 2, 2022, British Columbia Bill 15 – the Low Carbon Fuels Act – received royal ascent.[23] The bill triggers the review of the British Columbia LCFS (B.C. LCFS). Details on the B.C. LCFS measures, including the 2030 target, will be determined in a regulatory development process, which is targeted to be completed by October 2022. The updated LCFS is expected to be enforced on January 1, 2023. According to B.C.'s most recent climate plan, the Ministry of Energy, Mines, and Low Carbon Innovation announced the intent to increase the stringency of the carbon-intensity reduction targets for gasoline and diesel currently set at 20% below 2010 levels by 2030 to potentially 30%.[24]

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[17] Minnesota HF 2083: Future Fuels Act (2021 - 2022). https://www.revisor.mn.gov/bills/text.php?number=HF2083&type=bill&version=0&session_year=2021&session_number=0

[18] New York Senate Bill S2962B: Establishes the clean fuel standard of 2022. https://www.nysenate.gov/legislation/bills/2021/S2962
Assembly Bill 862 (2021-2022). https://s3.amazonaws.com/fn-document-service/file-by-sha384/a5e1f0cfc99898c86134bc3040d7d48f8a8bb5cd35e95893e18bd1310ac31e7fa00a37f4a7e2a648bba6435114a36215

[19] New Mexico Senate Bill 14: Enacting The Clean Fuel Standard Act (2022). https://legiscan.com/NM/bill/SB14/2022

[20] California Air Resources Board, *LCFS Data Dashboard*: https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard

[21] Workshop recording and materials accessible at https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-meetings-and-workshops?utm_medium=email&utm_source=govdelivery

[22] California Air Resources Board, *Draft 2022 Scoping Plan Update*, page 154 (pdf page 81). https://ww2.arb.ca.gov/sites/default/files/2022-05/2022-draft-sp.pdf?utm_medium=email&utm_source=govdelivery

[23] See Bill 15 in the list: https://www.leg.bc.ca/parliamentary-business/legislation-debates-proceedings/42nd-parliament/3rd-session/bills/progress-of-bills

[24] Government of British Columbia, *CleanBC Roadmap to 2030* (2021), page 28. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

Both the British Columbia and California examples result from the realization that greater ambition is needed in their LCFS targets to act swiftly on GHG emissions, and that sufficient near-term low carbon fuel supply is under development to make such increases in ambition feasible. These efforts also align with the need for more secure and resilient energy supplies globally. Russia's recent military aggression against Ukraine has massively disrupted Europe (and the world's) energy system. It has caused hardship due to high energy prices and it has heightened energy security concerns, bringing to the fore the EU's over-dependence on gas, oil, and coal imports from Russia.

As a result, on March 8, 2022, the European Commission called for a rapid phase out of Russian fossil fuels and an acceleration of the European Green Deal in its Communication "REPowerEU: Joint European Action for More Affordable, Secure and Sustainable Energy".[25] This action plan calls for Europe achieving 35 billion cubic meters (bcm) of annual RNG production by 2030. The European Biogas Association states that this target represents over 20% of the current EU gas imports from Russia and that by 2050, this potential can triple, growing to well over 100 bcm and covering 30-50% of the future EU gas demand.[26]

As the Notice states, "switching to non-petroleum fuels buffers consumers from crude oil price shocks due to market or weather or geopolitical factors, which can have a significant economic effect for both those consumers and the overall economy".[27] Current high (and volatile) prices for conventional fuels should strongly emphasize the necessity of swifter action to switch to alternative fuels and not be seen as a barrier to accelerated ambition. We would like to see a better treatment of such energy security and fuel diversity effects in future analysis of indirect costs to fuel consumers in future rulemakings.

By further increasing its CFP targets, Oregon could accelerate its shift away from uncertain global supply of fossil fuels to RNG produced in North America, and therefore increase energy security. We believe that even more ambition in the program's 2030 target could be justified and encourage DEQ to propose further enhancements in the Final Rules. RNG can contribute further CI reductions, beyond the contribution modelled for the proposed targets in the Draft Rule,[28] if offered the flexibilities discussed below.

Adoption of Electronic Registry for RNG Transactions and Full Ex-Post True Ups Will Accelerate the Use of RNG in Oregon

The participation of RNG in the CFP will be made easier and more robust with the helpful changes already included in the Draft Rules and discussed in detail with stakeholders at the RAC meetings. The adoption of an electronic tracking system like M-RETS will build on the RNG Coalition's efforts to create a robust North-America-wide RNG market and eliminate the risk of double counting RNG environmental attributes.

[25] https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_3132

[26] https://www.bioenergy-news.com/news/biomethane-will-deliver-20-of-current-eu-gas-imports-from-russia-by-2030/

[27] Notice, page 24.

[28] https://www.oregon.gov/deq/ghgp/cfp/Pages/longtermICS.aspx

Allowing for additional credits to be generated post-third-party verification based on the verified operational carbon intensity incentivizes ongoing improved actual environmental performance of all clean fuel facilities but is especially important for RNG. It will make sure the program rewards the true carbon intensity performance of each RNG producer. It also could, as discussed below, allow for the time needed to ensure correct accounting of RNG as an input to making other fuels.

The Rulemaking Should Encourage Broader RNG Use, Including at Liquid Biorefineries

The proposed rules do a great job of defining an RNG accounting system based around the "book-and-claim" concept that has proven highly successful for monitoring RNG use in natural gas vehicles. The same framework should be used to encourage RNG use as a process fuel to lower the CI of liquid biofuel production facilities.

The use of conventional gas for process energy is often a key driver of the production step component of CI scores in liquid biofuel production facilities and a key factor within CI scoring that is under the operational control of such fuel producers. Allowing them to use RNG as an input could expand the benefits that RNG can provide to the program significantly in the near term because there is not yet a large natural gas vehicle fleet in Oregon.

DEQ should adjust the Final Rule to allow the use of book-and-claim accounting as a straightforward method to track and recognize any RNG use in the liquid biofuel production facilities serving Oregon.[29] Adding this flexibility, in conjunction with ex-post true ups, will allow liquid biofuel production facilities to include detailed accounting of the RNG used to decarbonize their thermal process energy inputs and displace conventional natural gas use.[30]

DEQ'S Threshold to Allow Hydrogen to Generate Advance Credits is at The Correct Level, but More Can be Done to Encourage RNG to be used as a Hydrogen Input

In the Notice of Proposed Rulemaking, DEQ stated: "DEQ is proposing that hydrogen used to generate advance credits must meet a maximum carbon intensity of 117 gCO_2e/MJ. This is a carbon intensity that is consistent with hydrogen produced from non-fossil fuels. Should DEQ consider a different threshold and why?"

RNG Coalition believes DEQ's proposed threshold is set at the right level. By choosing a reference CI score equivalent to making compressed hydrogen from the landfill RNG in the lookup table,[31] DEQ incentivizes further the use of renewable hydrogen in fuel cell vehicles rather than fossil hydrogen. Moreover, facilities capable of delivering renewable hydrogen from the conversion of RNG already exist

[29] We recommend coordinating with California on this issue to build this option into the Tier 1 calculators.

[30] As another potential option, Oregon could consider a framework similar to Canada Clean Fuel Regulations (CFR), which allow limited recognition of gaseous fuel credits regardless of end use. See Section 95 of Clean Fuel Regulations: SOR/2022-140, Canada Gazette, Part II, Volume 156, Number 14. https://www.gazette.gc.ca/rp-pr/p2/2022/2022-07-06/html/sor-dors140-eng.html
Information summarized in presentation *7 – CFR – Compliance Category 2*, slides 4 and 12 in Environment and Climate Change Canada CFR Google Drive: https://drive.google.com/drive/folders/1zkF9b2-f-_zvVpzDsU4ahAUQDeDVVGTL

[31] Draft Rules, Table 4, Page 189.

in North America[32] and contracts to supply RNG as a feedstock to produce hydrogen used in the California LCFS have already been signed.[33] DEQ's proposal may attract additional renewable hydrogen supply to Oregon.

Further, while the Draft Rules allow the direct use of low-carbon hydrogen as a process input at fuel production facilities, they do not allow for the use of book and claim for that use of hydrogen. We recommend changing this approach. Essentially, DEQ should seek to holistically streamline how RNG can be deployed as an input into making other fuels, including hydrogen as an intermediary or a finished fuel. We note that such flexibility is already allowed—but in a limited way—through California's Renewable Hydrogen Refinery Credit Program.[34] Canada is also proposing such flexibility in its Clean Fuel Regulations via the Quantification Method for Low-Carbon-Intensity Hydrogen Integration.[35]

Conclusion

The Draft Rules improve the Clean Fuel Program and confirm its role as a keystone climate policy in Oregon. We applaud DEQ for adopting many of the RNG Coalition's recommendations that will reduce barriers for RNG to participate in the program.

RNG Coalition believes there is still room for more ambitious near-term CI reduction targets, which would likely align with the ambition of regional partners. Such additional ambition could be achieved by including methods to allow broader use of RNG, including its use to reduce the CI scores of liquid fuels.

RNG Coalition appreciates the opportunity to be part of the RAC meetings and provide comments in this process. We thank DEQ for their continued leadership on this program. We look forward to the publication of the final rules and implementation of the 2022 Expansion Rulemaking.

Sincerely,

/s/

[32] Mary-Page Bailey, "Air Liquide inaugurates $250-million hydrogen plant near Las Vegas," *Chemical Engineering*, May 24, 2022. https://www.chemengonline.com/air-liquide-inaugurates-250-million-hydrogen-plant-near-las-vegas/

[33] U.S. Gain, "U.S. Gain Enters First of its Kind Partnership to Supply RNG into Hydrogen Production," press release, February 9, 2022. https://finance.yahoo.com/news/u-gain-enters-first-kind-130000967.html

[34] Low Carbon Fuel Standard Regulation, § 95489. (f), Page 181 (pdf page 185). https://ww2.arb.ca.gov/sites/default/files/2020-07/2020_lcfs_fro_oal-approved_unofficial_06302020.pdf

[35] See Proposal in Folder 17 of the following Google Drive maintained by Environment and Climate Change Canada: https://drive.google.com/drive/folders/1udyJ9Imn7n3mDlQQLcgp3IsE3gEEYlVh

Sam Wade
Director of Public Policy
Coalition for Renewable Natural Gas
1017 L Street #513
Sacramento, CA 95814

July 21, 2022

Cory Ann Wind
Clean Fuels Program Manager
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232

Dear Ms. Wind:

We are writing to express our support for the Clean Fuels Expansion 2022 Rulemaking, which lays the groundwork for Oregon to maintain its global leadership role on climate issues. Thank you for considering our views and providing this opportunity to comment.

Darling Ingredients is North America's largest purveyor of waste fats and oils and owns the nation's largest renewable diesel production facility through a joint venture agreement. Most of our products are made from used cooking oil (UCO) and animal fat byproducts that we collect throughout North America and further process into sustainable, domestically-sourced finished fuels such as renewable diesel. We have recycling operations in Portland and collect used cooking oil throughout the state and Pacific Northwest. Our renewable diesel reduces greenhouse gasses (GHGs) by as much as 86%, particulate matter by 30%, NOx by 12%, and is sulfur and benzene free because it is produced from biological – rather than fossil – feedstocks. Renewable diesel is compatible up to 100% in all existing vehicles, equipment, and infrastructure and can be further processed into sustainable aviation fuel (SAF).

Darling would like to offer its strong support for the amendments to the Clean Fuels Program (CFP). We believe the carbon intensity benchmarks from 2026-2035, as proposed, will offer the incentive needed to spur continued investment and innovation from the clean fuels industry. The combination of escalating targets and certainty bolstered by a standard that extends through 2037 will keep Oregon on a progressive path toward addressing the climate crisis and important localized public health issues.

Finally, we would like to compliment DEQ staff for their exemplary stewardship of the program and commitment to an open, transparent, and inclusive public process. Once again, thank you and please feel free to contact me with any questions.

Sincerely,

Shelby Neal
VP - Renewables & Energy Policy

DecisionWare Group
Policy Analysis for
Energy, Economy and Environment

DEQ Clean Fuels Program Staff,

Thank you for the opportunity to provide comments on DEQ's proposed Clean Fuels Program rules and draft fiscal impact statement. I am writing to urge you to adopt the most ambitious Clean Fuels Program (CFP) expansion. In addition, I urge you to amend the draft fiscal impact statement (FIS) to more accurately capture the climate, public health, community, and local economic benefits of the Clean Fuels Program.

The Clean Fuels Program has proven to be one of Oregon's most important and cost-effective tools to reduce climate pollution from burning diesel and gasoline in our vehicles. Although I applaud DEQ's proposal to extend and increase the CFP's carbon intensity reduction targets to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035, I consider this to be the minimum level of ambition that is feasible and which DEQ should strive for. The latest U.N. Intergovernmental Panel on Climate Change (IPCC) report stated that current policies to limit climate emissions will not be sufficient to avoid catastrophic and irreversible climate impacts. While Oregon has made meaningful progress to address the fossil fuel pollution driving the climate crisis, Oregon is still not on track to achieve our climate goals. Stronger clean fuels targets will help us close this critical gap.

Stronger carbon intensity reduction targets will improve public health and economic outcomes across Oregon. Cleaner fuels also help increase our energy security and protect Oregonians against harmful oil and gas price fluctuations at the pump: the more we move toward electric vehicles and cleaner fuels made closer to home, the less we have to worry about the price of oil and gas being determined half a world away.

Furthermore, I urge DEQ to maximize the clean air, climate, and health benefits of the program, by achieving these new targets through electrification as much as possible, and to prioritize equitable economic outcomes, by encouraging credit-generating utilities to fund affordable and accessible public charging infrastructure in underserved areas such as low-income, BIPOC and rural communities.

Unfortunately, the draft fiscal impact statement (FIS) developed extremely *conservative* estimates of economic benefits while overestimating the costs of the program. For instance, while the program rewards reductions in lifecycle emissions, the FIS doesn't incorporate reductions in co-pollutants beyond the tailpipe. It also doesn't quantify other economic benefits, including job creation, investments, new tax base, waste reduction, and so forth. The FIS needs to be revised to more accurately capture the extensive health and jobs benefits of the Clean Fuels Program.

In addition, while we appreciate the inclusion of $916 million in benefits when using the federal estimate of the social cost of carbon, this is an extremely conservative estimate, especially when you consider there have already been hundreds of lives lost, thousands of homes and buildings burned, agricultural production losses, lost business days from climate impacts in Oregon in just the last two years alone.

Thank you for your consideration of these comments.

Dr. Pat DeLaquil
Gresham, OR

Electric Vehicle Charging Association
INNOVATION FOR CLEAN MOBILITY

July 21, 2022

Attn: Cory-Ann Wind
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

Re: Electric Vehicle Charging Association Comments on Clean Fuels Program Expansion 2022 Rulemaking

To Whom It May Concern,

The Electric Vehicle Charging Association (EVCA) is a not-for-profit trade organization of 19 leading EV charging industry member companies and two zero-emission autonomous fleet operators. EVCA's mission is to advance the goal of a clean transportation system in which the market forces of innovation, competition, and consumer choice drive the expeditious and efficient adoption of EVs and deployment of EV charging infrastructure.

EVCA would like to respectfully submit the feedback below in response to the Oregon Department of Environmental Quality's (DEQ) proposed permanent rule amendments to Chapter 340 of the Oregon Administrative Rules noted in the June 29th notice of proposed rulemaking.

1. EVCA is supportive of Oregon DEQ's proposal to extend and increase the Clean Fuels Standards to 20 percent below 2015 levels by 2030 and 37 percent below 2015 levels by 2035. These targets are consistent with Oregon's policies to decarbonize the transportation sector, including Oregon's Advanced Clean Trucks rule. It will also help ensure that investment certainty for EV infrastructure keeps pace with the widespread and accelerating adoption of EVs. More stringent carbon intensity ("CI") reduction targets may help balance credit markets, provide more investor confidence in the long-term credit market, and stabilize pricing volatility.

2. EVCA is supportive of Oregon DEQ's proposed approach to non-residential on-road electricity crediting hierarchy. This approach best allocates credit value where investments are being made. Placing the credit closest to the provision of low-carbon fuel infrastructure will help incentivize further investment in charging infrastructure.

3. EVCA requests that DEQ amend the advance crediting provisions to not require direct current fast chargers (DCFCs) to be a part of National Electric Vehicle Infrastructure formula program in order to be eligible for advance credits. Restricting advance credits to NEVI projects is an arbitrary pairing and will limit uptake of advance credits and overall deployment of DCFCs. EVCA supports the advance crediting provisions and applauds

DEQ for creating this novel crediting pathway but recommends the NEVI requirement be removed from the final rule.

Thank you for the opportunity to comment and for taking our feedback into consideration.

Sincerely,

Reed Addis
Governmental Affairs
Electric Vehicle Charging Association

July 21, 2022

Cory Ann Wind
Oregon Clean Fuels Program Manager
Department of Environmental Quality

RE: Comments on Oregon's Clean Fuels Program Expansion 2022

Energy Mission Control, Inc. (e-Mission Control, eMC) appreciates the opportunity to comment on the proposed Clean Fuels Program Expansion 2022 Rulemaking. e-Mission Control is a Sacramento-based technology company that helps facilitate participation in the Clean Fuels Program (CFP), as well as in California's Low Carbon Fuel Standard, for hundreds of small- and medium-sized businesses operating electric material handling equipment, cargo handling equipment, electric refrigeration units, and on-road light, medium, and heavy-duty vehicles. Building upon nearly two decades of clean-transportation industry and public funding experience, eMC has developed a comprehensive and streamlined software set that eliminates many of the administrative roadblocks that traditionally preclude small fleets from opting into clean fuel programs and allows them to take clear, affirmative, and immediate steps to reinvest in the electrification of their goods movement and material handling operations.

We offer this additional background on typical industry practice, information on the current state of affairs on electric fleet participation, and request the following adjustments to the proposed draft regulation:

We suggest the first reporting entity and credit generator for electric forklifts be the entity that makes facility and equipment use decisions, operates the equipment, and pays utility and maintenance costs, i.e. the "Facility Operator."

Unlike light or heavy-duty electric vehicles, eOGV, cargo handling equipment, or transportation refrigeration units, businesses utilizing propane and electric forklifts frequently utilize long-term lease agreements with forklift suppliers/dealers, typically in the three to five-year leases. These lease agreements are almost always packaged with associated chargers and batteries. The mix of owned vs. leased equipment within any specific fleet varies substantially from business to business, with many businesses leasing/renting a small portion of their fleet to support temporary needs or for seasonal purposes. However, it is always the case that the facility operator makes the procurement-use decision on the equipment type, quantity, charging/fueling systems utilized, and ultimately foots the bill for fuel, maintenance, and other operational costs. In the case where additional infrastructure is required to support new zero-emission equipment, it is the facility operator that must manage the project and include the associated installation costs into their bottom line. Additionally, it is almost always the case that the facility operator or business owner develops and manages internal company greening initiatives, which frequently includes decisions on use of more energy efficient and less carbon-intense vehicle types.

In Port ecosystems (for eCHE) and on-road trucking logistics ecosystems (for eTRU[1]), the terms "Fleet Owner" and "Facility Operator" may typically be used interchangeably[2], however in warehousing, cold storage, food and beverage, or the myriad of other industries utilizing propane or electric forklifts (often in disadvantaged communities), the definition of "Fleet Owner," and by extension, the right of claim to first fuel reporting entity causes significant disruption in the CFP system. Most importantly, this has led to current in-use practices where leasing companies have opted-in leased equipment (having claimed title of "Fleet Owner"), retained credit ownership, and have seen financial returns, while not disclosing their actions to the actual operator of the equipment. In our experience with such situations, we've found that no financial net benefit is returned to the facility operator to help them advance their own business operations in a "greener" direction through the financial terms of the lease agreement or otherwise. Frequently, the only time a facility operator becomes aware of this situation is when they try to opt-in their owned equipment at the same facility, but, due to the mechanics of the Fuel Supply Equipment (FSE) registration process, are rejected due to facility coordinate conflicts. Or worse, during the FSE registration process, if serial numbers are not accurately compared between submissions, a duplicate registration occurs, resulting in potential double counting of the leased equipment. As discussed later in this letter, a portion, potentially large, of the newer electric forklift CFP participation (in terms of FSE registration) in Oregon can be attributed to this practice.

Furthermore, in the case of leased forklifts, the financing company, typically large institutional banks, manage the lease agreement and take ownership of the forklift (via executed bill of sale) and the forklift dealer is paid in full for their original investment plus a dealer markup. The agreement then is then between the lessor/owner of the equipment (the institutional bank) and the lessee (the forklift operator). In this very common situation, the forklift dealer no longer has any financial ties to the equipment as they have already recouped their initial investment and made a profit on the lease transaction and are no longer owners of the equipment. At the end of the lease term, which is typically three to five years, the lessee or the original forklift dealer has the option to purchase back the equipment or the financing company sells the forklift. In this scenario, forklift dealers do not have any claim to CFP credits as they do not operate or own the equipment. It is the forklift operator who has made the decision to transition their fleet to zero-emission, is making the ongoing financial investment to have the forklift at their facility, is paying for the maintenance costs, and is also paying for the electricity to power the forklifts. Facility operators should have first right to credit generation.

[1] e-Mission Control has additional comments on shipping-containerized eTRU's typically owned by large shipping conglomerates.

[2] e-Mission Control understands and can expand greatly on the relationship between Port's and Terminal Operators and how CHE/eCHE equity, operational costs, and utility costs reflect FSE ownership, if requested.

Additionally, the Oregon CFP currently permits the use of the CA LCFS Regulatory Guidance 17-02 (which references "fleet operators" not "fleet owners"), which, because of the difficulty in accessing metered data in material handling fleet facilities, allows for the estimation of kWh values based on a variety of equipment and shift operation variables. As is currently practiced, leasing companies laying claim to credit generation at a particular facility where their equipment is leased, regularly do not disclose this to the facility operator, and therefore do not have an accurate method of collecting necessary operational variables required by Guidance 17-02 (i.e. shifts per day, days per quarter, charge cycles per shift, etc.). Even if extremely conservative values are assumed, this short-changes the CFP with under-generation. Telematic systems in the material handling space are improving, but the vast majority of fleets operate mixed-age fleets and various charging systems within their facilities and any one single telematics system may only cover a portion of a particular deployment.

Importantly, e-Mission Control sees the intent of the CFP program to help facilitate increased market penetration of low-carbon fuels. In the most-granular sense, helping offset increased fuel costs, electricity in this case (especially increased zero-carbon electricity costs), is a fundamental underpinning of the program. Redirecting these funds to "facility operators," who are in the most direct need and in the best position to advance electric forklift adoption should be considered as the First Fuel Reporting Entity.

Specific changes are suggested as follows:

340-253-0330 Credit Generators: Providers of Electricity
(5) Electric forklifts. For electricity used to power forklifts, the facility operator may generate the credits.

340-253-0040 Definitions
"Facility Operator" means the legally-registered state entity, including subsidiaries or affiliates, responsible for ultimate vehicle procurement and fuel purchasing decision making. In the case of electricity, this typically is the entity reporting to a local electrical utility and paying for local utility electrical costs.

"Fleet" means the collective group of vehicles or equipment operated together, whether wholly owned, partially owned, leased, or rented, at any one particular location, under the same management and operational direction.

We suggest the first reporting entity and credit generator for eTRU's be the entity that makes facility and equipment use decisions, operates the equipment, and pays utility costs, i.e. the "Fleet Operator".

As the current regulation is written, the “fleet owner” is the credit generator and is applicable to both over-the-road dry-box style containers as well as the “shipping container” style units.

In practice, shipping container eTRU’s are often moved from the ship then plugged in on-site akin to shore-powering a vessel before they are unloaded/loaded and sailed out again. Operationally, these eTRU’s are moved at the same frequency and with the same global footprint as typical dry-box shipping containers. They are exclusively owned by shipping lines and leasing companies but plugged in by distribution facilities and terminal operators. As a container arrives, it is plugged in, then may never see that same facility again after it leaves. Any single container is typically only on site for no more than seven days. These facilities have the capability to independently meter electricity consumption to just the eTRU’s, but can’t track to which eTRU, on a per-serial-number basis.

Importantly, there are many facilities state-wide that have no or very little infrastructure in place to directly plug-in eTRU’s on-site. These facilities must rely on diesel gensets to power the electrical componentry of the eTRU’s. Facilities that have opted to green their operations by installing associated electrical infrastructure have spent millions of dollars to do so and are also the entities paying utility costs. This industry example is the perfect candidate for the LCFS program to lessen the use of diesel fuel in thousands of gensets and increase penetration of grid-connected eTRU’s.

We suggest that the first fuel reporting entity be the “fleet operator” and to redefine the FSE as the meter monitoring energy consumption to the eTRU.

Specific changes are suggested as follows:

340-253-0330 Credit Generators: Providers of Electricity
(5) Electric Transportation Refrigeration Units. The fleet operator may generate the credits.

e-Mission Control thanks the DEQ for the opportunity to comment and participate in the amendment process and looks forward to working with the DEQ on future improvements that facilitate the transition of Oregon’s transportation fuel pool toward a more sustainable and decarbonized future.

Sincerely,

Energy Mission Control, Inc.

CC: Todd Trauman, CEO
Colby Green, Director of Business Development
Elaine O'Byrne, Director of Operations

July 12, 2022

To whom it may concern,

We take this opportunity to submit comments concerning credits advanced under OAR 340-253-1100 for actions that will result in real reductions of the carbon intensity of Oregon's transportation fuels, so-called, “Advance Credits.” In the current draft CFP Rule, downloaded July 8th, 2022, the following vehicle types are eligible to apply for Advance Credits:

A. Medium and Heavy Duty zero-emissions vehicles; and

B. Light-duty vro-emission vehicles if they are part of an organization's plan to fully electrify its light-duty fleet to zero-emission vehicles within a 15-year time period.

Under proposed rules, it is apparent that only battery-electric and hydrogen fuel cell technologies will be eligible to apply for Advance Credits. Throughout the Rulemaking process, Oregon DEQ has maintained that The Department takes a “technology-agnostic” approach toward reducing GHG emissions within Oregon’s transportation sector. In this regard, we do not believe that the proposed approach with regard to Advance Crediting is compatible with The Department’s technology-agnostic approach, because The Department is favoring battery-electric and hydrogen fuel cell technologies over other propulsion technologies that reduce GHG emissions in the transportation sector.

With the above context in mind, we suggest that all propulsion technologies that reduce GHG emissions on a CO_2e / MJ basis below the current CFP-compliance level be considered eligible to apply for Advance Credits. We further request that Oregon DEQ insert language confirming that applications for Advance Credits be judged exclusively on the merits of the project’s ability to reduce GHG emissions.

Thank you for considering our request. We look forward to continuing this conversation, and we will welcome your call or e-mail, any time.

Warm regards,

Alex

Alex Schay
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FIRSTELEMENT FUEL
FirstElement Fuel Inc. | 5281 California Ave, Suite 260, Irvine, CA 92617 | 949-205-5553

July 21, 2022

Oregon DEQ
700 NE Multnomah St., Suite 600
Portland, Oregon 97232-4100

Ms. Cary-Ann Wind,

Thank you for the opportunity to comment on the Clean Fuels Program (CFP) Expansion 2022 Rulemaking. FirstElement Fuel (FEF) is the largest retail hydrogen fueling provider in California and in the World, with 37 stations open and operating in California and another 45 in development. Furthermore, all the hydrogen we sell into the transportation market is certified net zero carbon. We are anxious to bring our technology and low carbon fuel to Oregon, the Pacific Northwest and beyond.

We have three main supportive comments regarding the proposed rulemaking and one general request for the CFP. Firstly, we agree and support the staff recommendation to expand the reduction targets beyond 10% after 2025, however, we would like the program to consider additional increases in the future, noting that California is considering a 30% reduction target by 2030. Secondly, FEF appreciates the additional clarity on book and claim accounting for renewable hydrogen derived from renewable electricity or natural gas as shown in 340-253-0600(6). Thirdly, FEF supports the addition of advanced crediting for hydrogen fueling infrastructure reflected in 340-253-1100, 2(c)(B) but requests that private fleets also be allowed to receive this credit. Further, this credit alone is insufficient to incentive hydrogen station deployment, leading to our final comment and request below.

To promote the investment in sustainable hydrogen refueling infrastructure, an additional incentive above and beyond the advanced crediting for public fleets is needed, such as California's Hydrogen Refueling Infrastructure (HRI) credit (i.e., capacity credit). This incentive structure has been successfully deployed in California and has resulted in the unlocking of significant private capital for hydrogen infrastructure investments, including more than $150 Million invested by FEF. We have learned through the California deployment of hydrogen fueling stations since 2015, a sustained, self-balancing incentive, such as the capacity credit, helps mitigate the investment uncertainty and provides the justifiable business case for long-term station operation sans government subsidy. California kickstarted its hydrogen station network solely through capital grants for the first round of stations in 2015 and 2016. This resulted in single dispenser, undersized stations that depended on government subsidies to fund approximately 70% the project equipment. Furthermore, those original stations will always be more expensive to operate and therefore the cost of hydrogen to the consumer will always be higher. However, as a result of the HRI credit program, FEF has been able to deploy 4 dispenser, large capacity hydrogen stations that will become self-sustaining in the future with a more competitive cost at the dispenser. The stations FEF has built under the HRI program rely far less on capital grants. Our private investment provides more than 70% of the capital expenditures on most of the stations, and we have built 7 stations entirely with private funds.

TRUE ZERO

FIRSTELEMENT FUEL
FirstElement Fuel Inc. | 5281 California Ave, Suite 260, Irvine, CA 92617 | 949-205-5553

We applaud Oregon DEQ for undertaking this proposed rulemaking to further decrease the carbon intensity of Oregon's transportation fuels. FEF has learned some hard and expensive lessons through the California deployment of hydrogen and fuel cell vehicles, and we hope to leverage these learnings to provide other areas with accelerated low and zero carbon transportation. We would be happy to provide further details on our comments and look forward to our future discussions.

Respectfully,

Matt Miyasato, Ph.D.
Vice President
Strategic Growth and Government Affairs

TRUE ZERO

From: Steve Vander Haak
To: CFP2022 * DEQ
Subject: Green-e
Date: Thursday, July 21, 2022 2:58:47 PM

Thank you for the opportunity to participate in the rule making process. I would like to request that DEQ remove the Green-e certified RECs requirements for biogas electricity projects. This rule creates much uncertainty for the future of our project. After recently achieving the CRS re-power by making necessary and costly investments to get the digester back online, our continued operation is now threatened because of certain draft language in the new v4.0 draft Green-e Standard. The draft v4.0 excludes animal waste/CAFOs from eligibility for Green-e Energy certification for biogas electricity projects, so RECs from our project could not be certified as Green-e which is a requirement by the Oregon Clean Fuels Program for our electricity generated from biogas. However DEQ places no similar requirement for M-RETS Renewable Thermal to meet the Green-e Renewable Fuel Standard. We request DEQ to be fair and equitable within the regulation for both biogas electricity and biomethane.

Now that we made the investment to meet Green-e's repowering criteria, significant uncertainty arises with the looming v4.0 Green-e Energy Standard. Therefore, I'd like to request DEQ remove the requirement for Green-e certification on RECs from biogas electricity projects. Our facility will undergo rigorous third-party verification from accredited verifiers as required by the CFP regulation, the Green-e certification and audit is redundant. Thank you for your consideration and we look forward to seeing the final rule.

Steve Vander Haak
FPE Renewables LLC

growth energy™
America's Ethanol Supporters

701 8th Street, NW, Suite 450, Washington, D.C. 20001
PHONE 202.545.4000 FAX 202.545.4001 GrowthEnergy.org

July 21, 2022

Cory Ann Wind
Oregon Department of Environmental Quality
700 NE Multnomah Street
Portland, Oregon 97232
Via electronic mail

RE: Clean Fuels Program Expansion 2022 Rulemaking

Dear Ms. Wind:

Thank you for the opportunity to comment on the Department of Environmental Quality's (DEQ) proposal to extend and increase the Clean Fuel Standards to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035. Growth Energy is the world's largest association of biofuel producers, representing 89 U.S. plants that each year produce more than 8 billion gallons of renewable fuel; 104 businesses associated with the production process; and tens of thousands of biofuel supporters around the country. Together, we are working to bring better and more affordable choices at the fuel pump to consumers, improve air quality, and protect the environment for future generations. We remain committed to helping our country diversify our energy portfolio in order to grow more green energy jobs, decarbonize our nation's energy mix, sustain family farms, and drive down the costs of transportation fuels for consumers.

We sincerely appreciate DEQ's attention and hard work to reshape Oregon's fuel mix to make it more sustainable. This objective is a central driver for our industry, and we look forward to continuing our work on our common goals as you explore revisions to the Clean Fuel Program (CFP) moving ahead. Specifically, liquid fuels will continue to play an important role in the transportation sector, even as alternative technologies flourish. As such, it is imperative to consider the vital role that environmentally sustainable fuel options such as bioethanol will play in reducing greenhouse gas emissions and cutting consumer costs in the current and future Oregon vehicle fleet.

As we have continued to advocate, a primary solution for cleaning up the liquid fuel supply is the promotion of additional use of bioethanol, from starch or cellulosic sources. According to recent data from Environmental Health and Engineering, today's bioethanol reduces greenhouse gas emissions (GHG) by an average of 46 percent compared to gasoline and can provide even further GHG reductions with additional readily available technologies.[1] In the existing light duty

[1] Environmental Research Letters: Carbon intensity of corn ethanol in the United States: state of the science (iop.org)

fleet, higher bioethanol blends can be immediately deployed to achieve immediate GHG reductions, reduce harmful air toxics, and reduce consumer costs at the pump.

Already, we've seen biofuels provide the foundation for the CFP. In fact, biofuels like bioethanol have generated more than 75 percent of CFP credits. Additionally, even with room to further improve GHG lifecycle modeling, the CFP recognizes the significant improvement in bioethanol's carbon intensity. In 2016, DEQ reported the average carbon intensity (CI) for bioethanol at 64.5 gCO2e/MJ. Through 2021, the average recorded CI for bioethanol has decreased to 53.98 gCO2e/MJ, a nearly 17 percent reduction in CI in just 5 years.[2]

Bioethanol's other environmental benefits are also noteworthy. As has been researched by the University of California, Riverside and the University of Illinois at Chicago, the use of more bioethanol and bioethanol-blended fuel reduces air toxics such as carbon monoxide, benzene, and other harmful particulates.[3] To fully realize these and other important air quality benefits, there needs to be a clear policy with a firm future for the role and growth of cleaner-burning, affordable bioethanol fuels.

As we have noted previously, we continue to urge DEQ to further develop clear policies that recognize the realities of today's fuel market and examine how homegrown biofuels can immediately contribute to achieving GHG reductions. Today, nearly all gasoline in Oregon - and across the U.S. - is blended with 10 percent bioethanol. E15, a blend consisting of 15 percent bioethanol, has been approved for use by the U.S. Environmental Protection Agency (EPA) in all passenger vehicles model year 2001 and newer, more than 96 percent of the vehicles on the road today, and is now for sale at more than 2600 locations in 31 states. We were very pleased to see Oregon move forward with its recent approval of E15 as it is another tool to help further reduce Oregon's greenhouse gas emissions.

Additionally, as we have seen in California, low carbon fuel programs are helping to drive growth in the use of E85 in flex-fuel vehicles. The use of E85 will promote even greater reductions in GHG emissions and reductions of air toxics.

We would encourage DEQ and other state agencies to push for policies that: strongly encourage and incentivize the use of higher bioethanol blends such as E15 and E85, the production and use of flex-fuel vehicles, as well as continued investment in infrastructure for the expanded use of E85.

With respect to some of the items in the proposal, we offer comment:

Correct the GREET Model to Reflect Updated Science on Land Use

While we are pleased that DEQ has a more realistic value for land use change of 7.6 gCO2e/MJ compared to other programs, a review of the more recent science over the last 5 years indicates

[2] DEQ CFP Data: Department of Environmental Quality : Quarterly Data Summaries : Oregon Clean Fuels Program : State of Oregon

[3] University of California Riverside: https://fixourfuel.com/wp-content/uploads/2018/04/UC-Riverside-Study.pdf; University of Illinois at Chicago: https://grains.org/wp-content/uploads/2018/11/Complete-Study-Summary.pdf

newer data indicates values closer to 4 gCO2e/MJ. The LUC value should reflect the latest science that better addresses innovation and increasing yields in agriculture.

Crediting for Field-based Farm Practices

Growth Energy strongly supports the appropriate crediting of on-the-farm field practices in the CFP. The U.S. EPA estimates that five percent of national GHG emissions is from crop cultivation and energy, there is an opportunity for lower emissions in agriculture within the CFP. There has been a wealth of data including a recent study done by Argonne National Laboratory that show the possibility of a 35 percent reduction in carbon intensity through adoption of current best on-farm practices such as cover crops, strip tillage, reduced fertilizer use, and other innovations.[4] With the CFP's verification requirements, capturing these on the farm benefits for biofuel pathways is now more realistic and scalable. Allowing appropriate credit will help bioethanol producers continue to further innovate and lower their carbon intensity, while providing key incentives for farmers to adopt these effective conservation practices.

Carbon Capture and Sequestration

New innovations at biorefineries throughout the U.S. allow pure, biogenic carbon dioxide (CO2) to be captured at a massive scale, and multiple projects are already underway that repurpose, reuse, or provide a permanent storage solution for the majority of that CO2. We encourage DEQ to allow for credit generation from carbon capture, utilization, and storage (CCUS).

Energy Allocation for Non-Fuel Products

Many bioethanol producers have continued to innovate their biorefineries and are producing varying grades of bioethanol for applications beyond fuel. Some of these grades and specifications require additional processing and energy. We encourage DEQ to clarify that its carbon intensity model does not allocate the energy used for non-fuel production inappropriately to biofuels.

Correcting Electricity Usage in Wet and Dry Distiller Grain (DDGS) Pathways

The Oregon GREET model currently distinguishes between wet and dry DDGS pathways for thermal energy but does not do so with regard to electricity use. Electricity use between wet and dry DDGS production is quite different. We recommend that DEQ further distinguish electricity use as it does with thermal energy in its GREET model.

Bioethanol/Fuel Cell Technology

Direct Bioethanol Fuel Cells for the use in motor vehicle transportation have been in development by Nissan for some time. As recently as January of 2020, Nissan and Lawrence Berkeley National Laboratory have published research on the use of 100 percent bioethanol in fuel cell technologies and innovations.[5] This technology not only meets zero emission vehicle requirements, but further eliminates particulates from tailpipe emissions. Using bioethanol in conjunction with a fuel cell would require less infrastructure change and investment and would

[4] Argonne National Laboratory: https://www.anl.gov/article/argonnes-pivotal-research-discovers-practices-technologies-key-to-sustainable-farming

[5] Lawrence Berkeley National Laboratory: https://eta.lbl.gov/publications/ethanol-internal-reforming-solid

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help the state meet its ambitious climate goals. As DEQ considers policies on zero emission vehicles in conjunction with the CFP, we would strongly encourage DEQ to consider ways to further develop this technology for consideration.

More broadly, we look forward to working with you through the regulatory process on revisions to the CFP program and ensure the role of biofuels in making Oregon's fuel mix more sustainable and help the state achieve its progressive climate goals through the expanded use of bioethanol.

Thank you in advance for your consideration.

Sincerely,

Chris Bliley
Senior Vice President of Regulatory Affairs
Growth Energy

701 8th Street, NW, Suite 450, Washington, D.C. 20001
Phone 202.545.4000 Fax 202.545.4001

From:	Jane Stackhouse
To:	CFP2022 * DEQ
Subject:	Clean Fuels Program
Date:	Thursday, July 21, 2022 3:56:23 PM

Dear DEQ Clean Fuels Program Staff.

Thank you for the great job you do managing this complex program that has proven to reduce total greenhouse gas emissions from our transportation sector. Six million tons in six years is an impressive accomplishment. As a member of the Metro Climate Action Team and Chair of our Transportation Committee I am pleased that DEQ takes your responsibilities to Oregonians to maintain and improve our environmental quality seriously. Some days I think you are our only hope to reduce greenhouse gas emissions. And, as I am sure you are aware, we all have to do even more.

As the effects of climate change become more apparent and the fossil fuel industry feels threatened they are pushing back. This is a sign that you are doing a good job. I know from talking with staff that DEQ has long worked with industry to help them understand and mitigate their environmental impact. The fossil fuel industry has known about their impact for many years and if they tell you they cannot comply with new rules it is because they have not taken action sooner and, in some cases, they may be a little greedy to gain as much as they can before they are gone. Please stand firm and even increase the carbon reduction goals for the program. At minimum, DEQ should expand the carbon intensity reduction targets to **go beyond the current proposed 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035**. We need a rapid shift to low carbon intensity power, ethanol and renewable diesel and electrification. Strong goals for the clean fuels program, may I suggest **50% below 2015 levels by 2035**, will encourage these types of cleaner power.

I know I do not need to list all of the reasons to make the program stronger. Everyone on your staff is aware of the adverse effects of climate change. Cleaner biofuels, not 'natural' gas methane, are the true transition fuel. They still release carbon into the atmosphere but they have fewer other harmful pollutants and they expend carbon from this decade rather than a millennium ago. The strongest possible clean fuels program CO2 reductions will create a biofuel industry in Oregon for vehicles that cannot yet be electrified and encourage zero emissions vehicle sales and development.

Stay strong. Oregonians are with you for a strong Clean Fuels Program.

Jane Stackhouse
Portland, Oregon

From: Mopolnople
To: CFP2022 * DEQ
Subject: Emission Reduction
Date: Saturday, July 2, 2022 1:35:11 PM

Dear DEQ,

I have heard about ylthe newest proposal to reduce future emissions by 10 percent more than your current plan, and I believe that would be a great change. I have recently talked with the Corvallis Mayor about energy and pollution in Corvallis. In our conversation Mr. Traber brought up how the current plan for reducing emissions is actually slower than we are or could be doing it. If we were to update the plan to reduce more emissions sooner we could still easily meet those goals.

On top of that, the goal would help encourage more people to take action now and meet that goal since the plan requires their actions sooner, as long as they can still be done. Of course the nice thing about a plan is that if this one isn't quite met, you can always also fall back on your old plan or a new one in-between the other two. These are all reasons that the plan should be changed to be faster; we can do it with little downsides. Paired with the failsafe of reverting back to the old plan, I think that the best choice should be abundantly clear.

Sincerely,
Johnny

Subject: Public comments re: Clean Fuels Program draft rules

DEQ Clean Fuels Program Staff,

As a family physician, a grandfather and an anxious Oregon citizen, I appreciate the chance to give comments on your proposed Clean Fuels Program rules and draft fiscal impact statement. I strongly support a bold Clean Fuels Program (CFP) expansion. This will generate climate, public health, community, and local economic benefits. I also encourage amending the draft fiscal impact statement (FIS) to better capture the benefits of an expanded Clean Fuels Program.

We all know we are in a crisis. The recent wildfires, droughts, and the 2021 heat dome deaths drove home the point that Oregon is not protected from climate calamity. Now that SCOTUS has limited EPA's ability to act nationally, there is all the more urgency for us to act locally. Taking drastic action takes courage, but it is terrifying to see worsening disasters on all sides, knowing that this process will only accelerate in coming years. The IPCC reports show us that current commitments (even if they were to be met) are insufficient to prevent catastrophic and irreversible climate impacts. While I am grateful that Oregon has made progress, we are not yet projected to meet our stated climate goals. Stronger targets for clean fuels will get us closer!

Transportation is our biggest source of GHG emissions. The Clean Fuels Program is our primary tool to reduce climate pollution from burning diesel and gasoline for transportation. While the DEQ proposal to extend and increase the CFP's carbon intensity reduction targets to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035 is laudable, this should be seen as a minimal target. We truly need bold action.

At minimum, I ask you to increase the carbon intensity reduction targets to **go beyond the current proposed 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035**. This will have multiple benefits for us all.

Shifting to cleaner fuels and speeding up electrification of the vehicle fleet will improve the health benefits of the program by reducing air pollution that causes lung and heart disease and cancers. According to DEQ's own accounting, diesel engine exhaust is responsible annually for an estimated 176 premature deaths, 25,910 lost work days and costs of $3.5 billion. We all pay for the damage from air toxics through medical and hospital bills, costly medicine, and missed days of work or school due to breathing dirty air.

Improved CI reduction targets will increase our energy security and protect Oregonians against costly oil and gas price fluctuations at the pump: the more we move toward electric vehicles and cleaner fuels made closer to home, the less we have to worry about the price of oil and gas being determined half a world away by tyrannical regimes. We must not allow the CFP process to be influenced by fossil fuel interests who try to shift blame for current high prices to try to derail climate action.

I encourage you to push as much as possible for electrification. While doing so, we should bring those benefits to marginalized people, by requiring credit-generating utilities to fund affordable and accessible public charging infrastructure in underserved areas such as low-income, BIPOC and rural communities.

The draft fiscal impact statement (FIS) should be amended to more accurately capture the extensive health and jobs benefits of the Clean Fuels Program. The economic benefits identified are extremely *conservative* estimates, whereas the costs of the program are overestimates. For instance, while the program rewards reductions in lifecycle emissions, the FIS doesn't incorporate reductions in co-pollutants beyond the tailpipe. It also doesn't quantify other economic benefits, including job creation, investments, new tax base, waste reduction, and so forth.

In addition, while we appreciate the inclusion of $916 million in benefits when using the federal estimate of the social cost of carbon, this is an extremely conservative estimate, especially when you consider there have already been hundreds of lives lost, thousands of homes and buildings burned, agricultural production losses, lost business days from climate impacts in Oregon in just the last two years alone.

From your own 2022 Clean Fuels Program report to the legislature, we see that:

- "The program has fostered a $100-million-a-year-plus market where investments are being made to increase the production of lower-carbon fuels, spark new innovations in technology, and invest in infrastructure to deliver these fuels across the state.
- The program's credit prices have remained steady, signaling to fuel producers and suppliers here and beyond that they should continue to invest in Oregon. These investments have allowed the transition from fossil products to cleaner fuels to happen without any significant rise in retail or wholesale fuel prices when compared to our neighboring states. In fact, the program brings down the cost of low-carbon fuels and creates the financial incentive to decarbonize the transportation sector as no other program can do."

To preserve a better future for my grandchildren, to protect us from diseases due to current tailpipe emissions, to increase justice for frontline communities, to improve our economic vitality, and to build a brighter tomorrow, please choose bold action by voting for the most stringent possible Clean Fuel Program targets.

Many thanks,

Joseph Stenger MD

CFP.2022@deq.oregon.gov

From; Julia Pommert,

Retiree living in Washington County, Oregon

PUBLIC TESTIMONY for Strengthening

OREGON D.E.Q. CLEAN FUELS PROGRAM (CFP) EXPANSION

Thank the panel for allowing me to add my comments to the record about the clean-fuels program.

In April 2022 the Intergovernmental Panel on Climate Change (IPCC) provided a summary for policymakers about the impacts, adaptation and vulnerabilities from climate change. It says;

> "SPM.D.5 It is unequivocal that climate change has already disrupted human and natural systems. Past and current development trends (past emissions, development and climate change) have not advanced global climate resilient development (*very high confidence*). Societal choices and actions implemented in the next decade determine the extent to which medium- and long-term pathways will deliver higher or lower climate resilient development (*high confidence*). Importantly climate resilient development prospects are increasingly limited if current greenhouse gas emissions do not rapidly decline, especially if 1.5°C global warming is exceeded in the near term (*high confidence*). These prospects are constrained by past development, emissions and climate change, and enabled by inclusive governance, adequate and appropriate human and technological resources, information, capacities and finance (*high confidence*)."
>
> **"**SPM.D.5.3 The cumulative scientific evidence is unequivocal: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all. (*very high confidence*)"

Thus, we need to reduce production of greenhouse gases rapidly. The largest source of greenhouse gases comes from burning fossil fuel. So, we need to stop burning fossil fuel. Adding a little bit of methane that has been recovered from land-fills or cows to the gas coming out of the ground does not make it ALL 'renewable' despite what the gas industry wants you to believe.

Making gas appliances more efficient does not change the fact that all gas appliances burn fossil fuel and thus produce greenhouse gases. We need to promote fuel switching from gas to electric. We should start by not building any more fossil fuel supplied new buildings. We need to promote the increased production of electric vehicles. When you find yourself in a hole the first thing to do is stop digging.

Oregon should encourage as many power plants to convert from natural gas electric generation to solar or wind power facilities rapidly. Yet the Oregon Department of Energy Facilities Siting council is prepared to allow PGE to postpone building a solar power facility at its natural gas electric generating facility for another 5 years at a site near Boardman, Oregon. (As soon as my ordered electric vehicle arrives, I produce enough electricity from my 36 solar panels at my home to power that vehicle mostly from sunlight and yes, we have a storage battery.) The fact that everyone can not afford to energy switch right now should not stop those that can.

We need to switch from fossil fuels to electric power rapidly. Burning anything, even ethanol produces greenhouse gases. I support that the Oregon Clean Fuels Program aims to move us away from fertilizer-intensive, food-based fuels. We don't have until 2050 to make this change.

LEAGUE OF WOMEN VOTERS OF OREGON

The League of Women Voters of Oregon is a 102-year-old grassroots nonpartisan political organization that encourages informed and active participation in government. We envision informed Oregonians participating in a fully accessible, responsive, and transparent government to achieve the common good. LWVOR Legislative Action is based on advocacy positions formed through studies and member consensus. The League never supports or opposes any candidate or political party.

July 16, 2022

To: CFP.2022@deq.oregon.gov

Re: Comments on Proposed Rules for Clean Fuels Program Expansion 2022

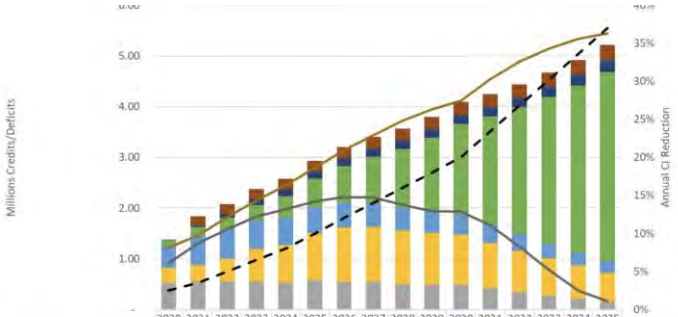
The League of Women Voters of Oregon (LWVOR) believes that climate change is a serious threat facing our nation and planet. The League believes that an interrelated approach to combating climate change—including through energy conservation, air pollution controls, building resilience, and promotion of renewable resources—is necessary to protect public health and defend the overall integrity of the global ecosystem.

The League appreciates this opportunity to comment on the "Notice of Proposed Rulemaking" for the Clean Fuels Program Expansion 2022 as published by the Department of Environmental Quality (DEQ) on June 29, 2022. We were impressed with the organized way in which the development of the rules was carried out. We have responded to three of the questions posed in the "Request for Other Options" and have included comments on two additional changes as documented in the "Summary of Proposed Changes."

2030 and 2035 Targets

DEQ is proposing to establish average carbon intensity targets of 20% in 2030 and 37% in 2035. Should DEQ consider targets different than these and why?

We believe that the proposed targets should be adopted. It was clear during the development of the rules that considerable thought was given to choosing the values. Executive Order 20-04 gave values of 20% in 2030 and 25% in 2035. It was recognized by DEQ that the 2035 target could be met strictly by electrification. DEQ wanted to make sure that there is also the need to decrease the carbon intensity of any remaining fuels used. As shown by the Annual Deficits line in this simulation, the targets will be difficult to reach without using credits starting in 2027 and especially after the increase in yearly reduction rate after 2030.



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
OffRoad Electrification	-	0.18	0.19	0.20	0.20	0.21	0.22	0.23	0.23	0.24	0.25	0.26	0.27	0.28	0.28	0.29
H2	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.02	0.04
CNG/RNG	0.01	0.03	0.08	0.12	0.14	0.15	0.16	0.17	0.17	0.18	0.18	0.18	0.19	0.19	0.20	0.20
Electricity	0.12	0.17	0.23	0.31	0.42	0.55	0.71	0.91	1.16	1.45	1.79	2.14	2.50	2.89	3.29	3.72
BD	0.44	0.58	0.57	0.55	0.53	0.51	0.49	0.47	0.44	0.42	0.39	0.36	0.32	0.29	0.26	0.23
RD	0.29	0.34	0.46	0.64	0.74	0.93	1.08	1.08	1.05	1.01	0.98	0.89	0.81	0.73	0.65	0.57
Ethanol	0.52	0.54	0.55	0.55	0.53	0.58	0.54	0.55	0.51	0.50	0.50	0.42	0.35	0.28	0.21	0.15
Credit Bank	0.91	1.31	1.59	1.83	1.98	2.13	2.22	2.20	2.06	1.93	1.93	1.66	1.24	0.78	0.37	0.16
Annual Deficits	1.22	1.46	1.82	2.15	2.45	2.80	3.14	3.44	3.73	3.95	4.12	4.54	4.88	5.15	5.34	5.44
CI Reduction %	3%	4%	5%	7%	8%	10%	12%	14%	16%	18%	20%	23%	27%	30%	34%	37%

Hydrogen

DEQ is proposing that hydrogen used to generate advance credits must meet a maximum carbon intensity of 117g CO2e/MJ. This is a carbon intensity that is consistent with hydrogen produced from non-fossil fuels. Should DEQ consider a different threshold and why?

We are pleased to see hydrogen's being included as an option in the Program. We would prefer to see the thresholds set or a specific requirement be included so that the hydrogen will be produced by electrolysis, not by using natural gas, even if it is considered biogenic or carbon capture and storage would be provided.

Program Review

DEQ is proposing to conduct a review of the Clean Fuels Program in 2029 to be submitted to the Environmental Quality Commission. The purpose of the review is to provide an update of the program's metrics and recommend whether additional changes should be made to carbon intensity targets for 2030 and beyond. Should DEQ consider a different year to conduct the review and why?

We agree that 2029 is an appropriate time for the review.

Penalties

We appreciate that "each deficit not complied with if the entity does not participate in the Credit Clearance Market or illegitimate credit" generates a separate violation. The League supported this in the generation of the rules for the Climate Protection Program (CPP) because we believe the cost of non-compliance should be significantly larger than the cost of compliance. As in the CPP, there are options to buy credits that can be used to cover potential deficits.

Multiple Claims of Environmental Attributes

It is proposed to update the provisions "to protect against multiple claims of the environmental attributes associated with renewable natural gas. This includes a new requirement for electronic tracking of the claims and clarifying the attestation language regarding book-and-claim transfers when electronic tracking does not take place."

We have been concerned about the use of credits containing only the environmental attributes of renewable natural gas and especially the possibility of the same credits multiple times, so we are pleased to see this change included.

We appreciate the effort you have taken in developing these rules and thank you for the opportunity to provide comments.

Rebecca Gladstone
LWVOR President

Claudia Keith
Climate Emergency Coordinator

Kathy Moyd
Climate Emergency Portfolio

From: Linda S Craig
To: CFP2022 * DEQ
Subject: Public comment
Date: Thursday, July 21, 2022 2:29:48 PM

Re. CFP 2022 expansion:

I am writing in support of your expanding the Clean Fuels Program, and would ask that you expand it beyond the targets you have set in the draft EIS. I can't say anything new about the technical aspects of the program; you have heard from the experts who are explaining why a stronger program is better for Oregonians and for the planet. You should expand the carbon intensity reduction targets for 2030 and 2035 because each day we learn that we are not moving nearly fast enough to avoid the worst of the climate disasters. And now, Congress has fallen down on their job to protect people's health and the economy. Because they will not take acton to reduce GHG emissions, it is up to the states, and Oregon can set a model with this program. When the initial targets were set for GHG reduction in the Governor's E-O, we did not realize how soon we would begin to suffer from climate change and how quickly we must move.

This program has been shown to work and to achieve benefits, not only for GHG reduction, but also for jobs and the health of Oregonians. You can go further with expanding the targets with good results. I urge you to do so.

Linda Craig
NW Portland

From: Martin Desmond
To: CFP2022 * DEQ
Subject: Clean Fuels
Date: Thursday, July 21, 2022 1:34:03 PM

Hi DEQ

I support a strong and robust Clean Fuels program.

Martin Desmond

From: Dan Frye
To: CFP2022 * DEQ
Subject: Public Comments re: Clean Fuels Program draft rules
Date: Tuesday, July 19, 2022 8:11:41 AM

DEQ Clean Fuels Program Staff,

I am writing today in strong support for accelerating the economic, public health and safety, and climate benefits to Oregon of adopting an ambitious expansion of Oregon's Clean Fuels Program.

First adopted in 2016, the Oregon Clean Fuels has had a significant positive impact on Oregon's greenhouse gas (GHG) emissions, reducing our climate change-inducing pollution by millions of tons of GHGs. However, as temperatures continue to rise to record levels, wildfires in Oregon get larger and larger, and negative economic impacts are felt throughout the state, we need to do more.

The current proposed goals for carbon intensity reduction of 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035 are insufficient to combat the growing climate crisis. I urge the DEQ to rethink those goals and to set higher and more meaningful targets. In addition to doing more to accelerate GHG reductions, those higher targets will improve public health and accelerate our transition to a clean energy economic future. DEQ should make it clear that the best approach to reductions in carbon intensity is by adopting a vision of "Electrify Everything". We have the opportunity to transition from a net energy-importing state to a net energy-exporting state. This will have enormous economic and public health & safety benefits as well as providing an opportunity to prioritize equitable economic outcomes for BIPOC, rural, and low income communities.

The draft fiscal impact statement (FIS) needs work. The economic benefits are much too conservatively estimated and the program costs are significantly overstated. The FIS needs to better quantify the range of economic benefits including waste reduction, job creation, and a new renewable energy economic base. Our crisis is real and half-measures are insufficient. DEQ has shown itself capable of climate leadership, we need it again here and now.

Thank you for listening,
Dr. Daniel D. Frye
Metro Climate Action Team

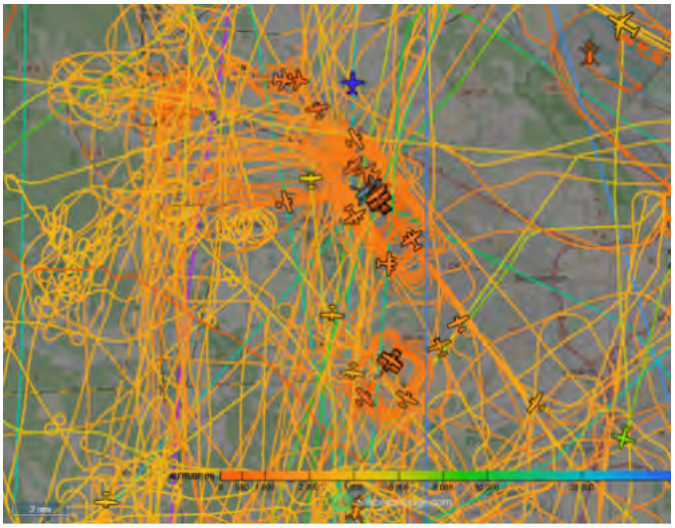
To: Clean Fuels Program

From: Miki Barnes

Date: 7/21/2022

Please expand the Clean Fuels Program to include aviation fuels especially the gasoline used by general aviation aircraft. Many of the users of general aviation airports are private pilots as well as for-profit flight training companies, private jet owners, air taxi businesses and charter companies. All should be required to reduce their pollution levels and contributions to global warming.

The majority of pilots that use Oregon's general aviation airports fly in piston-engine aircraft that continue to rely on leaded aviation fuel.



The ADS-B screenshot above provides an example of the impact of airports on local communities. It depicts flight tracks on June 8, 2022 during an 8 1/2 hour interval between 7:00 am and 3:30 pm. This is a typical occurrence that often starts in the early morning hours and extends into the night time not just at the Hillsboro Airport (HIO), but at many airports throughout Oregon.

The majority of aircraft shown in this picture are flying in and out of HIO located in the second most populated county in Oregon. This general aviation airport, which is surrounded on three sides by residential communities and on the fourth by prime farmland, is used primarily by flight training schools - Hillsboro Aero Academy (HAA), ATP and Hagele Aviation as well as private pilots.

Many of the thick, bright orange flight tracks in the upper center of the picture are produced by pilots performing low altitude touch-and-go maneuvers as well as take-offs and landings at HIO. The smaller cluster of orange aircraft to the south are flying out of Stark's Twin Oaks, 6 miles south of HIO. It, too, is a general aviation, flight training airport. The names of various towns

including Forest Grove, Banks, North Plains and others are completely buried under the tangle of flight tracks to the west, north and south of HIO and Stark's Twin Oaks - tracks generated by the student and private pilots that often relentlessly circle and loop over homes and neighborhoods for hours on end.

There are multiple other airports, not shown on this map, within a 25 mile radius of HIO, including Portland International 15 miles east. In addition, Scappoose Airpark, located 14 miles north, also engages in flight training as does McMinnville, 22 miles south. This insures that residents throughout the area are routinely deluged in multiple doses of noise, lead, and other pollutants.

Hillsboro Aero Academy

Hillsboro Aero Academy, the largest tenant at HIO, also trains students at the Troutdale Airport in Multnomah County and the Redmond Airport in Central Oregon.

HAA boasts of training pilots from over 75 countries. According to their website, "We draw more students from the APAC [Asia-Pacific] region than any other part of the world." Four of their seven Asian partners are from China:

- Air China
- Sichuan Airlines
- Shangdong Airlines
- Juneyao Air

Japan Airlines, Korean Air and Korea Aerospace University also partner with HAA, as do two European companies: ADAC from Germany and Bristol Helicopter based in Scotland.

The HAA website further states that they are certified by the Civil Aviation Authority of Vietnam to train pilots. "We are underway on partnership approvals with two Vietnamese airlines."

In addition, United and Horizon are listed as partners.

All of the companies identified above are from overseas or out-of-state. All routinely engage in activities that degrade livability, poison the air, and compromise the health of local residents.

The heavy and unrelenting nature of the air traffic helps to explain why HIO is ranked eighth in the nation among 20,000 airports in lead pollution. It is also a significant source of global warming, intrusive noise and other toxic and carcinogenic pollutants.

****

In addition to the above, I am including some of the comments I submitted to the Climate Change Program on 10-07-2021.

https://oregonaviationwatch.org/docs/ClimateChangeProgram-20211007.pdf

The failure of Oregon's Climate Protection Program to regulate aviation generated greenhouse gases and other pollutants is indefensible and hypocritical. Every airport in the state should be required to reduce global warming and toxic emissions out of respect for the overall health of the planet as well as current and future Oregonians.

While many Oregon residents are conscientiously reducing their reliance on fossil fuels by driving less, walking more, bicycling, using public transit, carpooling and traveling by train and bus, the Port of Portland, FAA, and State of Oregon with support from the state legislature, Oregon Department of Environmental Quality (ODEQ), and State Department of Aviation are continuing to promote environmentally irresponsible aviation activities that increase global warming and contribute to extreme weather conditions, including the massive wildfires that have become commonplace in the western U.S.

According to the ODEQ, "The purposes of the Climate Protection Program are to reduce greenhouse gas emissions from sources in Oregon, achieve co-benefits from reduced emissions of other air contaminants, and enhance public welfare for Oregon communities."

While ODEQ has drafted rules to regulate stationary industrial sources of greenhouse gas emissions, Port authorities, the Oregon Department of Aviation, and airports throughout the state are being given a free pass to increase operations and pollute with abandon. This is glaringly evident in Section (B) (ii) of the Oregon Protection Climate Program Draft Rules, which specifically exempts "Emissions that are from the combustion of fuels used for aviation including, for example and without limitation, aviation gasoline, kerosene-type jet fuel, and alternative jet fuel…"

Pilot Demographics

FAA statistics reveal that in 2020 there were 691,691 certified pilots in the U.S. Fewer than 9 percent are women. Of the total number, nearly one-third (222,629) were student pilots, many recruited from overseas. Another 117,578, more than one-sixth, were flight instructors. Thus nearly half of the total U.S. pilot population is associated with the publicly subsidized, for-profit, male-dominated flight training industry. Another 160,860, close to 25 percent, are private pilots.

The FAA, Port of Portland, and State of Oregon policies pertaining to general aviation airports are designed to cater to this less than 1/4 of one percent of the U.S. population, a minuscule minority that routinely imperils the health and well-being of local residents and the global community by pumping CO2, lead, noise, and a host of other pernicious toxins into the air on a daily basis.

Glut of Airports in Oregon

Oregon has a total of 420 airports. Seven are commercial passenger facilities, which also accommodate private and recreational pilots as well as flight training activity. The remaining 413 are general aviation (GA) airports that predominantly serve for-profit flight training businesses and private pilots.

It is noteworthy that not a single major country in Europe has as many airports as Oregon does. See pages 41-42 of the **General Aviation Manufactures Association 2019 Databook (GAMA)**.

- Germany – population of 83.8 million, more than 20 times that of Oregon, has 318 airports.
- France – population 65.2 million, more than 16 times that of Oregon, has 294 airports.

- United Kingdom – population 67.8 million, more than 16 times that of Oregon, has 271 airports.
- Spain – population 46.7 million, more than 11 times that of Oregon has 99 airports.
- Italy – population 60.4 million, more than 14 times that of Oregon, has 98 airports.

Though the population in each of these countries exceeds that of Oregon anywhere from 11 to 21 times over, they all manage to get by on far fewer airports.

> What these countries do have is high speed rail, a mode of transportation that has a much lower carbon footprint than aviation and also serves the broader population rather than an affluent few.

Aviation and Toxic Pollution

The Climate Protection Program speaks of achieving "co-benefits from reduced emissions of other air contaminants."

In this regard it is important to keep in mind that the vast majority of GA operations in Oregon and nationwide occur in piston-engine aircraft that still rely on leaded fuel (avgas). The U.S. fleet of approximately 170,000 piston engine aircraft routinely pumps 450 tons or more of lead into the air every single year, emissions that are responsible for 70% of all airborne lead pollution nationwide. The U.S. is now the biggest leaded fuel polluter on the planet.

Members of the Port of Portland Board of Commissioners and the board of the Oregon State Department of Aviation are appointed by the Governor. For more than a century, these two agencies have been pumping greenhouse gases, lead, PM2.5, PM10, benzene, elemental carbon, carbon monoxide, relentless noise and a host of other toxins into the air with precious little, if any, restraint whatsoever.

Port of Portland

The Port of Portland owns and operates 3 airports, Portland International, the largest commercial airport in the state as well as two general aviation airports - Hillsboro (HIO) and Troutdale (TTD). The majority of aircraft flying in and out of HIO and TTD are piston-engine aircraft which rely on leaded fuel. A primary tenant and major polluter at both these airports is Hillsboro Aero Academy (HAA), an international flight training company owned by out-of-state East coast investors. According to their website, HAA has trained pilots from over 75 countries. Yet this noisy, toxic, fossil-fuel burning, for-profit private business gets a free pass. Also of note, in 2017, HAA started training Chinese pilots at the Redmond Airport in Central Oregon, further adding to its global warming footprint. The Oregon State Legislature and the federal government are also complicit in promoting these heavy-handed and unregulated polluters especially insofar as it promotes legislation that forces the public to subsidize these facilities.

A review of the 2017 Environmental Protection Agency (EPA) National Emissions Inventory (NEI) revealed that HIO, TTD, and PDX combined released 1925 lbs. of lead into the environment annually during the landing and take-off phase of flight. Additional lead is emitted during pre-flight engine run-ups, repetitive training maneuvers, and overflights. The NEI database has identified HIO as the largest facility source of airborne lead pollution in the state and ranked this airport 8th among more than 20,000 airports nationwide in lead pollution. TTD which logs approximately 100,000 operations annually, on average 273 per day, is the third largest facility source of lead in Oregon and the largest source of airborne lead pollution in Multnomah County. The commercial passenger aircraft at PDX use jet fuel which does not contain lead.

Thus the lead emissions at PDX (159 lbs.) are significantly lower than HIO (1212 lbs.) and TTD (554 lbs.)

According to the 2021 FAA Terminal Area Forecast, PDX logged 237,051 annual operations in 2019. The 2017 EPA NEI revealed that statewide PDX is the number one facility source of benzene, 1,3-Butadiene, and acrolien, the third largest facility source of carbon monoxide, elemental carbon, and acetaldehyde, the fourth largest facility source of sulfur dioxide, the fifth largest facility source of nitrous oxides, and the 6th largest facility source of VOCs.

Turning to HIO, according to FAA Airport IQ5010 Master Records, this airport logged 253,847 operations in the 12 months ending 7-13-2020, an average of 695 take-offs and landings per day. Most were training flights that stayed within the borders of Washington County, though some practiced over neighboring Yamhill and Columbia Counties as well. Many remained in the air for an hour or more before returning to HIO. This means that 695 times per day for hours on end these aircraft are releasing greenhouse gases, noise, lead, PM2.5, benzene and a host of other toxins into the environment. As noted earlier, 2017 EPA NEI has identified HIO as the top facility source of lead emissions in Oregon. In Washington County it is the number one facility source of carbon monoxide, elemental carbon, benzene, 1,3 butadiene, and acrolien, the second largest facility source of PM2.5, nitrous oxides, sulfur dioxide, PM10, and acetaldehyde, and the third largest facility source of VOCs.

TTD is also a significant polluter. According to the 2017 EPA NEI, in Multnomah County it is the second largest facility source of carbon monoxide, acrolien, and 1,3-butadiene, the fourth largest facility source of elemental carbon and acetaldehyde, and the fifth largest facility source of benzene

Oregon Department of Aviation

The Oregon Department of Aviation (ODA), which owns and operates 28 general aviation airports, is also a major source of pollution. A review of 2017 EPA NEI revealed that these airports pump a combined total of 1627 lbs of lead into the air each year. When combined with the Port of Portland's airport lead emissions, it becomes clear that these two state agencies release 3552 lbs of lead, more than one and a half tons, into the air each year just during the landing and taking off phase of flight without even factoring in ground run-ups, practice maneuvers, and overflights. To put this more succinctly, these state agencies are knowingly and intentionally dosing Oregon residents with a toxin that is known to cause

Even more alarming are ODA reports that reveal plans for significant airport expansions with virtually no consideration for global warming, lead poisoning, noise, and the other toxic pollutants released by this sector. Meanwhile ODEQ is doing nothing to hold the highly toxic aviation industry accountable.

When Oregon filed for statehood in 1857, it was the only state in the union that codified a "whites only" agenda into its constitution. Over the ensuing 160 plus years, the legislature has shaped itself around these oppressive patriarchal ideals, many of which are still enshrined in the government institutions that remain in place to this day - values that are especially evident in the aviation system, which in many communities eschews democracy in favor of a top-down, authoritarian approach that exploits and pits itself against local communities. The laws pertaining to aviation in Oregon and across the country were crafted by the very people who

personally, financially and professionally benefit from white privilege while conveniently ignoring the environmental degradation and injustices produced by this mode of transportation.

Commercial Aircraft Pollution

A September 21, 2021 Center for Biological Diversity press release "100 Groups Demand Biden Cut Airplane Climate Pollution" identified the U.S. as "being by far the largest airplane polluter in the world." And further explained that, "Commercial aviation currently accounts for 11% of all U.S. transportation carbon dioxide emissions and 2.4% of carbon emissions around the globe. Despite a short-term downturn during the pandemic, this number is expected to grow in the coming decade. Flights departing from airports in the United States and its territories are responsible for almost one-quarter of global passenger transport-related carbon pollution."

Closing Statement

Clearly regulating aviation activity in Oregon will significantly reduce greenhouse gas emissions while also reducing "the emissions of other air contaminants." In so doing it will improve the public welfare of Oregon communities.

Thank you for your time and consideration.

Sincerely,

Miki Barnes
Founder of Oregon Aviation Watch - www.oregonaviationwatch.org
PO Box 838
Banks, Oregon 97106

July 21, 2022

Cory-Ann Wind
Oregon Clean Fuels Program
Environmental Solutions Division
Department of Environmental Quality
State of Oregon
811 SW 6th Avenue
Portland, OR 97204

Ms. Wind,

Thank you for the opportunity to comment on the proposed expansion to the Clean Fuels Program. In particular, NSP commends the DEQ for continuing its commitment to cleaner fuel and urges consideration of an indirect land use change (ILUC) value for sorghum ethanol similar to the ILUC value for corn ethanol.

NSP is a trade association representing 50,000 U.S. sorghum farmers on federal and state legislative and regulatory matters. NSP also speaks for the sorghum industry as a whole, advocating on behalf of the supply chain participants that rely on sorghum for the future of their businesses.

The proposed changes move Oregon's fuel marketplace in a positive direction. However, the ILUC value for sorghum ethanol remains at 19.4 gCO_2e/MJ while the ILUC value for corn ethanol is now 7.6 gCO_2e/MJ. The lack of a change for sorghum ethanol is simply due to Argonne National Laboratory (ANL) not updating the sorghum ethanol ILUC value when it updated the corn ethanol ILUC value. As can be seen in Figure 1, the ILUC values for the two fuels move in tandem as corn and sorghum are substitutes for one another in both ethanol production and livestock feeding.

Furthermore, as can be seen in Figure 2, sorghum acres have not been significantly affected by increases in ethanol production. In fact, as ethanol production has increased, sorghum acres in Kansas and Texas, where virtually all sorghum ethanol is produced, have trended downward. ILUC is predicated on the principle that producing more sorghum in the U.S. moves acres of other crops to international locations. Clearly, this has not occurred with sorghum as acres have actually declined.

Finally, as can be seen in Figure 3, soil organic carbon emissions in no-till systems are radically lower in the Sorghum Belt than the Corn Belt. Note the values depicted are for corn rather than sorghum since ANL has not updated the sorghum ethanol ILUC value. However, we would expect similar values for sorghum because of sorghum's relatively larger root system and the fact that it is grown in rotation with wheat. Such rotations tend to work synergistically to build a large amount of biomass and thus accumulate a large amount of soil organic carbon. The report from which this figure was taken is also attached to these comments. It was prepared by Lifecycle Associates and found sorghum should have an ILUC value at least the same as that of corn and possibly lower.

4201 North Interstate 27 ⚫ Lubbock, Texas 79403 ⚫ phone: (806) 749-3478 ⚫ fax: (806) 749-9002
www.sorghumgrowers.com

We hope the DEQ moves forward with their commitment to cleaner fuel while at the same time reducing the ILUC value for sorghum ethanol to an amount similar to the ILUC value for corn ethanol. Please do not hesitate to contact me if you have additional questions.

Regards,

Tim Lust

Tim Lust
CEO

Figure 1. Indirect Land Use Change Emissions for Corn and Sorghum Ethanol in Three Models.

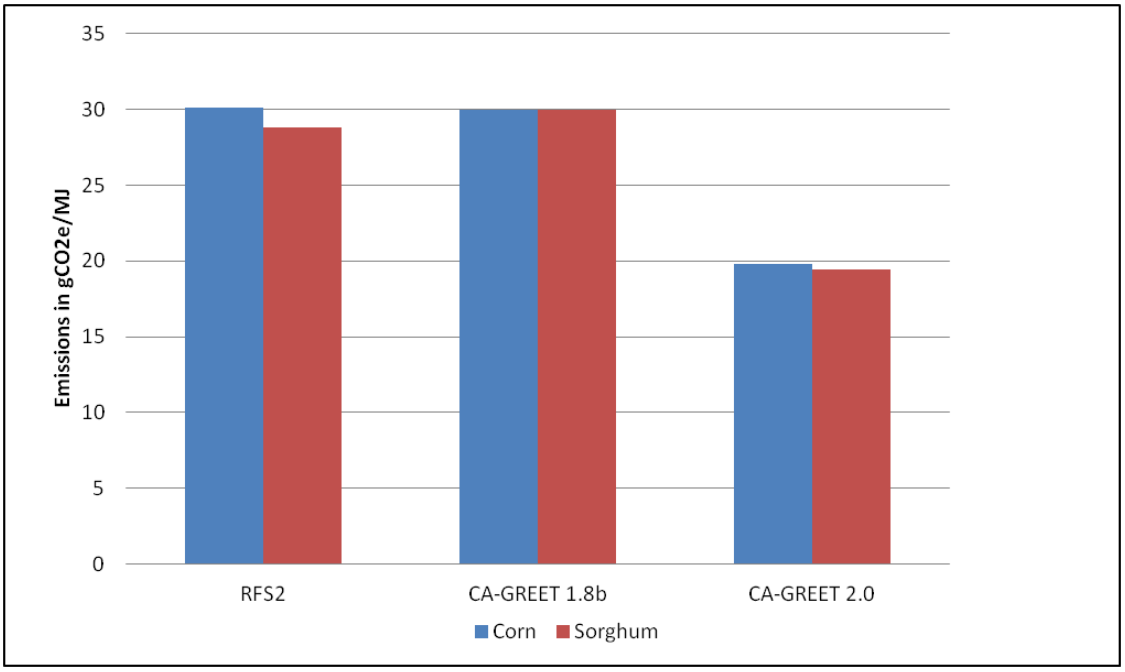
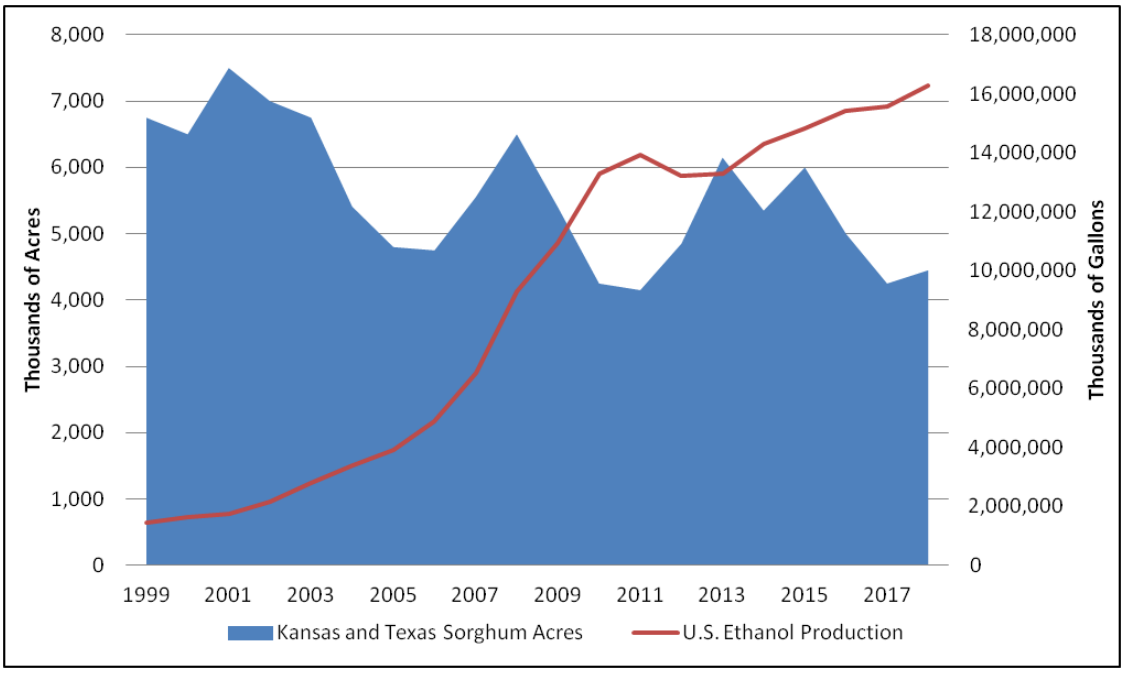


Figure 2. Kansas and Texas Sorghum Acres and U.S. Ethanol Production.



4201 North Interstate 27 ⚫ Lubbock, Texas 79403 ⚫ phone: (806) 749-3478 ⚫ fax: (806) 749-9002
www.sorghumgrowers.com

Figure 3. Soil Organic Carbon Emissions in the Corn Belt Compared to the Sorghum Belt.

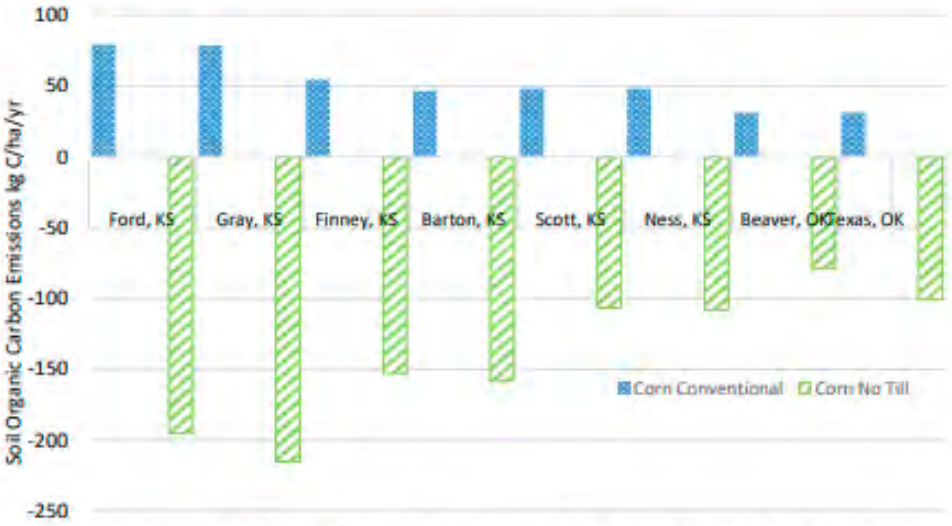


Figure 24. CCLUB results for corn grown conventionally and with no-till in high sorghum-producing states.

Figure 25. CCLUB results for corn grown conventionally and with no-till in high corn-producing states.

Life Cycle Associates



Evaluation of Indirect Land Use Conversion for Grain Sorghum

Prepared for:
The Sorghum Checkoff

LCA.8169.225.2022

Prepared by:
Lucy Buchan
Stefan Unnasch
July 15, 2022

DISCLAIMER

This report was prepared by Life Cycle Associates, LLC for the Sorghum Checkoff. Life Cycle Associates is not liable to any third parties who might make use of this work. No warranty or representation, express or implied, is made with respect to the accuracy, completeness, and/or usefulness of information contained in this report. Finally, no liability is assumed with respect to the use of, or for damages resulting from the use of, any information, method or process disclosed in this report. In accepting this report, the reader agrees to these terms.

ACKNOWLEDGEMENT

Life Cycle Associates, LLC performed this study under contract to the Sorghum Checkoff. John Duff was the project manager.

Contact Information:

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www.LifeCycleAssociates.com

Recommended Citation: Buchan, L., and S. Unnasch. 2022. Evaluation of Indirect Land Use Conversion for Grain Sorghum. Life Cycle Associates Report LCA.8169.225.2022. Prepared for the Sorghum Checkoff.

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TABLES

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TERMS AND ABBREVIATIONS

AEZ-EF	Agro-Economic Zone Emission Factor
CA	California
CARB	California Air Resources Board
CCLUB	Carbon Calculator for Land Use Change from Biofuels Production
CI	Carbon Intensity
CO_2e	Carbon Dioxide-Equivalent
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FAPRI	Food and Agricultural Policy Research Institute- Center for Agricultural and Rural Development
FASOM	Forest and Agricultural Sector Optimization Model
GHG	Greenhouse Gas
GREET	Greenhouse Gases Regulated Emissions and Energy Use in Transportation
GTAP-BIO	Global Trade Analysis Project-Biological
iLUC	indirect Land Use Conversion ("i" to emphasize "indirect" aspect of LUC)
ILUC	Indirect Land Use Conversion (capitalized version for sentence beginnings)
kWh	kilo-Watt Hour
LCA	Life cycle analysis
LCFS	Low Carbon Fuel Standard
LUC	Land Use Conversion
MJ	Megajoule
RFS2	Renewable Fuel Standard Program

1. Introduction

Sorghum is a resilient crop that is primarily grown as an alternative to corn where farming conditions (water stress and high temperatures) do not support sufficiently profitable corn growth and yield (Staggenborg et al., 2008). Sorghum farming practices typically employ similar inputs as corn farming on a per tonne and per acre basis. As a result of being grown under less-optimal farming conditions, however, sorghum's yield is usually lower than that of corn. Consequently, sorghum is potentially perceived and treated in transportation policy and regulatory contexts, such as the California Air Resources Boad (CARB) Low Carbon Fuel Standard program (LCFS) and the U.S. Environmental Protection Agency's ((EPA) Renewable Fuel Standard program (RFS2), as a comparatively less-efficient crop that requires greater acreage to produce comparable yield. Notably, in some instances, sorghum can be grown as a double crop[1], resulting in incremental production of food and fuel, and thereby having a favorable land use efficiency.

Since the estimated amount of land converted for biofuel feedstock production factors significantly into the calculations of greenhouse gas (GHG) emissions associated with biofuels and with RFS2 and LCFS compliance, it is an important factor to carefully evaluate and track. This Report reviews U.S. EPA RFS and CARB LCFS GHG analysis, associated models, and data pertaining to existing iLUC values for corn and sorghum, and establishes support for a stance on biofuel policies indicating that iLUC values for sorghum should be no greater than those for corn in future regulatory updates.

1.1 Indirect Land Use Conversion - Background

In addition to GHGs that are directly emitted from the production and use of biofuels, emissions associated with increased demand for biofuel feedstocks is referred to as indirect land use change or iLUC. Some analysts attribute the increase in emissions to a change in regulatory policies such as clean fuel standards; however, in the case of sorghum used in ethanol production, the feedstock is a substitute for grain corn both in feed and fuel markets. A presumed increase in acreage needed to meet increased demand for feedstock could lead to non-agricultural or underproductive lands being converted to cropland. ILUC is estimated from the conversion of land with carbon that may have remained sequestered in soils and cover vegetation. Biomass removal and well as tillage of below ground biomass are part of the iLUC estimate.

ILUC is treated as an agro-economic phenomenon where increasing worldwide demand for biofuels stimulates a corresponding increase in the price and demand for the crops used to produce those fuels. To meet such demand, farmers may:

[1] Double cropping occurs on 2-3% of total US cropland (USDA, 2014).

- Grow more biofuel feedstock crops on existing cropland by reducing or eliminating crop rotations or fallow periods, incorporating cover crops or planting double crops, and by adopting other regenerative practices that improve soil and growing conditions;
- Convert existing agricultural lands from food to fuel crop production;
- Convert lands in non-agricultural uses to fuel crop production; or
- Take steps to increase yields beyond that which would otherwise occur.
- Shift the uses and consumption of feed and fiber

Land use change (LUC) effects are predicted to occur when the acreage of agricultural production is expanded to support increased biofuel production. Lands in both agricultural and non-agricultural uses may be converted to the cultivation of biofuel crops. Some land use change impacts are indirect or secondary. When biofuel crops are grown on acreage formerly devoted to food and livestock feed production, supplies of the affected food and feed commodities are reduced. These reduced supplies lead to increased prices, which, in turn, stimulate the conversion of non-agricultural lands to agricultural uses. The land conversions may occur both domestically and internationally as trading partners attempt to make up for reduced imports from the United States. The land use change will result in increased GHG emissions from the release of carbon sequestered in soils and land cover vegetation. These emissions constitute the land use change impact of increased biofuel production.

Not all biofuels have been linked to indirect land use change impacts. Biofuels produced by using waste products as feedstocks are treated as having insignificant land use effects. The use of corn stover as a feedstock for cellulosic ethanol production, for example, is not likely to produce a land use change effect due to the changes in the demand for feed and fiber. Feedstocks such as native grasses grown on land that is not suitable for agricultural production are unlikely to cause land use change impacts. Waste stream feedstocks such yellow grease, waste cooking oils and municipal solid waste, are not considered as drivers of land use change impacts even though their use requires new sources of oleochemicals.

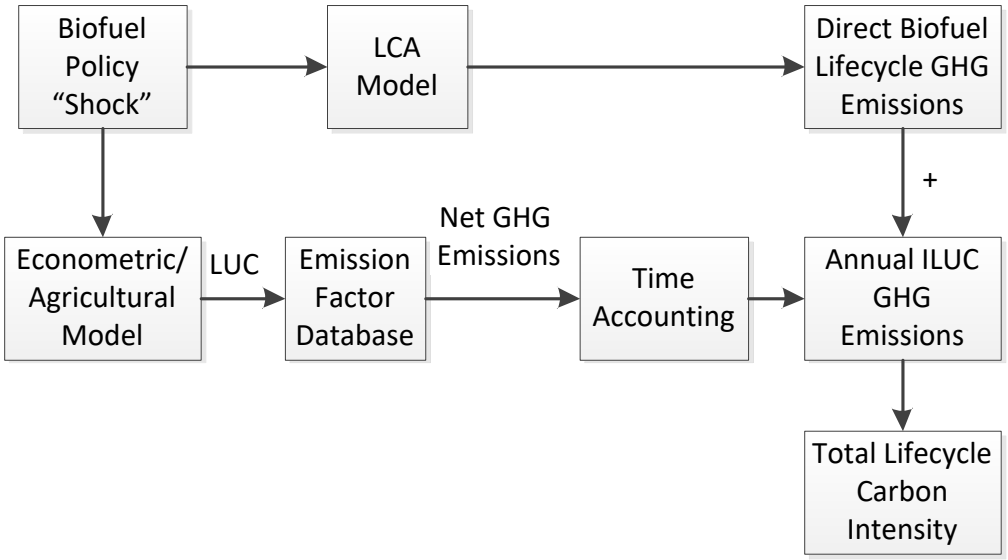

Figure 1. Modeling Flow for Determination of Total Biofuel Lifecycle Carbon Intensity, Including Both Direct and Indirect Effects.

The correlation between LUC and an expansion in biofuel is typically estimated with agro-economic models. ILUC corresponds to the emissions resulting from land conversion associated with new demand for biofuels. Economic models that simulate market behavior (particularly those in the agricultural sector) are often linked to predict the location of land cover change and the emissions associated with conversion to crops as illustrated in Figure 1. Results from economic models that predict the location and type of land conversion are combined with emission estimates associated with land conversion. The results are amortized over a time horizon to develop an iLUC estimate.

1.1.1 Range of iLUC Estimates

iLUC values have evolved over time with refinements in modeling and contributions from numerous researchers. Figure 2 shows a range of values estimated for corn ethanol. The results from different studies have not provided a strong consensus on the most representative value which depends on numerous factors including the extent of biofuel usage as well as agricultural modeling and land conversion emission factors. Analysis of iLUC values found in various publications support both higher (Malins et al 2021; Lark et al., 2022) and lower (Scully et al., 2021; Taheripour et al., 2021; Taheripour et al., 2022) values. The debate over iLUC includes evaluations of land cover predictions as well as carbon stocks for different land cover types.

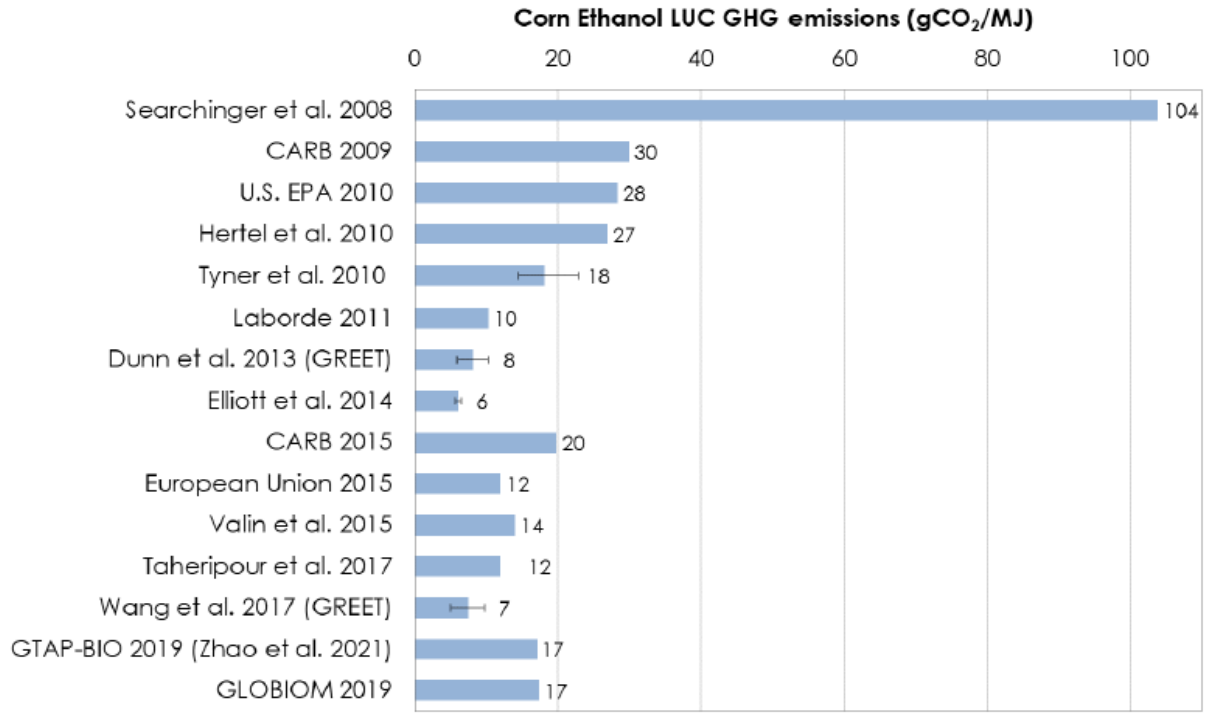

Figure 2. Range of iLUC estimates for corn ethanol.

1.2 Overview of iLUC Assessments in U.S. Biofuel Policies

The RFS2 and the LCFS programs require that transportation fuel GHG reduction targets be met through the use of alternative fuels. The GHG emissions are determined through life cycle assessments (LCAs), which account for all energy and emission flows during the life of the fuel, i.e., "cradle to grave". The GHG reductions are measured through comparison of LCA results of an alternative fuel to its conventional counterpart (such as gasoline or diesel). The net GHG is determined in terms of a carbon intensity (CI), which includes all GHG emissions, measured in CO_2 equivalency.

Implementing LCAs requires clearly defining boundaries, assumptions, and acquiring numerous data inputs. LCA Results are highly dependent on these inputs and thus, can differ depending on their relative scope. Because of their importance in policy, LCA methodologies implemented for the RFS2 and the LCFS have been critically reviewed by stakeholders and experts in an effort to ensure that the life-cycle GHG emissions of alternative fuels are fairly represented. The assumptions that generate the greatest uncertainties, and have the largest impacts on biofuel LCAs, are those regarding co-product allocation, agricultural emissions (particularly N_2O emissions) and indirect land use changes (iLUC). ILUC refers to changes in land cover that occur as a result of increasing the amount of biomass for a particular fuel feedstock in order to increase biofuel production.

Both EPA and CARB calculate emissions associated with iLUC by linking results from agro-economic models to their life cycle assessment (LCA) models (Table 1). Changes in biofuel production volumes are input to predict how much land will be required to compensate for the crop that has been displaced by the production of biofuels. CARB (2015), for example, has associated a considerable impact in indirect land use conversion (iLUC) for sorghum (19.4 gCO_2e/MJ) and a slightly higher iLUC value for corn (19.8 gCO_2e/MJ). Since iLUC values affect the carbon intensities associated with fuel feedstock in the RFS and LCFS, it is important that they are as accurate as possible, both now and in the future.

Table 1. Comparison of Agro-Economic Models for Land Use Conversion Analysis.
Source: Broch and Hoeckman, 2011.

Model	GTAP	FAPRI	FASOM
Application	CARB-LCFS	EPA RFS2	EPA RFS2
Type	Global computational general equilibrium model (CGE) with explicit treatment of land.	Global partial equilibrium model of agricultural sector.	Partial equilibrium model of U.S. forestry and agriculture incorporating GHG emissions
Regions	18 international AEZs	54 International regions	11 U.S. Regions
Fuel demand	Biofuel shock with surrogate petroleum tax subsidy.	Demand for feedstock modeling of blend wall price effects.	Demand for feedstock on agricultural system
Price/ yield response	0.2-0.3 price/ yield elasticity plus exogenous yield multiplier	0.074 long run price/ yield elasticity	No price response
Area/ yield response	0.66-0.75 area expansion multiplier	0.977 area expansion multiplier	Yield projections for new land in U.S.
Co-product treatment	Feed co-product is subtracted from bio-fuel feedstock requirements	DGS and SBM are treated as separate agricultural commodities	DGS and SBM are treated as separate agricultural commodities
Co-product power	New power for agriculture and biorefineries included in GREET calculations with region-specific emission factors	Credit for power export from biorefineries using GREET emission factors	U.S. agricultural system power modeled by FASOM with new power consumption from biorefineries
Carbon Accounting	Emission factors from Woods Hole database.	MODIS satellite data and Winrock analysis of land conversion factors	Endogenous, direct emission factors comparable to GREET. Land emissions from CENTURY

EPA's (2010) approach to linking agro-economic databases to their emission factor databases to estimate the net GHG emissions associated with fuel production involves two different pathways to determine domestic LUC and international LUC (Figure 3). Domestic changes are determined through the Forest and Agricultural Sector Optimization Model (FASOM) economic model. FASOM is linked to the DAYCENT/ CENTURY and FORCARB databases to determine the net iLUC. International iLUC is modeled with the Food and Agricultural Policy Research Institute-Center for Agricultural and Rural Development (FAPRI) model. The land use results from FAPRI are linked to emission factors from the Winrock databases, which are aggregated according to historical land use changes measured through MODIS satellite imagery. Although EPA has not updated its iLUC methodology, it has published new GHG emission values for selected biofuels. To determine the iLUC emissions associated with each fuel, the results from a reference case, or the "business as usual scenario", is compared to the control case which includes the policy volume targets. The change in each fuel volume type is modeled individually to estimate the changes attributable to that fuel. The resulting net carbon intensity of each fuel is the sum of all the outputs listed on the right-hand side of Figure 3.

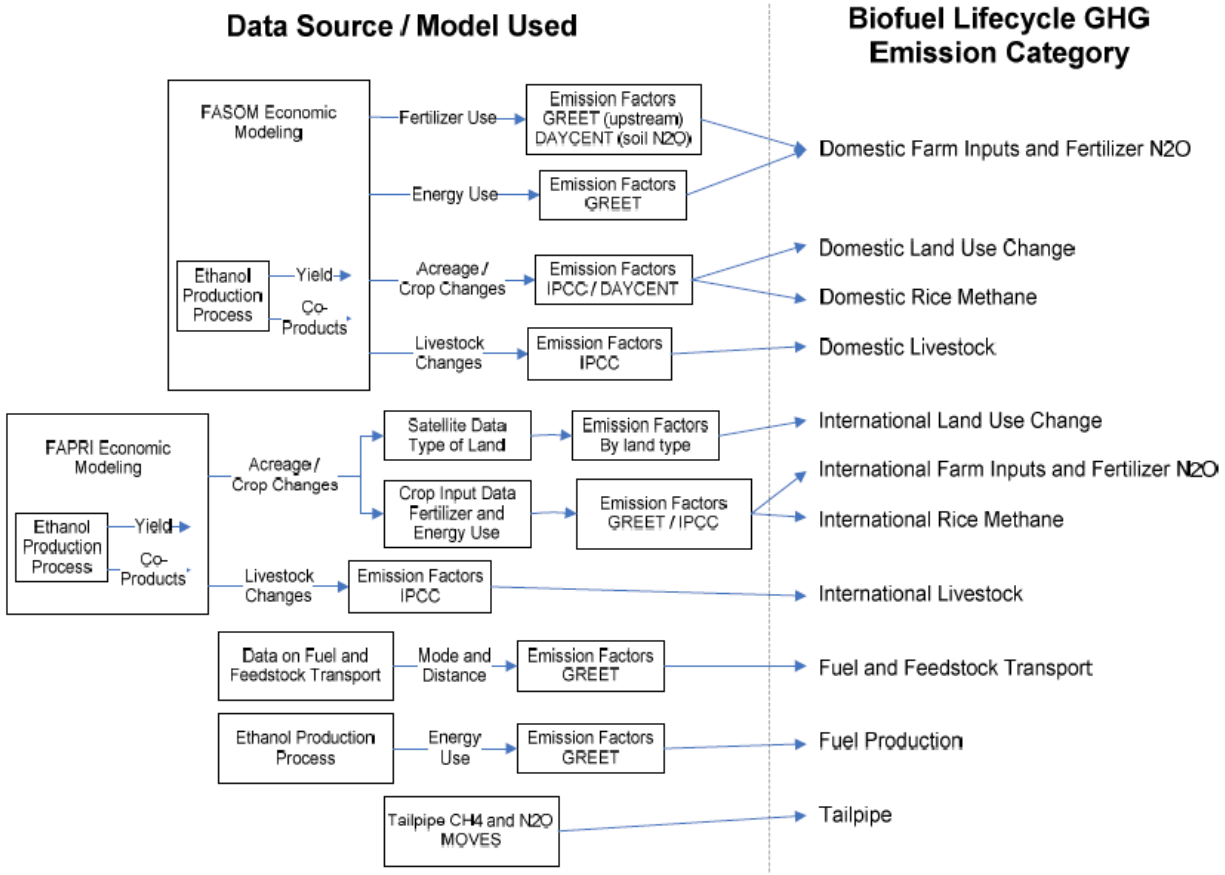

Figure 3. System boundaries and modeling flow chart for biofuel LCA in EPA RFS2
Source: Broch and Hoekman, 2011.

The research and analysis behind CARB's updated[2] sorghum iLUC value was based on running the Global Trade Analysis Project (GTAP) agro-economic model, modified to account for biofuels and their co-products, and referred to as the GTAP-BIO model (CARB, 2014). Estimated carbon emissions associated with modeled land use change are calculated using a carbon emissions model called the Agro-Ecological Zone Emission Factor (AEZ-EF) linked to emission factors from the Woods Hole database. CARB's original 2009 modeling results were vetted by extensive stakeholder review through the CARB Environmental Expert Workgroup before the LCFS regulation was adopted. Stakeholders raised the issue of uncertainty in the output values for iLUC. Staff, working with the University of California, developed a Monte Carlo approach for estimating total uncertainty of iLUC resulting from variability in individual parameters. The assumptions and input parameters used in the GTAP-BIO and AEZ-EF models provided the basis for the 2014 rule making.

[2] CARB's original analysis in 2009 was updated in 2014.

2. iLUC Analysis for Grains

ILUC estimates have evolved considerably since the original assessments performed over 14 years ago. Factors affecting iLUC include the response to yield improvements and price, characterizations of agricultural land type, treatment of co-product credits, characterization of soil carbon stocks, and soil carbon accumulation due to different farming practices. The most notable refinements have included updates to the GTAP database as well as more detailed net soil carbon assessments based on county-by-county farm data. Figure 4 illustrates the temporal trend of values estimated for LUC and iLUC in association with corn ethanol production using different agro-economic models.

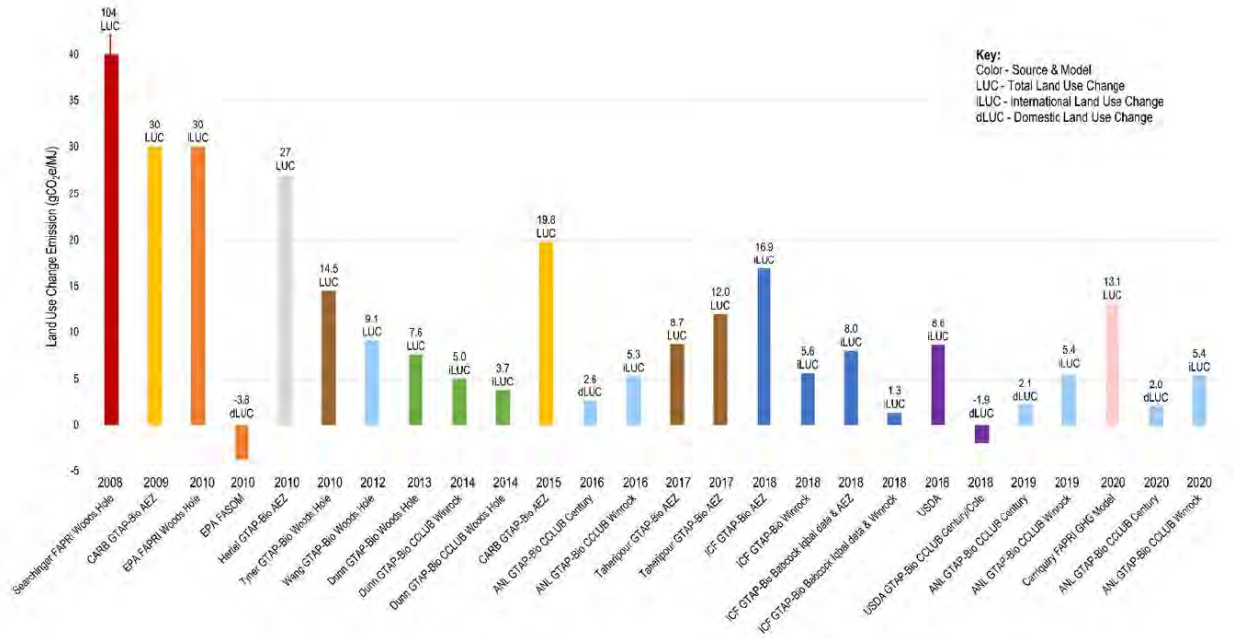

Figure 4. Estimated GHG emissions associated with corn ethanol-related LUC.
Source: Scully et al., 2021

The iLUC is generally considered to include the international and the domestic land use change. Figure 5 illustrates the emissions associated with iLUC for the RFS2 (US EPA, 2010) and the LCFS programs (CARB 2009, 2014). EPA's analysis resulted in a slightly lower iLUC for sorghum than for corn as shown in Figure 5. As part of the 2009 LCFS rulemaking, CARB developed ILUC results that were of a similar order of magnitude as EPA's and assigned the same ILUC to both corn and sorghum. Subsequently, in 2014, CARB performed separate ILUC analyses, which resulted in a slightly lower iLUC for sorghum than for corn, comparable to the magnitude of difference calculated by the EPA. Regardless of the year and model used, the outcome of each of the aforementioned analyses resulted in the ILUC of sorghum-based ethanol being comparable or slightly lower than that of corn-based ethanol.

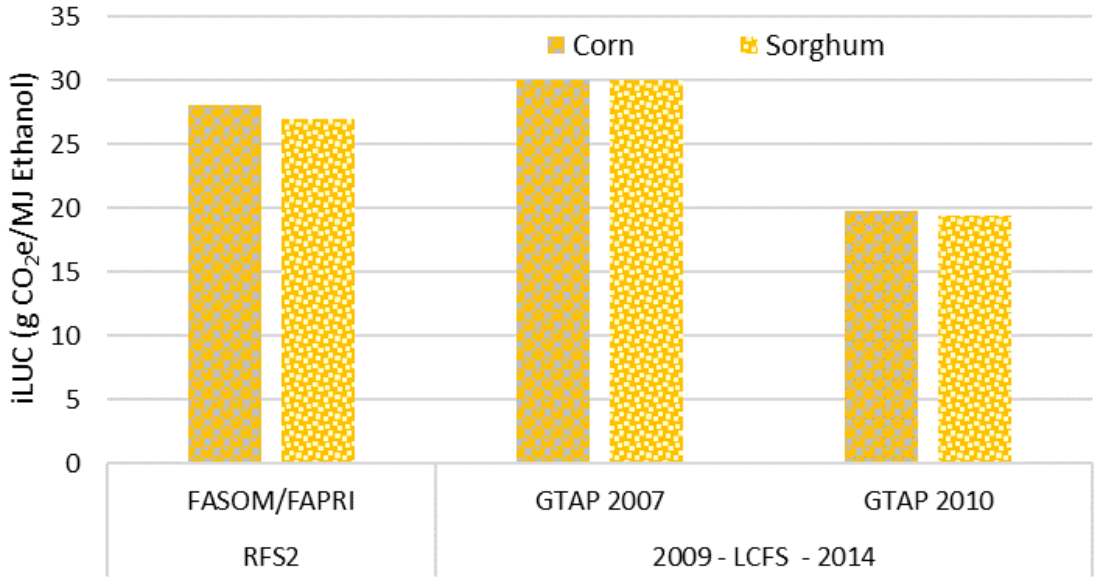

Figure 5. Indirect land use change emissions for corn and sorghum ethanol in three models.

2.1 U.S. EPA Regulatory Impact Analysis Rulemaking

The U.S. Environmental Protection Agency (EPA) conducted a Regulatory Impact Analysis (RIA) to assess the impacts of an increase in the production, distribution, and use of renewable fuels sufficient to meet volumes specified in the revised Renewable Fuels Standard (RFS2), as mandated by the Energy Independence and Security Act (EISA) of 2007. Pathways for ethanol produced from grain sorghum feedstock were approved in a rule published on December 17, 2012 (the ''December 2012 RFS Rule''). This Rule was based on a life cycle assessment to determine the overall impact on global greenhouse gas (GHG) emissions that would be associated with an increase in renewable fuels. The primary[3] reference case was a projection of renewable fuel volumes expected in 2022 that was made prior to EISA implementation by the US Energy Information Administration (EIA) in their 2007 Annual Energy Outlook (AEO, 2007). Research conducted since the RIA demonstrates that corn ethanol emissions are significantly lower than those predicted in the RIA for 2022 (Qin et al., 2018).

2.1.1 Regulatory Impact Analysis Summary

In the U.S., 27 million wet tons of sorghum residue were projected to be available in 2022 for cellulosic ethanol production (based on Beach et al., 2010). The RIA, however, focuses on sweet sorghum rather than grain sorghum. The RIA estimated the top counties in close proximity to each other, with sufficient acreage in sweet sorghum production to annually produce 0.1 billion gallons of ethanol. They projected a decline in U.S. sorghum planted acreage and production in response to increases in both corn ethanol and soybean biodiesel production (Figure 6). In

[3] A 2009 reference case was also considered, however, it reflects the initial impacts of implementation of the RFS2 standards, and projected crude oil prices for 2022 were $116/barrel, in contrast to the 2007 reference benchmark value of $53/barrel, which is closer to the observed market values for the past 5 years ($50-$75/barrel).

comparison to corn, projected diesel use for sorghum farming was about a gallon less per acre on average, and gasoline consumption was about a gallon per acre greater (Figure 7, Figure 8). Average electricity consumption was approximately 2 kWh/acre less for sorghum than for corn, and average carbon dioxide emissions from grain drying were projected to be substantially lower for sorghum than for corn (Figure 9, Table 2).

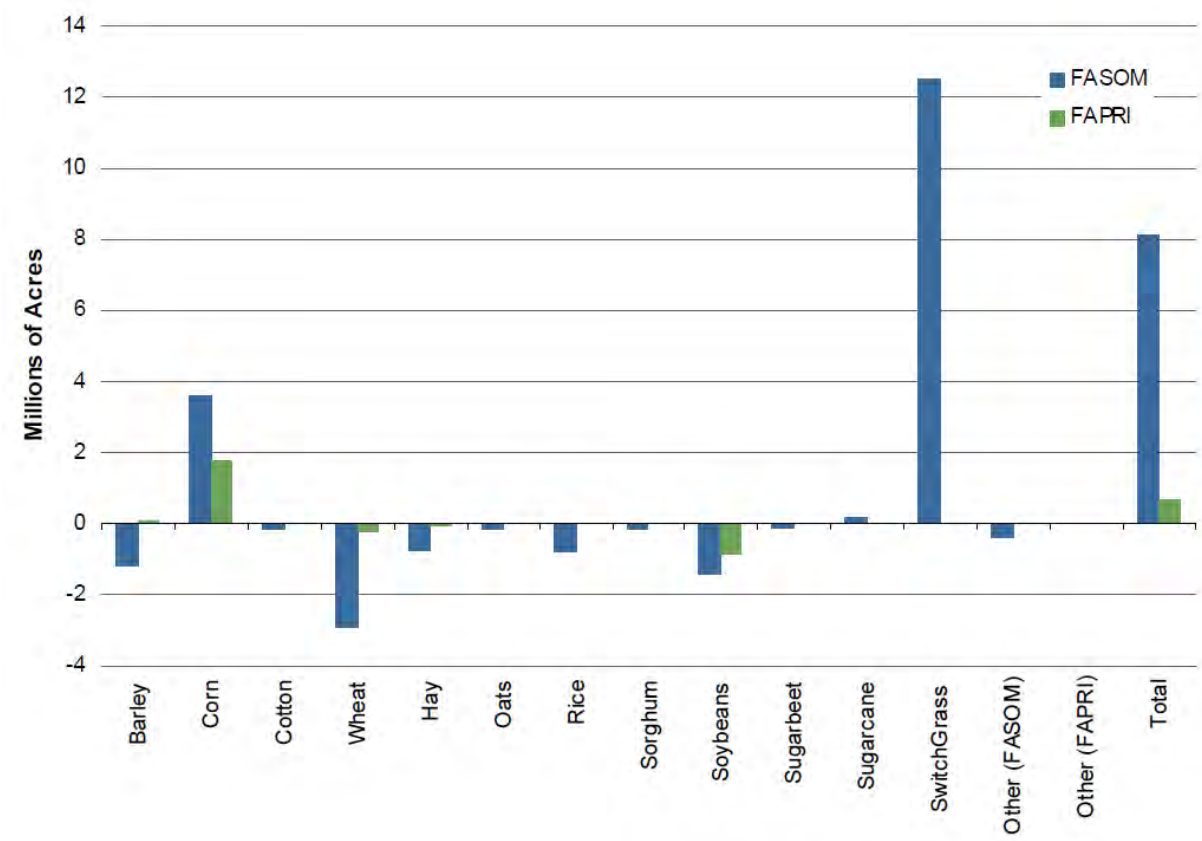

Figure 6. Estimated change in U.S. crop acres in 2022 relative to the Annual Energy Outlook 2007 reference case.
Source: EPA, 2010.

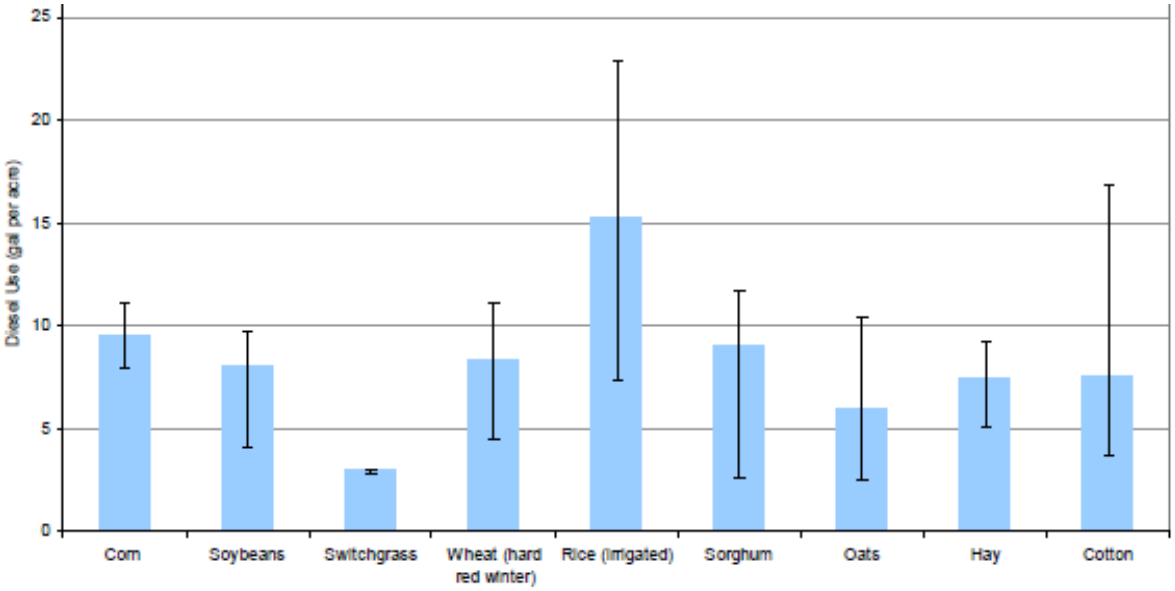

Figure 7. Projected diesel use (2022) for non-irrigated no-residue crop harvesting in the U.S.
Source: EPA, 2010.

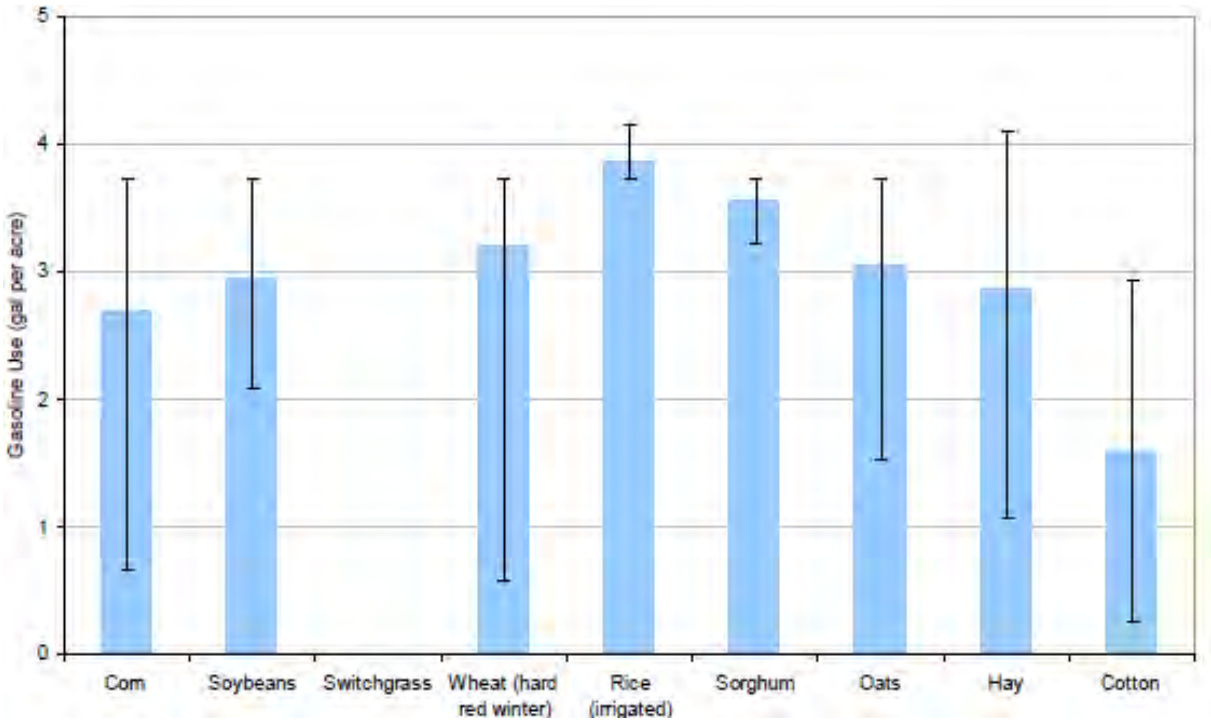

Figure 8. Projected gasoline use (2022) for non-irrigated no-residue crop harvesting in the U.S.
Source: EPA, 2010.

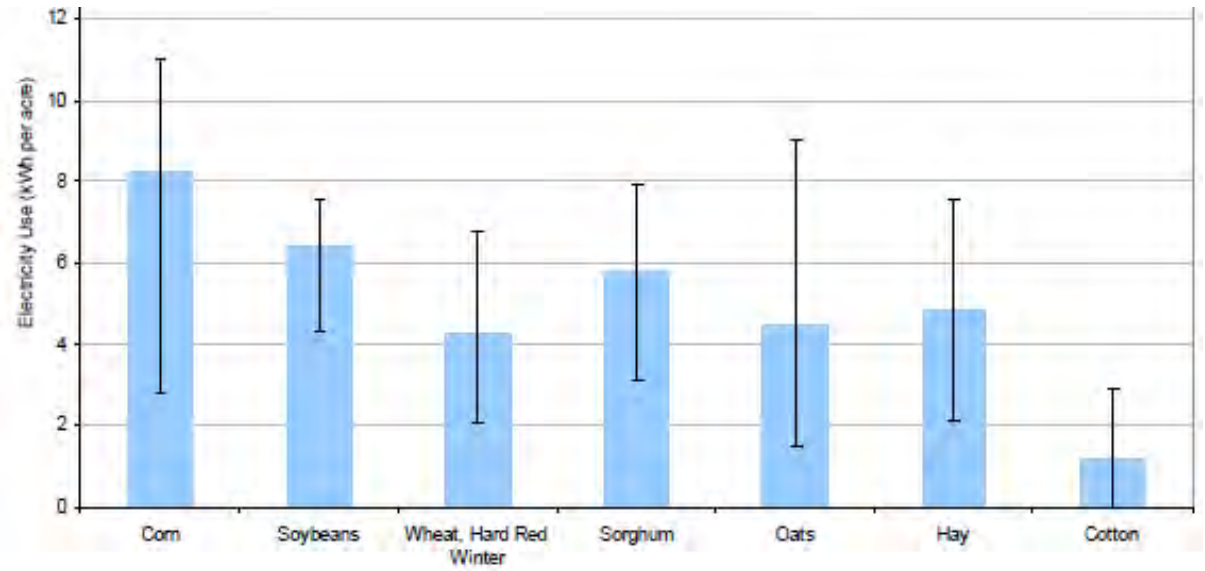

Figure 9. Projected electricity use (2022) for non-irrigated no-residue crop harvesting in the U.S. Source: EPA, 2010.

Table 2. FASOM Average Carbon Dioxide Emissions from Grain Drying by U.S. Market Region. Source: EPA, 2010.

Crop	Corn Belt	Great Plains	Lake States	Northeast	Pacific NW East Side	Pacific Southwest
Dryland						
Corn	161.4	135.9	202.2	160.5	NA	NA
Sorghum	99.4	22.3	NA	54.3	NA	17.7
Irrigated						
Corn	NA	185.1	NA	NA	132.6	121.6
Rice	1,216.6	NA	NA	NA	NA	1667.3
Sorghum	NA	33.0	NA	NA	NA	NA

Figure 10 illustrates the annual hectares of sorghum under cultivation in the United States with a range from 1.5 to 3 million over the associated time span. Also shown is the price of ethanol, which is not correlated in any clear way with sorghum acreage. If taken by itself, there is little to be drawn in the relationship between sorghum acres and ethanol price. Sorghum acreage represents approximately 2% of corn acreage, and both have remained relatively flat over the past two decades. A comparison of Figure 10 and **Figure 11** illustrates that the relationship between corn acreage and ethanol price does not reflect an increase in corn acres induced by a more than tripling of ethanol prices from 2002 to 2012., During this timeframe, despite soaring ethanol prices (likely in response to U.S. fuel policies), sorghum production initially declined, and even upon increased production, it did not achieve a level corresponding to the ethanol price signal.

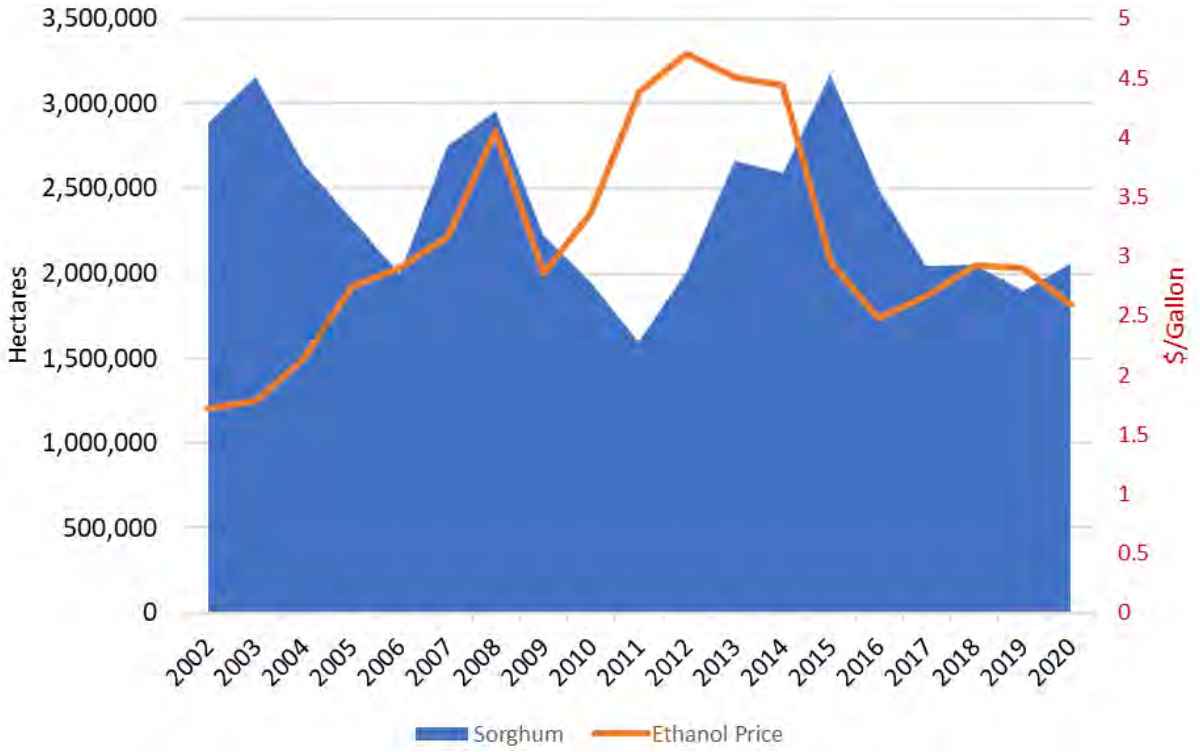

Figure 10. U.S. Sorghum crop area versus ethanol price.
Source: FAO Stat, 2022.

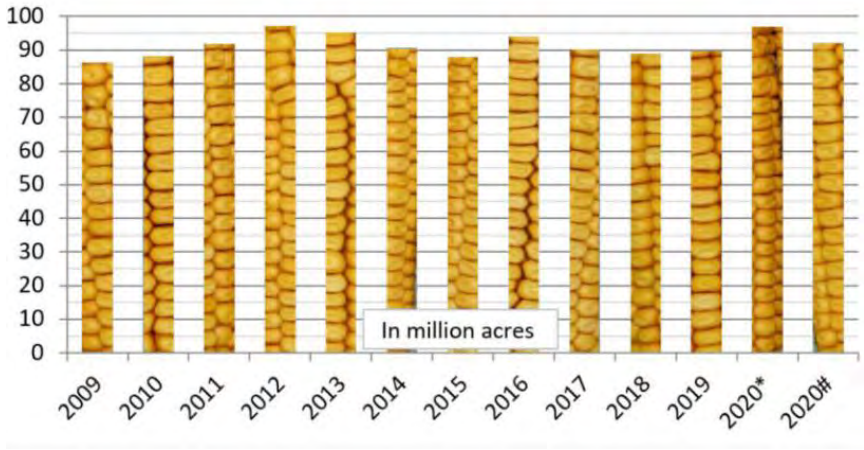

Figure 11. USDA Annual Corn Acreage.
Source: https://www.foodbusinessnews.net/articles/16341-usda-2020-corn-wheat-soybean-acres-below-trade-expectations

2.2 Evolution of the Global Trade Analysis Project Model

The Global Trade Analysis Project (GTAP) is a computable general equilibrium model (CGE[4]) developed at Purdue University. The model uses a database containing global data describing

[4] A CGE model represents the entirety of the global economy (or macroeconomy) and searches for a simultaneous equilibrium on all relevant markets.

bilateral trade patterns, production, consumption and intermediate use of commodities and services. It constrains primary production factors such as capital, labor and land to model the global economy and capture interdependencies between agriculture, the upstream and food industry, as well as the commercial economy and service sectors. The intraregional and interregional linkages of markets and actors are taken into account along with the resulting feedback effects.

Since its application in biofuel LCA, the model has been continually updated to more accurately model biofuel and biofuel crop markets. The most recent database for LUC modeling is the GTAP Version 10 Land Use Database (Aguiar et al., 2019), which includes baseline land cover data by land type and agro-ecological zone (AEZ) for the years 2004, 2007, 2011 and 2014. The GTAP model has also been improved for the treatment of biofuels and by products, called GTAP-BIO (Taheripour et al., 2008). The database has been modified to include data on production, consumption and trade of biofuels including grain-based ethanol, sugarcane ethanol, and biodiesel from oilseeds. Tyner et al. (2010) has updated the GTAP-BIO model (GTAP-BIO-ADV) for recent work to improve the analysis of corn ethanol. GTAP-BIO accounts for the vast majority of corn ethanol-related LUC estimates (Scully et al., 2021).

GTAP uses a Constant Elasticity of Transformation (CET) supply function to estimate the supply of land across cropland, forestry, and grazing land (Gibbs et al., 2010). The CET function used in GTAP is based entirely on U.S. data, but is applied to all the world regions. GTAP can be used to predict LUC in 18 agro-ecological zones (AEZ) and 20 regions including 121 countries worldwide (Taheripour, 2022). The CET function is used to predict how much land is transferred between forests, pastures and croplands, and its LUC outputs are the area of land converted under each category. It has been noted that because GTAP simulates a land scarcity regime, in which biofuel demand results in new land to be cleared (rather than a net land surplus regime in which increased demand for biofuels would result in less land reversion), the methodology is flawed, and should instead be able to account for the possibility of a net reduction in total agricultural lands (Roundtable on Sustainable Fuels, 2008). However, historic patterns show that demand for biofuel crops has outpaced yield improvements, so corn and soybean production are likely to be in the land scarcity regime in the near term.

2.3 CA LCFS Analyses

CARB calculates LUC effects for crop-based biofuels using the GTAP-BIO and AEZ-EF models. Figure 9 illustrates U.S. AEZs. LUC values for size feedstock/finished biofuel combinations are included in the LCFS Regulation (CARB, 2018) (Table 3). These estimates of feedstock emissions are included in estimates of emissions associated with finished fuels for producers participating in the LCFS.

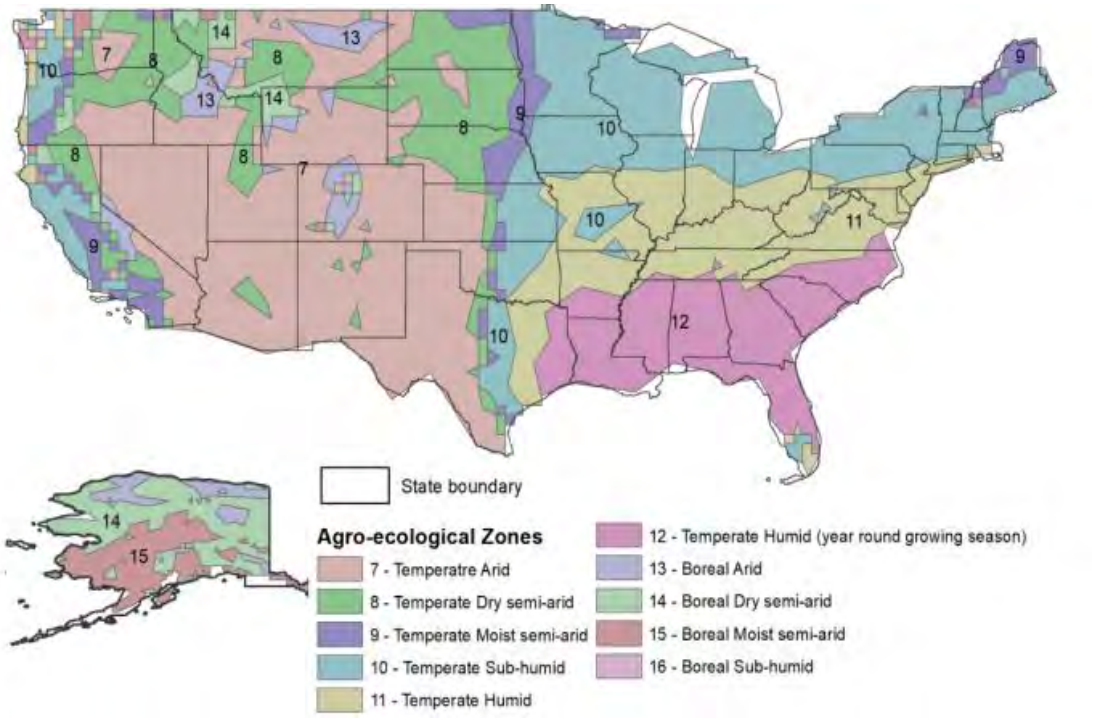

Figure 12. Agro-ecological zones in the U.S.
Source: Kwon et al., 2020.

Table 3. Land Use Change Values Included in the CA LCFS.
Source: CARB, 2014 (Table 6).

Biofuel	LUC (gCO_2/MJ)
Corn Ethanol	19.8
Sugarcane Ethanol	11.8
Soy Biomass-Based Diesel	29.1
Canola Biomass-Based Diesel	14.5
Grain Sorghum Ethanol	19.4
Palm Biomass-Based Diesel	71.4

Land Use Change Effects for Sorghum Ethanol

Starting with the 2004 U.S. sorghum ethanol production level of 0.0005 billion gallons, CARB staff analysis added 400 million gallons of sorghum ethanol shock for a total shock of 0.4005 billion gallons of U.S. sorghum ethanol (

Table 4, Figure 13).

Table 4. CA LCFS iLUC Modeling Results for Sorghum
Source: CARB, 2014 (Table H-10).

Scenario	World-Wide Land Converted (ha)			Land Converted in the U. S. (ha)			iLUC (gCO_2/MJ)
	Forest	Pasture	Cropland-Pasture	Forest	Pasture	Cropland-Pasture	
1	-19,249	-35,614	-152,858	-2,877	-2,664	-137,596	26.0
2	-16,760	-38,348	-154,751	-2,409	-3,270	-139,263	24.6
3	-15,751	-28,567	-145,808	-2,694	-2,409	-133,051	22.1
4	-13,519	-30,988	-147,557	-2,212	-3,107	-134,599	20.9
5	-12,191	-21,125	-137,882	-2,462	-2,048	-127,722	18.2
6	-10,567	-23,210	-139,478	-2,070	-2,774	-129,137	17.4
7	-9,777	-16,306	-131,988	-2,194	-1,946	-123,581	15.7
8	-8,398	-17,960	-133,429	-1,884	-2,450	-124,877	14.9
9	-7,620	-12,403	-125,912	-2,016	-1,747	-119,163	13.3
10	-6,473	-13,698	-127,205	-1,704	-2,206	-120,324	12.7
11	-17,851	-32,199	-153,219	-2,678	-2,045	-137,849	24.9
12	-15,327	-35,076	-155,134	-2,221	-2,909	-139,510	23.4
13	-14,546	-25,396	-146,100	-2,505	-1,950	-133,243	21.2
14	-12,303	-27,711	-147,879	-2,025	-2,531	-134,810	19.8
15	-11,306	-18,956	-138,181	-2,241	-1,665	-127,936	17.6
16	-9,505	-20,812	-139,814	-1,823	-2,293	-129,355	16.5
17	-9,031	-14,594	-132,251	-2,073	-1,505	-123,785	15.1
18	-7,636	-16,304	-133,710	-1,722	-2,078	-125,074	14.3
19	-7,152	-10,803	-126,120	-1,938	-1,407	-119,293	12.9
20	-5,962	-12,120	-127,423	-1,551	-1,800	-120,483	12.2
21	-24,898	-44,570	-152,056	-3,582	-3,522	-137,229	30.7
22	-22,380	-47,629	-153,909	-3,085	-4,389	-138,850	29.3
23	-20,329	-35,449	-145,095	-3,275	-3,142	-132,676	26.0
24	-18,348	-37,950	-146,774	-2,837	-3,878	-134,173	24.9
25	-15,973	-27,102	-137,309	-3,002	-2,829	-127,404	21.4
26	-14,137	-28,937	-138,847	-2,565	-3,462	-128,777	20.3
27	-12,805	-21,290	-131,479	-2,699	-2,660	-123,295	18.1
28	-11,480	-22,947	-132,876	-2,396	-3,121	-124,547	17.4
29	-10,102	-15,827	-125,436	-2,478	-2,370	-118,857	15.2
30	-8,933	-17,166	-126,713	-2,156	-2,934	-120,001	14.6
						Average iLUC (gCO_2/MJ)	**19.4**

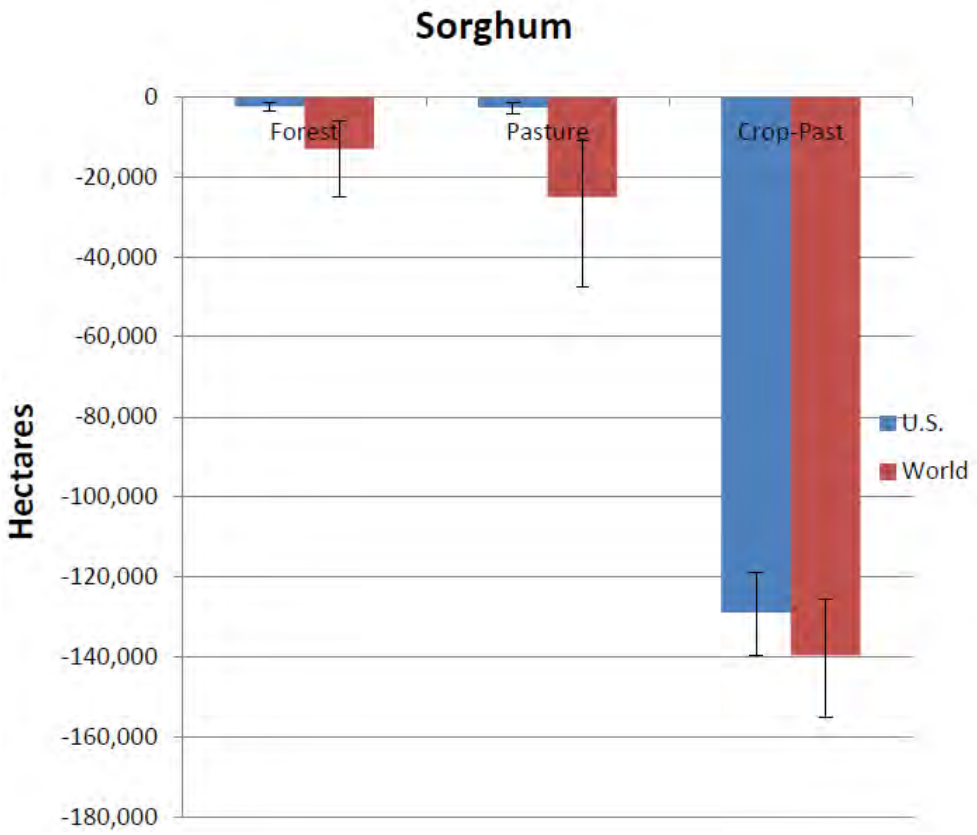

Figure 13. CA LCFS Land Conversion Model Predictions for Sorghum Ethanol.
Source: CARB, 2014 (Table H-10).

Land Use Change Effects for Corn Ethanol

For the CA LCFS GTAP-BIO AEZ-EF model runs, an ethanol production increase of 11.59 billion gallons was assumed for all the modeling runs (
Table 5, Figure 14).

Table 5. CA LCFS iLUC Modeling Results for Corn
Source: CARB, 2014 (Table H-6).

Scenario	World-Wide Land Converted (ha)			Land Converted in the U. S. (ha)			iLUC (gCO_2/ MJ)
	Forest	Pasture	Cropland-Pasture	Forest	Pasture	Cropland-Pasture	
1	-679,524	-1,505,426	-2,506,087	-97,860	-84,389	-1,925,473	28.1
2	-589,400	-1,609,064	-2,566,630	-81,593	-108,799	-1,975,693	26.2
3	-558,686	-1,237,442	-2,283,720	-92,070	-76,823	-1,794,270	23.4
4	-481,687	-1,327,540	-2,339,330	-77,192	-99,437	-1,841,030	21.8
5	-432,457	-965,628	-2,036,552	-85,096	-68,498	-1,643,313	18.5
6	-369,332	-1,040,551	-2,086,458	-71,719	-88,782	-1,685,961	17.3
7	-345,421	-784,225	-1,852,660	-79,454	-61,998	-1,526,570	15.2
8	-292,193	-848,116	-1,898,136	-67,263	-80,671	-1,565,934	14.1
9	-264,442	-620,432	-1,666,646	-73,259	-55,382	-1,403,790	12.1
10	-220,520	-674,327	-1,707,522	-62,308	-72,198	-1,439,634	11.2
11	-627,263	-1,379,371	-2,516,588	-91,386	-70,478	-1,931,292	26.6
12	-536,722	-1,481,523	-2,577,768	-74,994	-93,773	-1,981,956	24.7
13	-515,504	-1,133,500	-2,293,019	-86,069	-64,192	-1,799,643	22.2
14	-438,089	-1,222,011	-2,349,199	-71,008	-85,563	-1,846,810	20.6
15	-398,639	-884,243	-2,044,556	-79,630	-57,100	-1,648,182	17.6
16	-335,317	-958,065	-2,094,974	-66,158	-76,364	-1,691,200	16.3
17	-317,823	-717,813	-1,859,697	-74,356	-51,590	-1,531,038	14.4
18	-264,492	-780,925	-1,905,642	-62,036	-69,336	-1,570,738	13.4
19	-242,760	-568,315	-1,672,745	-68,610	-45,979	-1,407,838	11.5
20	-198,707	-621,187	-1,714,014	-57,560	-61,974	-1,443,985	10.6
21	-892,880	-1,839,556	-2,480,812	-119,115	-108,703	-1,914,876	34.3
22	-803,191	-1,946,081	-2,540,034	-103,125	-134,962	-1,964,431	32.4
23	-734,015	-1,512,311	-2,261,531	-111,872	-99,309	-1,784,429	28.4
24	-657,526	-1,604,739	-2,315,949	-97,260	-123,515	-1,830,565	26.9
25	-568,773	-1,179,392	-2,017,772	-103,252	-88,776	-1,634,382	22.4
26	-506,430	-1,256,748	-2,066,635	-90,125	-110,577	-1,676,452	21.2
27	-455,684	-956,380	-1,836,344	-96,236	-80,530	-1,518,359	18.3
28	-403,097	-1,022,992	-1,880,901	-84,312	-100,550	-1,557,177	17.3
29	-350,740	-755,549	-1,652,757	-88,601	-72,201	-1,396,338	14.5
30	-307,418	-811,583	-1,692,817	-77,892	-90,287	-1,431,683	13.7
						Average iLUC (gCO_2/MJ)	**19.8**

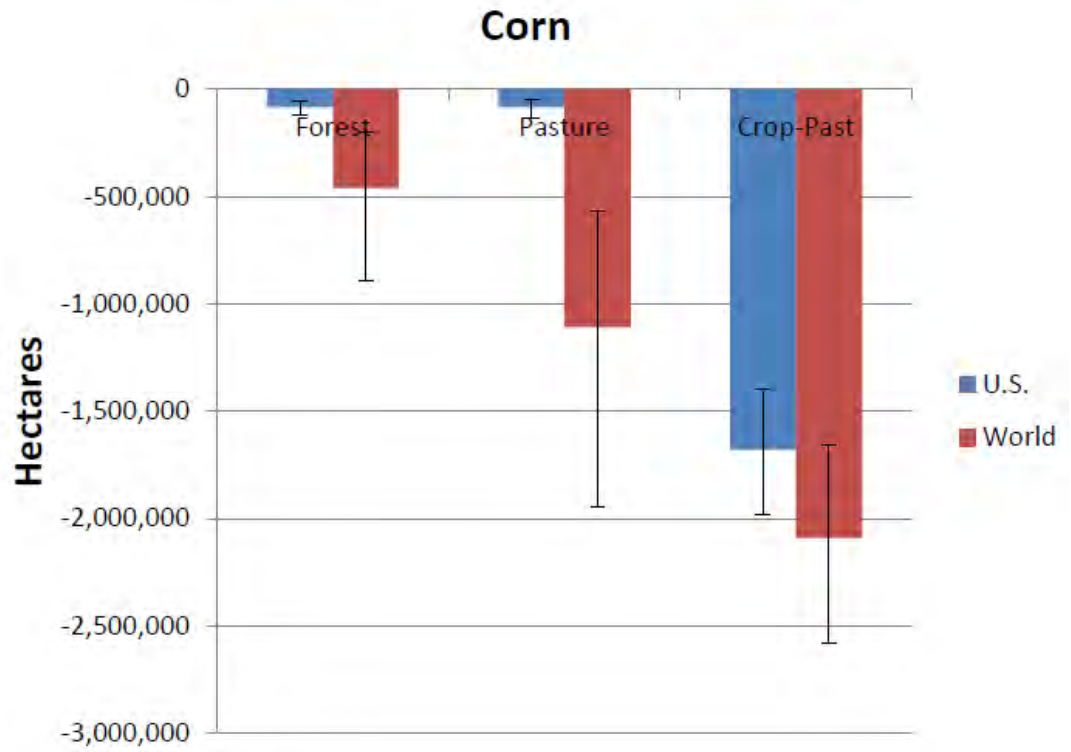

Figure 14. CA LCFS Land Conversion Model Predictions for Corn Ethanol.
Source: CARB, 2014 (Figure H-6).

Comparison of iLUC Values from GTA-BIO AEZ-EF Model Runs

Interestingly, Table 6 illustrates that the average from scenario runs for sorghum ethanol is considerably lower than for corn ethanol.

Table 6. iLUC Values Adopted in CA LCFS, 2018.
Source: CARB, 2014 (Table H-12).

Biofuel	Average from Scenario run (gCO_2/MJ)	Mean from Uncertainty Analysis (gCO_2/MJ)
Corn Ethanol	19.8	21.8
Sugarcane Ethanol	11.8	14.1
Soy Biodiesel	29.1	27.4
Canola Biodiesel	19.4	13.2
Sorghum Ethanol	14.5	22.8
Palm Biodiesel	71.4	72.5

Figure 15 and Figure 16 portray the results from the probabilistic Monte Carlo simulations for corn and sorghum ethanol, respectively, and illustrate the similarity in the resulting distributions.

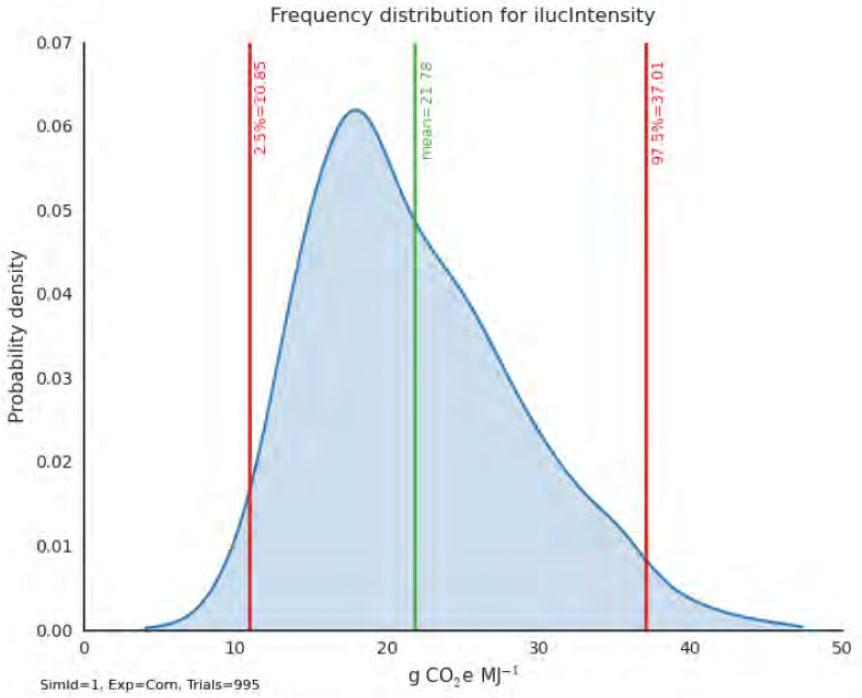

Figure 15. Probability distribution for corn ethanol from Monte Carlo simulations in GTAP-BIO.
Source: CARB, 2014 (Figure H-12).

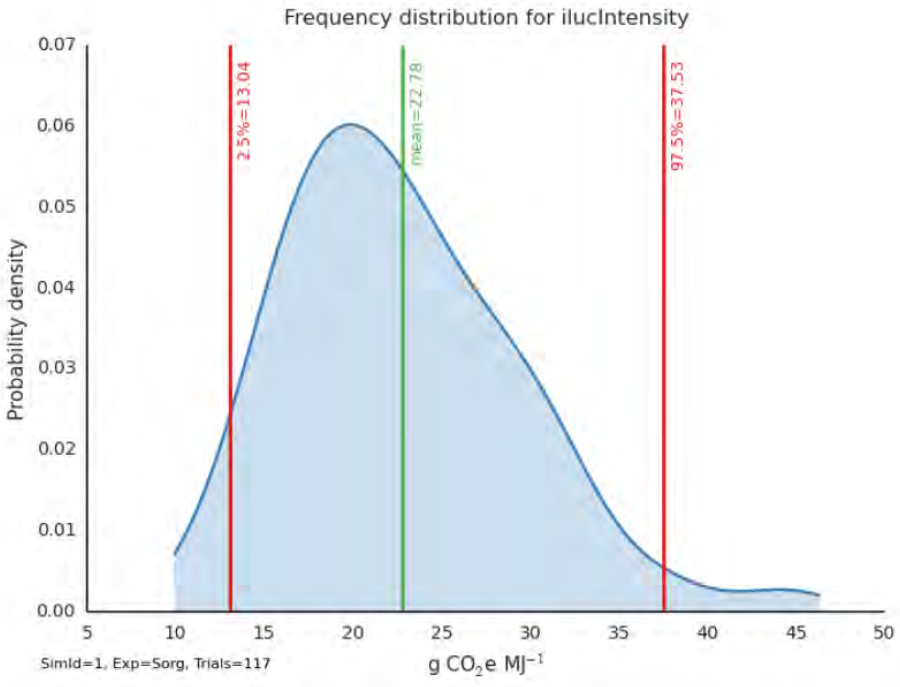

Figure 16. Probability distribution for sorghum ethanol from Monte Carlo simulations in GTAP-BIO.
Source: CARB, 2014 (Figure H-16).

2.4 CCLUB Model

The Carbon Calculator for Land Use Change from Biofuels Production (CCLUB) was developed by Argonne National Laboratory as an integral component of their Greenhouse Gases Regulated Emissions and Energy use in Technologies (GREET) model (Wang et al, 2020) to analyze GHG emissions from LUC and land management change (LMC) in the context of the overall biofuel life-cycle analysis. The CCLUB model calculates CO_2e emissions (accounting for carbon dioxide, nitrous oxide, and methane) associated with LUC/LMC using soil carbon data at the county level (Kwon et al., 2020). To date it has been implemented for four ethanol pathways -corn grain, corn stover, miscanthus, and switchgrass – and for a soy biodiesel pathway. It has not, however, been implemented for a sorghum ethanol pathway. ANL has performed preliminary analysis of iLUC using CCLUB but this analysis has not been published.

CCLUB Update Process

Argonne National Laboratories regularly updates CCLUB. The latest value for corn ethanol LUC, based on the CCLUB GTAP 2013 model, is 3.9 g CO_2e/MJ (Scully et al., 2021), which is almost half of the value estimated from the CCLUB GTAP 2011 model (7.4 g CO_2e/MJ), and approximately one-fifth that of the value in the current CA LCFS regulation (CARB, 2018).

2.5 DayCent Model

DayCent (Figure 17 and Figure 18) is the daily time step version of the Century biogeochemical model (Parton et al., 1994) which operates on a monthly time step. Both models simulate plant-soil nutrient cycling to in turn simulate carbon and nutrient dynamics among the atmosphere, vegetation and soil. The model calculates the flow of carbon, nitrogen, phosphorus, and sulfur using key submodels that include soil water content and temperature by layer, plant production and allocation of net primary production (NPP), decomposition of litter and soil organic matter, mineralization of nutrients, N gas emissions from nitrification and denitrification, and CH_4 oxidation in non-saturated soils. As discussed in Section 1.2 and illustrated in Figure 3, DayCent was linked to the FASOM model as part of the U.S. EPA's Renewable Fuel Standard approach.

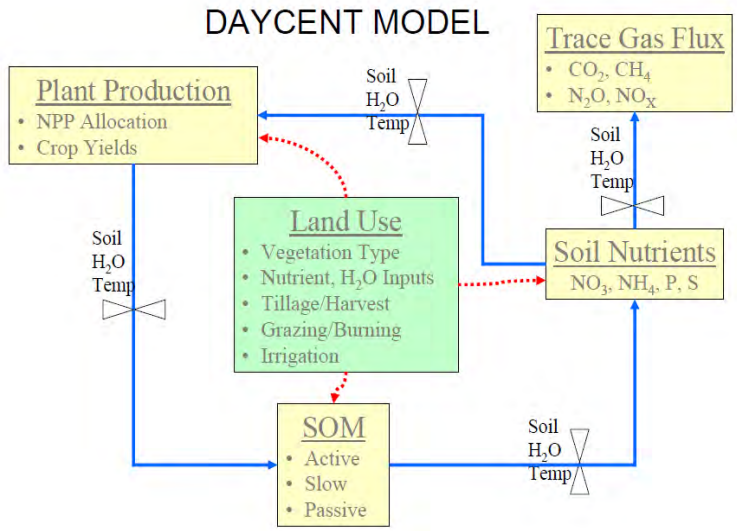

Figure 17. DayCent model primary inputs and outputs.
Source: Ojima in Zhang and Paustian.

The issue of soil carbon storage is illustrated in comments in the literature regarding LUC modeling. The authors of critiques of CCLUB, which represents the newest iLUC analysis from GTAP, (Malins, 2020) argue that the Winrock data for domestic crop conversion is more accurate (which is an option to utilize in GTAP). Much of the debate around LUC estimates, as presented in GTAP, pertains to the use of emission factors associated with soil carbon release. CCLUB uses the CENTURY emission factors as U.S. defaults, and Winrock emission factors as international defaults. **Figure 19** shows the comparison of different emission factors, which support the argument that the higher Winrock emission factors for domestic LUC would be an appropriate estimate; however, this argument is inconsistent with EPA's GHG accounting for the U.S. GHG inventory, which uses FASOM. Shifting to greater corn production from other crops, along with the deployment of low carbon farming practices, stores carbon, as reflected in FASOM and CCLUB. Accordingly, criticisms of the more recent versions of GTAP are at odds with the regulatory results in the 2010 RIA (which utilizes FASOM) and in CCLUB showing negative LUC emissions. Alternatively, the framework for assessing agricultural emissions in the U.S. GHG Inventory can be reassessed.

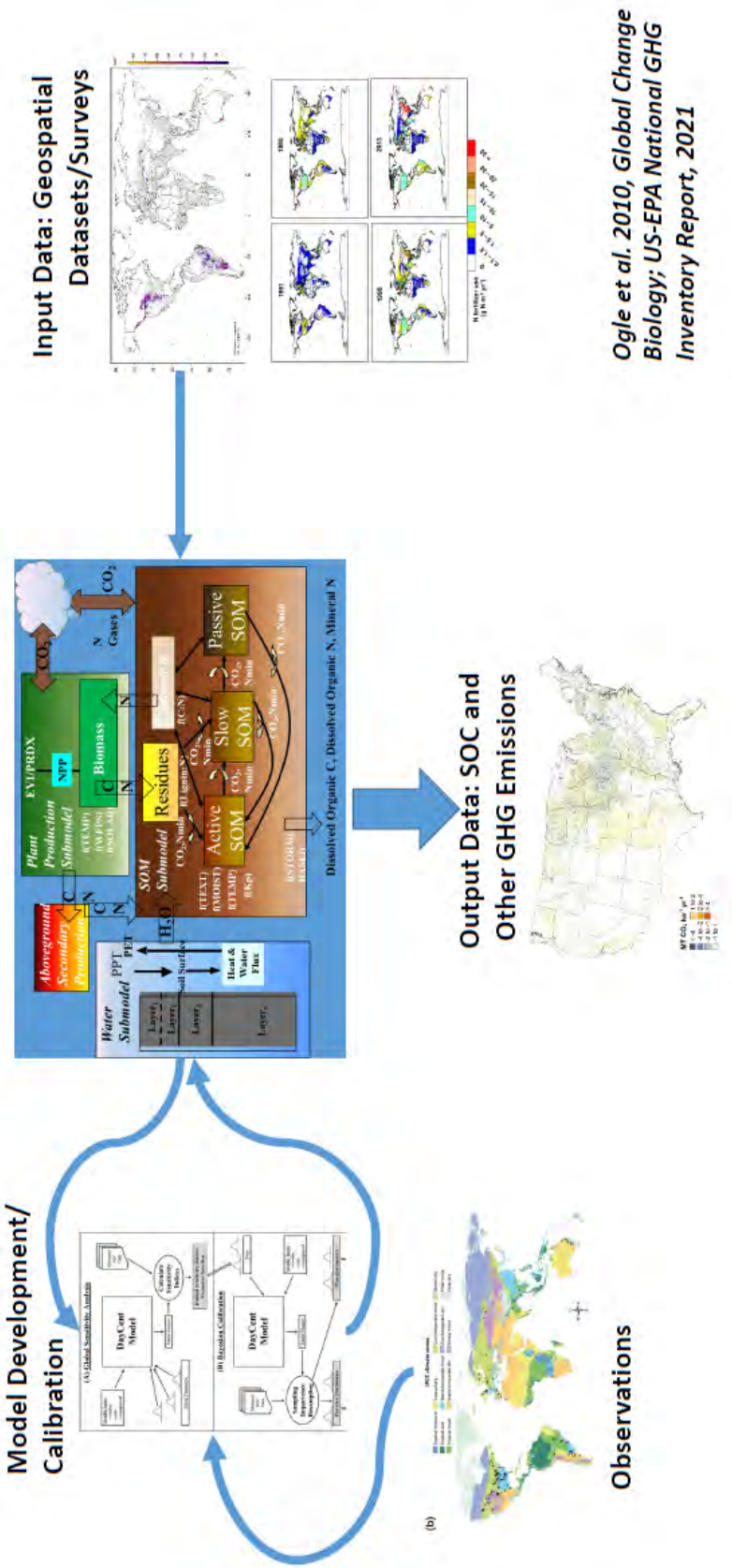

Figure 18. DayCent ecosystem modeling platform.
Source: Ogle, 2022.

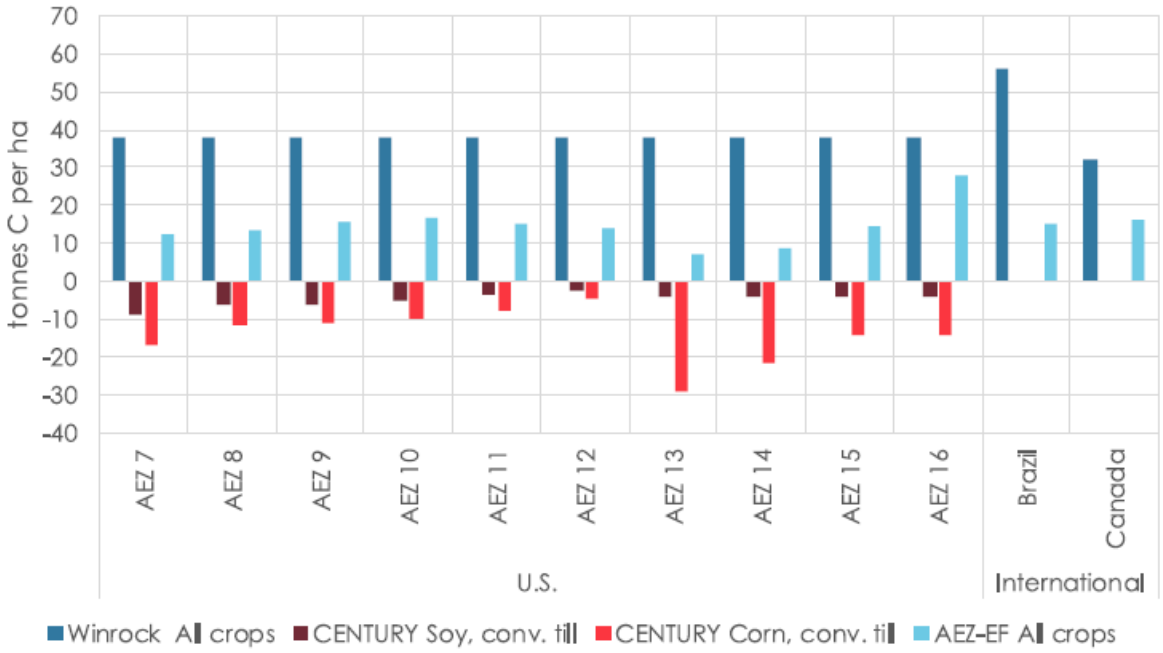

Figure 19. Carbon loss following cropland pasture conversion using Winrock, CENTURY and AEZ-EF emission factor models.
Source: Malins, et al., 2020

A significant outcome of the recently held EPA biofuels workshop (EPA, 2022) was consistent alignment between presentations on the potential for U.S. soil carbon accumulation and the U.S. State Department's strategy for GHG emissions reductions through climate-smart agricultural practices (**Figure 20**).

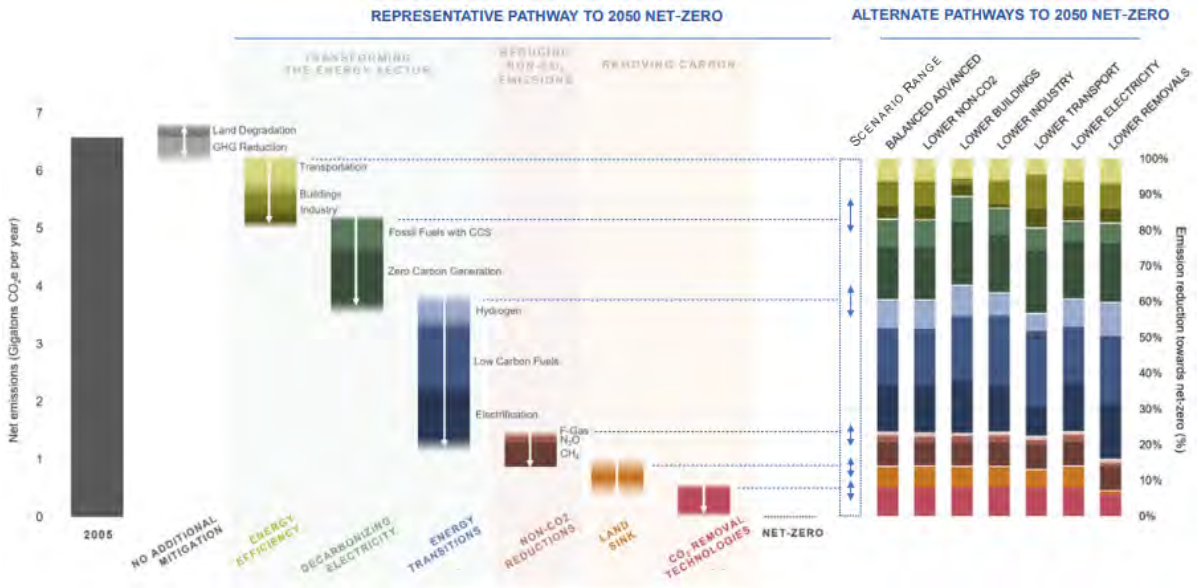

Figure 20. U.S. State Department includes emission reductions based on FASOM in projections to achieve 2050 Net-Zero in the United States.
Source: U.S. State Department, 2021.

Figure 21 illustrates the trends for tillage activity in the U.S., demonstrating the trend for adoption of reduced till and no till across multiple crops in the past decade plus.

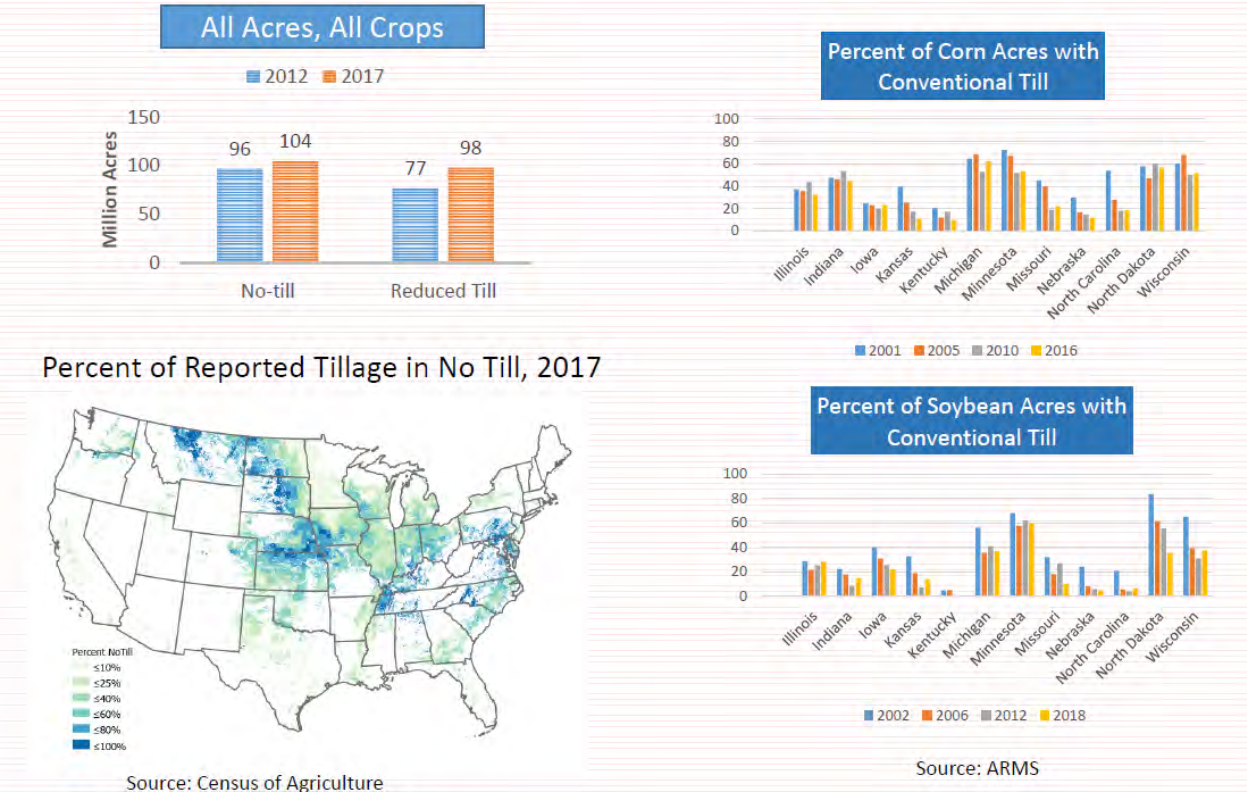

Figure 21. Trends in agriculture tillage.
Source: Hohenstein, 2022.

DayCent analysis is consistent with the CENTURY data used in the FASOM model that predicted a negative U.S. soil carbon change (carbon storage, see Figure 1.1). The relationship between this important prediction in the 2010 RIA and ongoing research was not covered in EPA's recent workshop. The relationship between EPA's FASOM modeling, the U.S. agriculture inventory, and all of the estimates used to determine GHG reductions associated with regenerative agriculture, however, are closely linked. EPA could perform a side-by-side comparison of soil carbon estimations among the modeling systems currently deployed for U.S. GHG accounting and compare those to the predictions in the 2010 RIA; however, this may be a challenging exercise. The latest Purdue analysis provides a revised estimate of iLUC as described in Section 2.2.

3. Model Inputs

This section discusses the inputs incorporated into models that are employed to estimate iLUC.

3.1 GTAP-BIO (CARB)

The input parameters to GTAP for modeling land use changes include:

- Baseline year
- Fuel production increase
- Land use change analysis: the change in biofuel production expected in response to policy.
- Crop yield elasticity: which defines how much a crop yield will increase in response to a price increase (as prices increase, farmers have more incentive to intensify production of their existing crops). A higher elasticity means a greater yield increase in response to a price increase.
- Elasticity of crop yields with respect to area expansion: yields on newly converted land will be lower than corresponding yields on existing crop land.
- Elasticity of harvested acreage response: the extent to which land cost changes affect changes of cropping patterns on existing agricultural lands.
- Elasticity of land transformation across cropland, pasture and forest land: the extent of which types of lands change.
- Trade elasticity of crops: express the likelihood of substitution among imports from all available exporters.

Recent studies, including Scully et al. (2021) recognize that LCAs that reflect the updates listed below, have improved the analysis of iLUC analysis based on the GTAP model. LCAs that incorporate such updates yield a central best estimate of carbon intensity for corn ethanol of 51.4 gCO_2e/MJ (range of 37.6 to 65.1 gCO_2e/MJ) which is 46% lower than the average carbon intensity for neat gasoline. The largest components of total carbon intensity are ethanol production (29.6 gCO_2e/MJ, 58% of total) and farming practices net of co-product credit (13.2 gCO_2e/MJ, 26%), while land use change is a minor contributor (3.9 gCO_2e/MJ, 7%).

(1) market-driven changes in corn production that lowered the intensity of fertilizer and fossil fuel use on farms;
(2) more efficient use of natural gas and recent electric generation mix data for energy consumed at ethanol refineries; and
(3) land use change analyses based on hybrid economic-biophysical models that account for land conversion, land productivity, and land intensification.

3.2 CCLUB

CCLUB inputs include farm management practices including tillage, and sources illustrated in **Figure 22**.

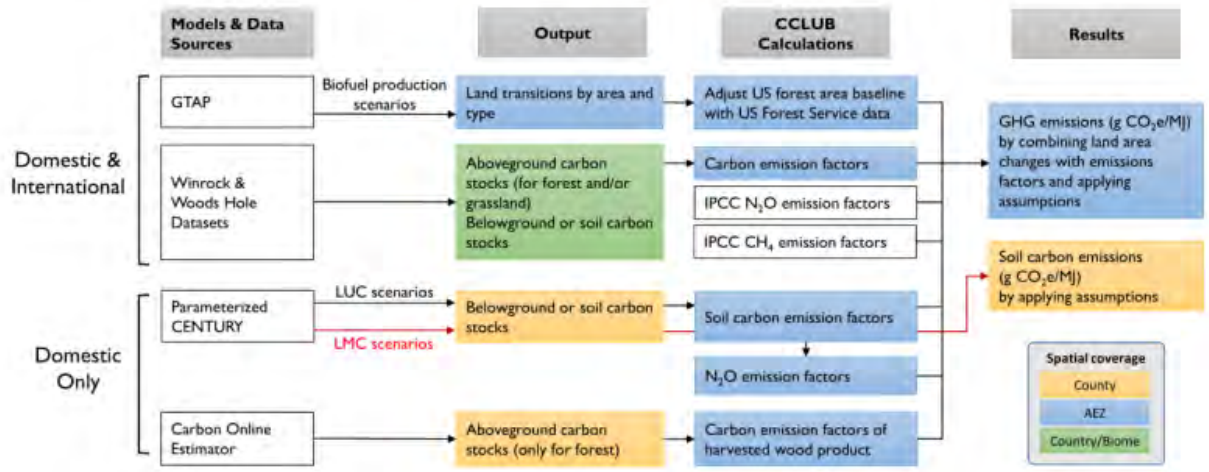

Figure 22. CCLUB model primary inputs and outputs.
Source: Kwon et al., 2020.

The CCLUB analysis of soil carbon storage for corn and sorghum growing regions provides insight into the potential for soil carbon storage. We ran CCLUB (ANL, 2021) for corn for the top-producing sorghum counties in three of the top producing sorghum states (Kansas, Texas, and Oklahoma) and corn states (Iowa and Illinois) that were identified from the USDA National Agricultural Statistics Service (NASS) Quick Stats Database for the years 2018-2020.

3.3 DayCent

Primary inputs to the DayCent model are illustrated in **Figure 23**.

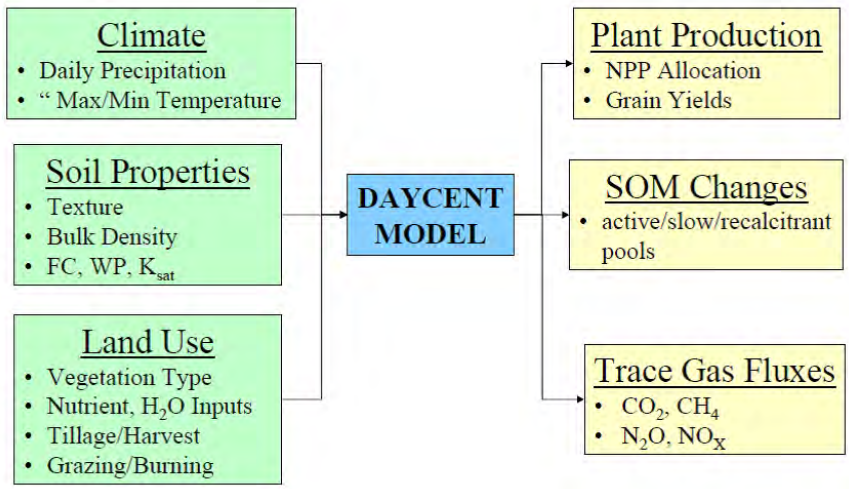

Figure 23. DayCent model primary inputs and outputs.
Source: Ojima in Zhang and Paustian.

4. Results

Running the CCLUB model to compare the GHG emissions associated with LUC and iLUC for farming in corn and sorghum growing regions provides insights in the potential iLUC implications of sorghum. The CCLUB model provides regionally specific estimates of the land use emissions associated with different grain growing regions in the US. The model provides an assessment of the direct soil carbon changes generally associated with a carbon storage component. Examining the net GHG emissions for different grain growing regions provides insight into the potential iLUC for sorghum. Note that the CCLUB model only produces the iLUC results for corn and not for sorghum, nonetheless, the changes in emissions provide an estimate of the effect associated with different crop-growing regions. ILUC values have been employed in several fuel policies. Notably, U.S. policies, such as the CA LCFS (CARB 2015), and EPA RFS (EPA, 2010) report iLUC values for corn and sorghum that are relatively similar (19.8 and 19.4; 26.3 and 28.0, g CO_2e/MJ fuel respectively). As discussed previously, CARB's initial iLUC values (CARB, 2009), which were based on the original GTAP model, were substantially higher than the EPA's and were subsequently reduced using updated versions of GTAP-BIO (CARB, 2015).

4.1 Baseline CCLUB Analysis

Results from running the most recent version (2013) of the CCLUB model for corn ethanol (Table 7) indicate that domestic GHG emissions are negative, and when added to the positive emissions associated with international estimated GHG emissions, result in a much lower iLUC value than currently employed in the LCFS.

Table 7. CCLUB Results for Corn Ethanol – GTAP 2013 Database

LUC Emissions	Forest	Grassland	Cropland-Pasture	Young Forest-Shrub	Sum
Carbon Emissions					
--Domestic Emissions	0.8	-0.1	-3.0	0.1	-2.3
--International Emissions	0.7	3.1	1.8	0.0	5.5
				Total	3.3
N_2O & CH_4 Emissions					
--Domestic Emissions	0.0	0.0	0.0	0.0	0.0
--International Emissions	0.2	0.1	0.2	0.0	0.4
				Total	0.5
Total GHG Emissions					
--Domestic Emissions	0.8	-0.1	-3.0	0.1	-2.3
--International Emissions	0.8	3.2	1.9	0.0	6.0
				Total	3.7

4.2 Effect of Crop Growing Region on Soil Carbon Storage

In order to compare the relative capacity of corn and sorghum to sequester carbon in soil, we ran the CCLUB model in ANL's FD-CIC calculator. The latest version of this calculator (2021) estimates soil organic carbon (SOC) sequestration potential based on corn and not sorghum cultivation. Therefore, to make this comparison, we identified the top producing states and counties for both corn and sorghum (NASS Quickstats, 2022), and ran the model in each of these counties for conventional till and no-till. A comparison of Figure 24 and Figure 25

illustrates that SOC sequestration potential is considerably greater in the top sorghum-growing states than in the top corn-growing states. This may be due to several factors, including sorghum's deeper root structure, and the potential for higher SOC sequestration rates observed in marginal lands (Minasny et al., 2017; Lamb et al., 2021; Bates et al., 2022). Such results lend support for fuel policies to favorably consider the potential for lower carbon-intensive LUC values associated with sorghum production compared to that of corn.

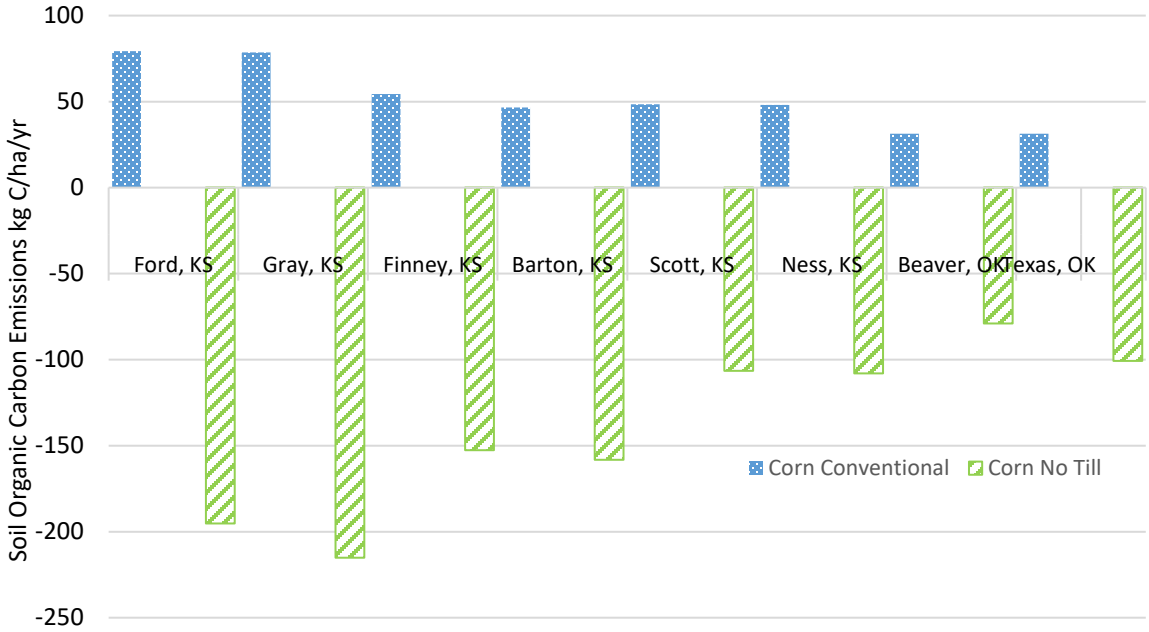

Figure 24. CCLUB results for corn grown conventionally and with no-till in high sorghum-producing states.

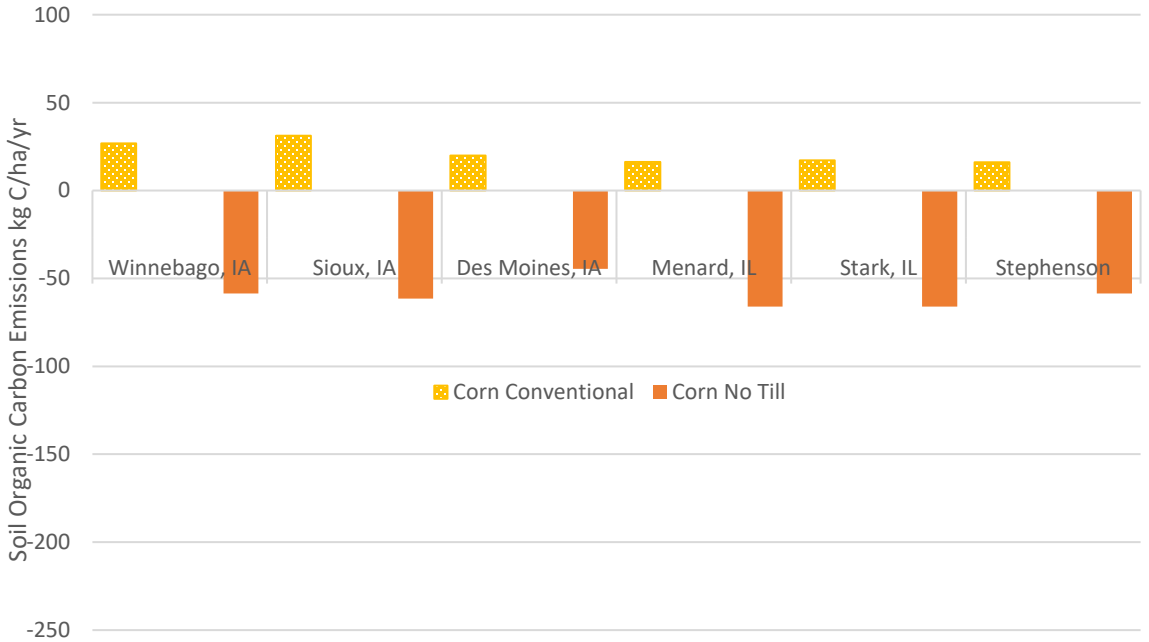

Figure 25. CCLUB results for corn grown conventionally and with no-till in high corn-producing states.

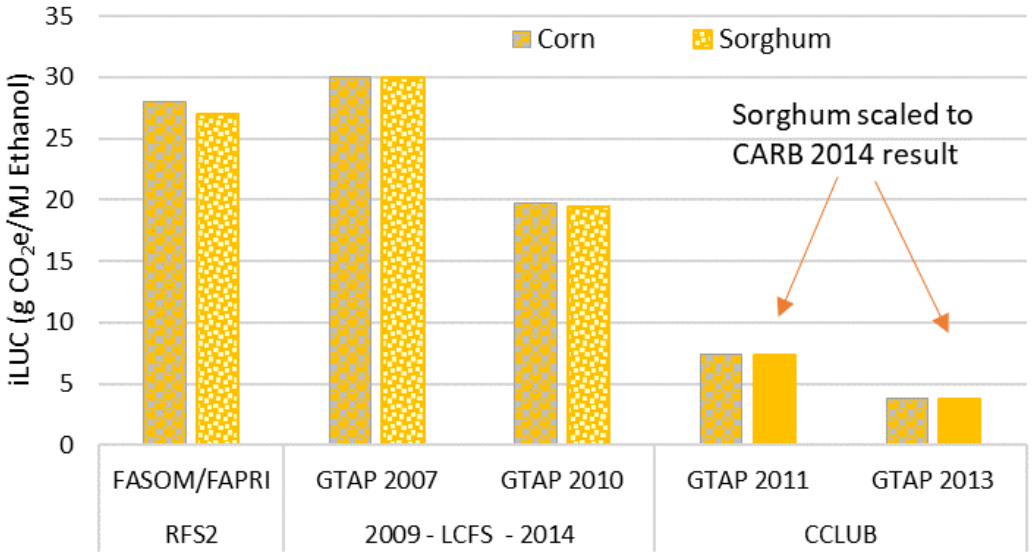

Figure 26. Comparison of iLUC calculations from the EPA RFS2, the CA LCFS, and CCLUB.

Figure 26 compares the prior iLUC results from EPA and CARB to the newer results from ANL's CCLUB model. These results have been frequently published and show that the newer estimates predict a lower iLUC then previously presented. Also shown on the chart are the sorghum results scaled to the same ratio of sorghum to corn in the 2014 LCFS results. ANL plans[5] to further develop the FD-CIC model to cover LUC estimates for other crops, including sorghum, which could provide additional insights.

4.3 iLUC Assessment: Influential Factors

Variability among the LUC estimates can be attributed primarily to differences in four main components: the agro-economic model, economic data year, and land intensification, and yield price elasticity (YPE) (also referred to as YDEL) (Scully et al., 2021). Economic data year refers to the baseline point in time used in agro-economic models for estimating corn ethanol LUC and is significant because it establishes the year in which the agro-economic model is 'shocked' with an expansion of a specified volume of corn ethanol. Land intensification is the practice of using existing cropland more efficiently and is defined as activities undertaken with the intention of enhancing the productivity or profitability per unit area of land. YPE refers to percent change in crop yield change per unit of land.

Of these identified model components, the YPE parameter has received the most feedback from stakeholders, particularly those from biofuel industries. This is because this parameter has special significance in the GTAP-BIO analysis: it has the largest influence on outputs from the model. YPE is a parameter in the GTAP-BIO model which determines how much crop yield will increase in response to a price increase for the crop. It measures sensitivity of yield with respect to a crop price change assuming all other things constant. For example, if price yield elasticity is 0.25, a 10 percent

[5] H. Kwon, personal communication, April 28, 2022.

increase in the price of the crop relative to input cost will result in a 2.5 percentage increase in crop yield.

CARB (2014 – *Attachment 1*) summarized the review of YPE used in the GTAP-BIO model as follows:

"The assignment of a value for YPE for use in the GTAP-BIO model poses important challenges:

- Large majority of data for price and yields are for corn grown in the United States. There are no data for corn production outside the United States. Furthermore, most of the analysis has been for data from the Mid-Western region of the United States.
- Researchers use different econometric methods to derive relationship between yield and price. They sometimes report contrasting values even when using the same data.
- Most of the data used in published studies used data for crop yields and prices for periods that do not represent the current timeframe for biofuel production for the LCFS (2004-2012).
- Besides corn, GTAP-BIO includes paddy rice, wheat, canola, soybeans, palm, sorghum, etc. As currently used, any input value of YPE is used for all crops and regions in the model. Using YPE derived from corn for all crops (and regions) may bias the results one way or the other. The most optimal approach is to use crop and region specific YPEs derived from appropriate econometric treatment of data. However, there are currently no data available to estimate YPE by crop and by region. Hence it is not possible to use regional and crop-specific YPE in the GTAP-BIO model at the present time.
- The model uses the same value of YPE for irrigated vs. rain-fed crops. It is likely that there are different responses to price changes between these two types of agricultural practices in different regions of the world.
- There is limited data for double-cropping for crops for all regions of the world. As suggested by stakeholders, double-cropping can be accounted by using a higher input value of YPE. However, in the current version of the GTAP-BIO model, net increase in crop yields includes effects related to price changes, crop switching, and extensification. Any change in the value of YPE must be calibrated to ensure that only double cropping effects are accounted by any increases in the value of YPE.

Taking all these into consideration and with a wide range of likely values for YPE from published literature, staff used a range of values between 0.05 and 0.35 to conduct scenario runs for all biofuels studied for the LCFS. These input values are used for all crops and regions for the 30 scenario runs conducted for each of the 6 biofuels."

Taheripour et al (2017) reviewed crop yield data from 19 global regions and recommended a YPE range of 0.175–0.325. Scully et al (2021) examined YPE for corn reported in 20 studies published from 1976 to 2017. They calculated a simple average of 0.23, and determined a YDEL central best estimate of 0.25 and a credible range of 0.175–0.325. Eighteen of the analyses that they reviewed had YPE values within that range.

Since sorghum, as a biofuel feedstock, is a substitute for corn, the use of the corn-based YPE is reasonable. However, the prevalent practice of farming rain-fed sorghum as an alternative to

irrigated corn, where the latter isn't considered to be profitable, and the potential for planting sorghum as a double crop, present key differences that support a case for a lower YPE value for sorghum, which could reduce the associated iLUC values estimated in GTAP-BIO. Such scenarios support the argument that the sorghum iLUC value should not exceed that of corn, and arguably could be lower than corn.

5. Discussion

Sorghum is a water-smart, climate resilient crop. Ninety-four percent of U.S. sorghum acres cultivated in the past three years are rain-fed, and the 6% of sorghum acres that are irrigated are done so efficiently given sorghum's water-sipping attributes (SMRP, 2022). Sorghum reduces greenhouse gas emissions and sequesters carbon. Sorghum translocates carbon deeper into soils with its dense and robust root structure. Through breeding innovations, sorghum farmers have successfully adopted no-till or minimum-till practices on 97% of sorghum acres (SMRP, 2022) – meaning carbon is sequestered for longer and deeper than in most cropping systems. Sorghum stalks left in the fields as crop residues contribute to soil health in multiple ways, including by providing organic matter for integration into the soil, enhancing soil structure by reducing compaction and, and by reducing effects of wind erosion and evaporation, thereby retaining soil moisture.

Since CARB last published their iLUC evaluation results, several researchers have studied relationships that improve our understanding of the linkages between, and impacts related to changes in corn ethanol markets and iLUC values, and come to varied conclusions. The following describe several recent studies.

The Coordinating Research Council funded a critical review of CARB's 2015 iLUC methodology (Sierra Research, 2016), and concluded that several of CARB's decisions pertaining to methods for establishing GTAP-BIO parameters and associated ranges led to higher iLUC values and GHG emissions. Lewandrowski et al. (2020) found that iLUC emissions for corn ethanol trend downwards over time and are significantly lower (by 33 – 60%) than the values adopted in the 2010 RFS.

Gautam et al. (2020) ran the DayCent model and found that in rainfed lower midwestern and southern states, sorghum production systems, productivity and carbon sequestration were considerable, indicating support for these bioenergy production systems as land use-based climate mitigation strategies (Figure 27). They concluded that 10.2 million ha of cultivated rainfed land in these same regions demonstrated high productivity with net C sequestration (>10 Mg/ha). The data associated with this study provide spatially explicit support for the analysis of sorghum iLUC.

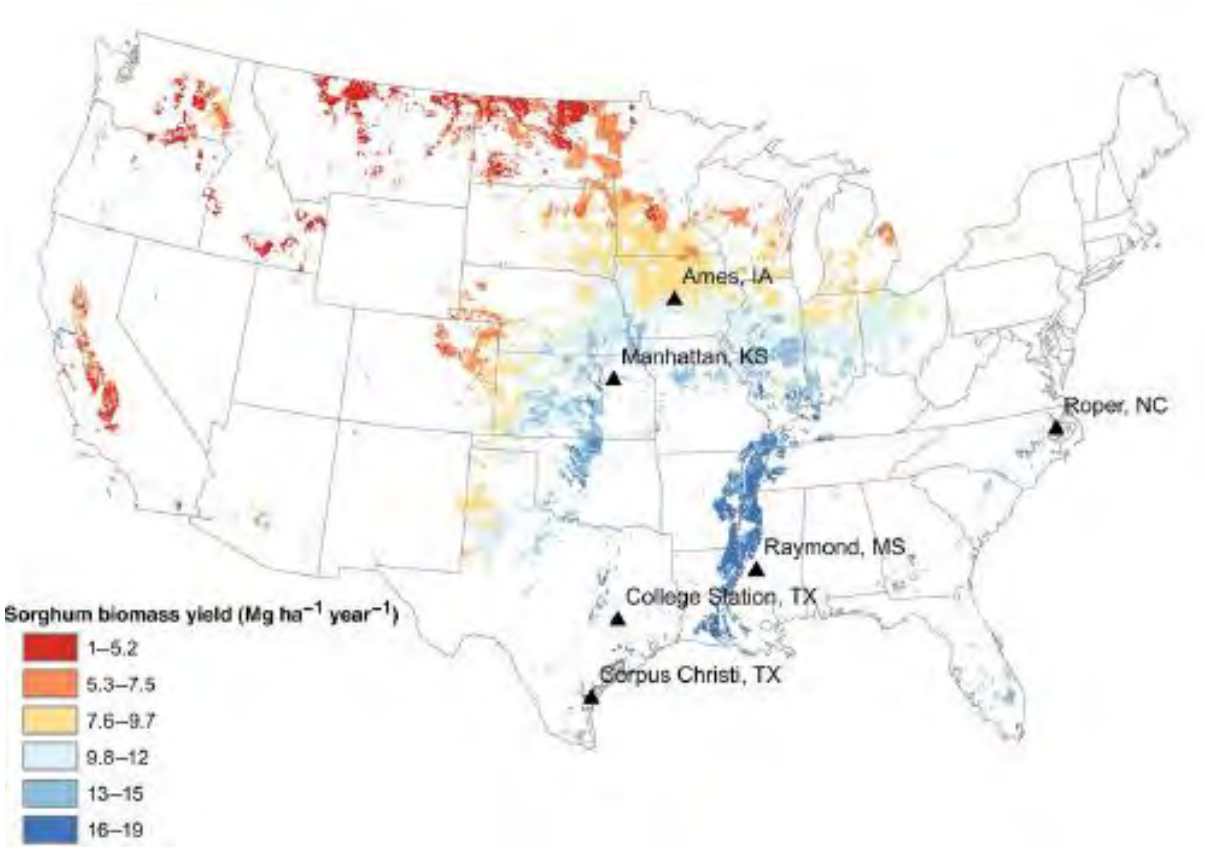

Figure 27. Rainfed biomass yield of sorghum based on the DayCent model.
Source: Gautam et al., 2020.

Malins et al. (2020) concluded that the large reductions in iLUC emissions from CARB's 2015 updated GTAP-BIO modeling reflect subjective modeling decisions based on limited data and analysis that lacks the power to demonstrate causal relationships. Had modelers chosen different subjective parameters or chosen to develop different areas of the model, iLUC estimates may well have risen compared to earlier published values. Key points pertained to:

- Intensive Yield Change
- Cropping Intensity Responses
- Cropland-Pasture Role
- Model Emission Factors
- Extensive Yield Responses

Scully et al. (2021) contend that it is important to consider the time-component involved in GHG emissions accounting, and that LUC is a dynamic property which begins as a large source of emissions, and over time transitions to a net carbon sink, meaning that the initial carbon debt is repaid over time. They point out that the original analyses based upon a 'debt-dividend' framework suggested a payback period for corn ethanol of 48–167 years based upon a relatively small biofuel dividend. As previously discussed, their modeling indicates lower emissions values, based on an increased dividend result. They posit that the timescale for ethanol production is shorter than modeled in previous iLUC calculations, and recommend that

analyses should be updated based on recent data on the carbon content of Midwest prairie lands and the net CI of corn ethanol farming and production relative to gasoline refined from petroleum.

6. Conclusions

Because sorghum and corn interact in the same food and biofuel markets, and exhibit similar price responses to market demand, they are effective substitutes for each other, and assessment of their iLUC values should be similar. Sorghum is primarily sold as animal feed, and secondarily as feedstock for ethanol. In contrast to corn, sorghum is more drought tolerant, and capable of growing on less fertile, marginal lands. As a result, sorghum yields are typically lower than those for corn. Such differences support a case for a lower YPE value for sorghum, which would effectively reduce the associated iLUC values estimated in models such as GTAP-BIO, which is used in the CA LCFS. In addition, because the majority of sorghum is cultivated using no-till or minimum-till, and common harvest practice is to leave substantial crop residue on the fields, current sorghum farming practices greatly contribute to soil carbon sequestration, and reduction of GHGs.

In addition to the market similarities and the farming practice benefits that sorghum provides, as summarized above, regardless of the year and model used, the iLUC of sorghum-based ethanol is shown to be comparable or slightly lower than that of corn-based ethanol (**Figure 4**). The most recent iLUC value modeled for corn from CCLUB is 3.9 g CO_2e/MJ (Scully et al., 2021). Other ongoing research[6] may soon provide updated iLUC values specific to sorghum. However, absent such data, given the strong similarities between corn and sorghum, and the close relationship between respective iLUC values, it is clear that a conservative approach to updating the iLUC for sorghum in any biofuel program, is to set it no higher than that for corn. In the case of the most recent CCLUB results, that would mean establishing a sorghum iLUC no greater than 3.9 g CO_2e /MJ.

[6] H. Kwon, personal communication, April 28, 2022.

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From: Mary Peveto
To: CFP2022 * DEQ
Subject: Clean Fuels Program Public Comment
Date: Thursday, July 21, 2022 3:59:47 PM

Hello,
I'm sending this message regarding the need to expand Oregon's Clean Fuels Program (CFP), and appreciate the opportunity to speak up in support of this crucial program.

I have seen first hand how this program can benefit our communities and create a tangible incentive to businesses to reduce carbon emissions, and other harmful emissions. About six years ago, Neighbors for Clean Air entered into a Good Neighbor Agreement with Vigor, which operates a shipyard on Swan Island. The company agreed to address the sources of the most toxic emissions that might be putting the community, and its own workforce, at risk. From third party analysis it was determined that diesel particulate emissions were the single greatest threat to human health from shipyard operations. But diesel emissions are not regulated under federal or state law. The company therefore voluntarily chose two pathways for reducing the harmful emissions:
1. Change out/retrofit older diesel equipment used on the shipyard
2. Require its customers to forgo burning diesel engines and instead plug in to shore power when docked for repair.

The benefits of these actions have been huge. And the company made the second change, at risk of potentially being less competitive in its market due to the obligation of its customers to comply, because of the benefits to its neighbors in terms of harmful emissions reductions. It wasn't until six years later, that Vigor has realized the economic benefit from the clean fuels program, because of the huge reductions they achieved from idling ships which otherwise would be running their engines burning dirty fuel.

I am a huge supporter of providing market incentives to make our economy and our environment cleaner and safer. Vigor is one anecdotal example of the impact and potential good of the existing program.

But I don't think currently the proposed CFP is enough. The DEQ must maximize the benefits of the CFP for Oregonians and shift the scope of targets for reduced emissions beyond where they already stand. Doing so will boost the health of Oregon's climate and the people living within it, create jobs, ensure that we breathe in cleaner air, and provide funds to the local communities and economies who need it most, allowing them access to sustainable energy infrastructure.

I heartily urge the DEQ to:

-Expand the carbon intensity reduction targets to go beyond the current proposed 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035 at minimum. The less carbon burned, the better our chances at resisting the worst impacts of climate change are.

-Ambitiously bolster goals for the widespread use of clean and electric energy to cut emissions. Oregon is still behind where we should be in achieving our slated hopes for climate protection. Stronger clean fuels targets will help us close this critical gap in our top polluting sector.

-Use the CFP to shield Oregonians from volatile, unreasonably high fuel prices. As more and more folks in our state make the vital shift to electric energy and clean fuel alternatives, we need to use the CFP to establish strong, state-based energy infrastructure such that our bills and gas prices are affordable, and determined right here at home instead of being dictated by mega-polluting fossil fuel companies on the other side of the country.

-Significantly move the needle on emission reduction targets to establish a healthier atmosphere in Oregon and improve economic outcomes for its residents.

Thank you for your time and consideration,
Mary

Mary Peveto
Executive Director, Neighbors for Clean Air

For our latest information, please visit www.neighborsforcleanair.org
503-705-0481
Twitter: pdxair
Facebook:facebook.com/neighborsforcleanair

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Mary Peveto
Executive Director, Neighbors for Clean Air

July 21, 2022

VIA ELECTRONIC FILING

Cory Ann Wind
Oregon Department of Environmental Quality (DEQ)
700 NE Multnomah Street, Suite 600
Portland, OR 97232

Re: Clean Fuels Program Expansion 2022 Rulemaking

Dear Ms. Wind:

Neste appreciates the opportunity to provide these comments on the Clean Fuels Program (CFP) Expansion 2022 Rulemaking published by DEQ on June 29, 2022. Neste is the world's largest producer of renewable diesel and renewable jet fuel refined from waste and residues. Over the past ten years, Neste's transformation journey has taken the company from a local oil refining company to becoming a global leader in renewable and circular solutions. Neste continues to make substantial investments in low carbon technologies and our goal is to reach carbon neutral production by 2035. We intend to supply Oregon with these products so the state can reach the climate goals outlined in Executive Order 20-04 and we look forward to continuing to be a partner in helping Oregon achieve its climate and racial equity goals.

The comments below are regarding materials provided by DEQ in the June 29, 2022 Clean Fuels Program (CFP) Expansion 2022 Rulemaking package and includes several comments that we have already highlighted to the Regulatory Advisory Committee (RAC). We look forward to continuing to work with DEQ on this rulemaking.

Proposed Targets Through 2035:

Neste applauds extending and increasing the Clean Fuel Program (CFP) standards to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035. The proposed standards will not only make significant strides in helping Oregon reach its ambitious carbon reduction goals, but it also sends a strong signal of support for renewable fuels and low carbon fuel programs. The ability to comply with the proposed standards is bolstered by the projected significant growth in renewable fuels production (most notably renewable diesel) over the next few years, as reflected in the most recent 2022 Clean Fuels Forecast[1]. To make these standards attainable and efficient, Neste requests that Oregon continue to pursue a technology neutral approach so that Oregon consumers can obtain renewable fuels faster and at the lowest cost possible.

By attempting to align its CFP program standards with California and British Columbia, Oregon is pursuing consistency and parity across the West Coast low carbon fuel standards. However, since the last RAC meeting on May 26th, 2022, California announced it is considering more stringent CI reduction goals for 2030 than are currently proposed by Oregon in this rulemaking. California is evaluating either a 25% or 30% CI reduction by 2030, whereas Oregon is pursuing a 20% CI reduction. California is very likely to proceed with these higher CI reduction targets for 2030 given the current oversupply of California LCFS credits. This will put Oregon at a disadvantage as it pertains to the introduction of lower carbon fuels and Oregon will not be as attractive as the California renewable fuels market. Neste recommends that DEQ continue to pursue alignment on reduction goals with California, and conduct another rulemaking after California has updated their LCFS regulation.

[1] https://www.oregon.gov/deq/ghgp/Documents/CleanFuelsForecast2022.pdf

Alternative Jet Fuel CI Standard:

Neste appreciates that DEQ re-established parity between the diesel and alternative jet CI standards as part of this latest version of the CFP regulation. However, in light of the newly proposed CI reduction targets for California, we would like DEQ to consider a sustainable aviation fuel (SAF) multiplier to ensure that SAF in Oregon can generate similar credit value as in California. SAF consumption has grown at a slower rate than renewable diesel primarily due to the aviation industry being preempted by the Commerce Clause from participating in state fuels mandates. As a result, SAF customers require all possible incentives to make the switch to SAF, and having parity between the California LCFS and Oregon CFP is of the utmost importance to drive SAF consumption in Oregon. This parity can only be achieved via a multiplier for SAF in the CFP program.

Definition of Renewable Hydrogen:

Renewable hydrogen is a promising low carbon fuel, and DEQ expressed interest in establishing a definition that will further incentivize renewable hydrogen projects. However this latest version of the CFP regulation does not contain a proposed definition for renewable hydrogen.

Neste previously requested that DEQ add hydrogen produced from electricity derived from geothermal, tidal, wave and hydropower to part (1) of the previously proposed renewable hydrogen definition. These additional sources of renewable electricity have a carbon life cycle similar to solar and wind per the National Renewable Energy Laboratory (NREL)[2], and should therefore be added to the definition as shown below.

- "Renewable Hydrogen" definition in OAR 340-253-0040- hydrogen derived from (1) electrolysis of water or aqueous solutions using solar, geothermal, tidal, wave, hydropower and wind; (2) catalytic cracking or steam methane reforming of biomethane; or (3) thermochemical conversion of biomass, including the organic portion of municipal solid waste (MSW)."

Additional Proposals to Consider - Additional Credit Generation:

Neste reviewed the document "Opportunities for Additional Credit Generation" prepared by ICF in March 2022. Neste suggests that DEQ consider these additional opt-in sources of credit generation that are "drop-in" fuels that do not require significant infrastructure or investments to implement.

- Rail Opt-in: The rail sector indicated to Neste an interest in using lower carbon fuels if incentivized under the CFP. As a direct drop-in replacement of fossil diesel, renewable diesel could play an important role in decarbonizing the rail sector in Oregon if allowed as an opt-in fuel and incentivized by the CFP. Should the rail industry use renewable diesel, nearby communities would see added co-benefits of lower criteria and toxic air pollutant emissions. These added benefits are unique to renewable diesel use as noted in CARB's Alternative Diesel Fuels Regulation[3] and further support the incentivizing the use of drop-in lower carbon fuels in the rail sector.
- Stationary Generators Opt-in: The past several years have seen significant growth in the installation of stationary backup generators in several states, including Oregon. Operators of stationary generators have expressed to DEQ and Neste a strong interest in creating incentives to replace fossil diesel with renewable diesel. DEQ should add stationary generators as an opt-in use of renewable diesel to help decarbonize this growing source of reliable power. Similar to rail

[2] https://www.nrel.gov/docs/fy21osti/80580.pdf, September 2021
[3] https://ww2.arb.ca.gov/our-work/programs/alternative-diesel-fuels

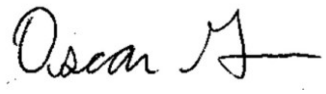
applications, nearby communities would see reduced air emissions if renewable diesel was used in these generators.

Additional Proposals to Consider - Administrative Streamlining and Updates:

We also have a few suggestions that could further optimize the administration of the CFP:

- Pathway Approval Reciprocity: The Oregon CFP has previously established pathway approval reciprocity with California, and we strongly support such administrative streamlining. Neste suggests that DEQ evaluate similar reciprocity with the low carbon fuels programs in Washington, British Columbia, and Canada (federal). This will allow Oregon to more quickly receive innovative low carbon fuels approved by nearby programs considering how similar they are to the CFP.
- Update OR GREET 3.0: Neste requests that DEQ use the most up to date GREET model developed by Argonne National laboratory and other best available data to update OR GREET 3.0. Argonne's GREET model has improved since 2016, the version used by OR-GREET, and is seen as a valuable independent tool to determine CI values of renewable fuels. One major improvement opportunity in the OR-GREET is how the vessel transport emissions for renewable diesel and associated feedstocks are calculated. This gap can be easily addressed by adjusting the OR-GREET to take into account this discrepancy when calculating the actual transportation CI scores for renewable diesel and other renewable fuels that rely on smaller vessel sizes.

We appreciate your consideration.



Oscar Garcia
West Coast Regulatory Affairs Manager
Neste US, Inc.

NORTHWEST
HANDLING SYSTEMS, INC.
The Material Handling Experts

July 21, 2022

Cory-Ann Wind
Oregon Clean Fuels Program Manager
Oregon Department of Environmental Quality
800 NE Oregon Street
Portland, OR 97232

Comment Submitted via email to CFP.2022@deq.state.or.us

RE: Comments on the Oregon Clean Fuels Program Rulemaking

North West Handling Systems, Inc. (NWHS) is a local company in Oregon and Washington. We have been in the business of providing material handling solutions to our customers for the past 50 years. We take great pride in the fact that we are the premier Crown Electric Forklift dealer in the Pacific Northwest. We appreciate this opportunity to provide comments on the recent draft rules released for the May 26 Rulemaking Advisory Committee meeting.

In addition to selling electric forklifts to various businesses in the PNW, we also maintain a fleet of electric forklifts for customers. Some of our customers do not want to make the large upfront financial commitment of owning and maintaining electric forklifts and would rather rent or lease them from us as needed. NWHS has made significant financial investments, in the tens of millions of dollars, in purchasing and maintaining a fleet of electric forklifts for use by our customers.

We recommend the **fleet owner** as the entity to eligible entity to generate credits in electric forklifts, the fleet owner should have priority for credit generation for electric forklifts. The fleet owner is the one who has made the large upfront investment in acquiring the fleet of electric forklifts. Our customers are very price/cost sensitive and focused on cost reduction. The ability to generate credits helps fleet owners offset some of the high cost of equipment acquisition and further promote the use of electric forklifts.

We recommend the text of OAR 340-250-0330 should read:

> (5) Electric Forklifts. For electricity used to power forklifts, the forklift fleet owner may generate the credits. If the forklift is being operated by a person other than the owner, the owner may generate the credits if they have ~~detailed~~ documented usage ~~and charging data~~, otherwise the operator of the forklift may generate the credits.

NWHS carefully monitors usage in its forklift fleet, tracking hour meter usage to ensure that equipment is routinely serviced according to maintenance intervals, therefore as the fleet owner we have good visibility into electric forklift usage. Additionally, we have Crown's InfoLink fleet management system to provide robust information on forklift usage and charging.

We are concerned that some out of state "credit aggregators" are submitting comments to DEQ, requesting that the credit generator for electric forklifts be the 'fleet operator". These credit aggregators have found a niche market to tap into and profit from the dispersed nature of fleet operators, charging high fees and have a credit marketing, selling process that is not transparent. We sincerely urge DEQ not to give into requests by "credit aggregators" to change who has first priority to generate credits for electric forklifts. The fleet owner is the best entity to generate credits. CFP regulation also allows the fleet owner as the credit generator to pass along or designate credit generation.

We appreciate the opportunity to provide comment and look forward to working with DEQ during the rulemaking process and providing additional comments and feedback in the coming months. Thank you.

Sincerely,

Rupesh Sansgiri, CPA
CFO | North West Handling Systems Inc | 1100 SW 7th St | Renton, WA 98057
Phone: 425-255-0500 | Fax: 425-228-6946
rupeshs@nwhs.com | www.nwhs.com

From: David Gardner-Dale
To: CFP2022 * DEQ
Subject: CFP Expansion Comment - NovoHydrogen
Date: Thursday, July 21, 2022 1:28:29 PM
Attachments: image001.png
image002.png
image003.png

Hello,

This is David Gardner-Dale with NovoHydrogen, a renewable hydrogen developer. I am writing to provide a comment on the proposed expansion of the 2022 CFP:

Thank you very much for all of your hard work on this. NovoHydrogen supports and encourages the CFP and the proposed expansion and we appreciate what it will do to incentivize investment in alternative fuels and progress the state towards a decarbonized economy. It is our understanding that the renewable hydrogen pathways in CARB's LCFS may only use renewable electricity sourced from the grid, with associated RECs, for electrolysis itself, while grid sourced renewable power for ancillary, non-electrolysis needs (compression, pumping, storage, liquefaction) is allocated a grid-mix CI, despite RECs sourced and retired for all of the electrolysis and ancillary power needs. I did not see this in my review of the Carbon Intensities section of the proposed rule (340-253-0400), so perhaps this determination was made by CARB for a specific fuel pathway, and is not in the rule itself. I could have missed something however and want to provide this comment in case it is in the rule. The comment will apply to the determination of the fuel pathways in the case this language isn't in the rule.

We encourage DEQ to take a logical approach in determining CI scores for different pathways, updating the rule if needed, so as to not to treat power from the same source with a different CI score based on that power's use. This unreasonably disadvantages certain use cases for renewable hydrogen as a fuel. As an example of this, we have met with a transit district which faces time and space constraints and therefore needs to use liquefied hydrogen because battery electric and gaseous stored hydrogen aren't able to match the fueling rates they need. Liquefaction is an ancillary process to the actual generation of hydrogen via electrolysis, and is quite energy intensive itself. Therefore, under the LCFS fuel pathway this fuel is allocated a high CI score, despite reliance on 100% renewable electricity. The district would be unable to generate the credits they deserve given 100% renewably sourced power, hampering the economic benefit of the CFP despite their earnest transition to a zero carbon fleet and ultimately hurting their ability to make that transition.

Thanks again for all of your work on this,

David Gardner-Dale
Business Development Associate
NovoHydrogen

NOVO HYDROGEN

July 12, 2022

To whom it may concern,

We take this opportunity to submit comments concerning credits advanced under OAR 340-253-1100 for actions that will result in real reductions of the carbon intensity of Oregon's transportation fuels, so-called, “Advance Credits.” In the current draft CFP Rule, downloaded July 8th, 2022, the following vehicle types are eligible to apply for Advance Credits:

A. Medium and Heavy Duty zero-emissions vehicles; and

B. Light-duty vro-emission vehicles if they are part of an organization's plan to fully electrify its light-duty fleet to zero-emission vehicles within a 15-year time period.

Under proposed rules, it is apparent that only battery-electric and hydrogen fuel cell technologies will be eligible to apply for Advance Credits. Throughout the Rulemaking process, Oregon DEQ has maintained that The Department takes a “technology-agnostic” approach toward reducing GHG emissions within Oregon’s transportation sector. In this regard, we do not believe that the proposed approach with regard to Advance Crediting is compatible with The Department’s technology-agnostic approach, because The Department is favoring battery-electric and hydrogen fuel cell technologies over other propulsion technologies that reduce GHG emissions in the transportation sector.

With the above context in mind, we suggest that all propulsion technologies that reduce GHG emissions on a CO_2e / MJ basis below the current CFP-compliance level be considered eligible to apply for Advance Credits. We further request that Oregon DEQ insert language confirming that applications for Advance Credits be judged exclusively on the merits of the project’s ability to reduce GHG emissions.

Thank you for considering our request. We look forward to continuing this conversation, and we will welcome your call or e-mail, any time.

Warm regards,

Alex

Alex Schay
Membership Services
NW Alliance for Clean Transportation
www.nwalliance.net

NW Natural®

250 SW Taylor Street
Portland, OR 97204

503-226-4211
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Mary Moerlins
Director of Environmental Policy & Corporate Responsibility
NW Natural
250 SW Taylor Street
Portland, OR 97204

July 21, 2022

Oregon DEQ
Attn: Cory Ann Wind
700 NE Multnomah St., Room 600
Portland, OR 97232-4100

Dear Cory Ann,

Thank you for the opportunity to comment on the proposed 2022 Clean Fuels Program rulemaking.

NW Natural is a natural gas utility headquartered in Portland, Oregon and serves over 2.1 million customers. Given the current climate imperative, NW Natural is committed to reducing the carbon footprint of our product, as well as helping fleets reduce emissions through the use of renewable natural gas and hydrogen.

The Oregon Clean Fuels Program (CFP) has been instrumental in helping customers reduce their greenhouse gas emissions. We applaud the efforts towards expanding the program, and we believe that changes to the proposed draft will further help accelerate decarbonizing the transportation segment. We are requesting that the DEQ reconsider the role of compressed natural gas (CNG) and hydrogen use given the natural gas grid is decarbonizing over time (similarly to the electric grid), and hydrogen production and availability is growing nationwide.

Specifically:

1. Hydrogen, synthetic methane, and any other gas that can be injected into a common carrier pipeline to produce renewable thermal credits (RTCs) should be eligible for book and claim accounting. Any gas that displaces fossil gas at lower carbon intensities can produce RTCs in M-RETS. Since one RTC is simply a measure of energy, (1 RTC = 1 dekatherm of renewable thermal generation), any RTC pathway should apply to any Oregon CFP pathway. In the current draft rule language only renewable electricity and biomethane qualify for book and claim, and expanding this definition could allow for lower-cost fuels to be used and add flexibility for clean fuels program participants.
2. The current draft does not consider the carbon intensity of natural gas in light of the mandated Oregon Climate Protection Plan (CPP) decarbonization schedule in its claims for which clean fuels will produce deficits in years to come. In addition, the carbon intensity of fossil natural gas has a blanket carbon intensity (CI) of 79.98 gCO2e/MJ even though natural gas utilities can source natural gas from lower-carbon sources (i.e., Certified, Responsibly Sourced Gas Suppliers). The DEQ should consider the decreasing CI of the natural gas grid and alternate sources of natural gas in its calculations.

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3. The current wording around hydrogen CI states that “DEQ may not approve the use of a Table 4 value if it believes the actual operational carbon intensity of the hydrogen will exceed the Table 4 value” (OAR 340-253-0400(3)(c)). NW Natural requests that this wording be changed such that applicable data and analyses must be provided by DEQ to any hydrogen pathway applicant to support these beliefs.
4. NW Natural requests clarification around the only allowing advance credits for hydrogen with a CI of 117gCO2e/MJ or below. Is this CI static for the life of the program? Why is this the only pathway with a stated CI value for advance credit generation?
5. NW Natural has found that barriers remain with incremental purchase costs of alternative fuel vehicles and additional capital required for fueling infrastructure. Therefore, the advance credit mechanism being proposed in the rule making is a much-needed tool to increase alternative fuel adoption. We believe the advance credit mechanism should be applied equally to all alternative fuel pathways. The current bias towards zero emission vehicles appears to be in conflict with the overall goal of the clean fuels program to decrease transportation greenhouse gas emissions, especially when pathways such as biomethane have deeply negative CIs. OAR 340-253-1100 should be revised to allow for advance credit generation from all alternative fuel pathways.

Thank you for considering our comments. Should you have any questions, please reach out to me.

Sincerely,

/s/ *Mary Moerlins*

Mary Moerlins
Director of Environmental Policy & Corporate Responsibility
NW Natural

Statement for the CFP Expansion Rulemaking – Pathways Workshop on February 17, 2022

My name is Tim Bielenberg, owner of Oak Lea Dairy in Aumsville, Oregon which I started in 1974. We're a family-owned business that milks about 450 dairy cows and sells the milk to a local and family-owned milk processor in Vancouver, Washington, and who then distributes our milk through a regional employee-owned retailer.

I know the manure from our cows produces methane, which is why back in 2012 I did the right thing by installing a digester on our farm. We were one of just three facilities to invest in this technology, which was new at the time and requires a dedicated plant operator, tons of time and frankly lots of money to keep operational. Because of these issues, we're the only remaining facility left operating of the three original facilities. When we took over the digester, we looked at producing RNG but it was too expensive for a small family farm like ours.

We don't just help reduce our own carbon footprint but also reduce emissions for others in our community. We receive and process brown grease from local restaurants and bars which normally goes to a landfill to create fugitive methane emissions. We also work with the local biodiesel refinery out of Salem to process their wastewater, further protecting and improving local water quality and creating a sustainable alternative for waste disposal in our community.

One other major barrier facing our operation and others will be the renewal of Power Purchase Agreements that were signed around 10 years ago. Originally, we were offered around $0.10 per kWh but we'll likely be lucky to get $0.03 per kWh on a new PPA when our existing PPA expires. The Oregon Clean Fuels Program represents the only tool left available to help us keep the digester operating, capturing and destroying harmful methane gas before it enters the atmosphere.

Part of our farm's income came from the State of Oregon through Oregon Department of Agriculture in the form of tax credits issued based on tons of biomass put through the digester. Originally the income was $5 per ton and then it dropped to $3.50 per ton but that program ended December 31,2021. It was a large part of our operating income. We are now heavily relying on the Clean Fuels Program to help our digester to stay operating.

We'd like to see a strong policy signal from DEQ for the Clean Fuels Program to incentivize farms like mine across Oregon to reduce methane emissions, the CFP is important for us to support continued operation of the digester on our small farm. The Green-e standard creates uncertainty in three ways that jeopardizes this vision of mine:

1) The Green-e standard currently only allows a 15-year project life because of the New Date. We do not anticipate being able to reset the Green-e New Date. Do you know how much a digester costs and what the Return on Investment is like? We're talking *millions* of dollars on a project that actually does not pencil in today's electricity market environment.
2) The Green-e standard is developed outside of the Oregon DEQ Clean Fuels Program rulemaking process. I'm busy running a small farm, it is a challenge for me to participate

in the CFP stakeholder process, and nearly impossible for small farmers such as myself to engage in monitoring or participating in the Green-e Standard development.

3) Businesses need strong policy indicators to invest in large and complex projects such as on-farm digesters that require significant financial investment and time, especially in light of rock-bottom PPA electricity prices. The Green-e Standard creates significant uncertainty into the future as the Standard continues to evolve independent of the Clean Fuels Program Regulation.

On-farm digesters such as ours at Oak Lea are one of the best tools for Oregon to fight methane emissions while generating renewable electricity – it is low-hanging fruit. Methane is over 25x worse than carbon dioxide in terms of its global warming impact, so I would hope Oregon and DEQ strive to reduce methane emissions first wherever possible.

We are updating our digester continuously so the repowering to reset the new date requirement could cause us to replace components that may have been recently replaced. The New Date requirement in the Green-e Standard will prevent our project and many others from continuing to capture and destroy planet-warming methane emissions and I hope DEQ recognizes the impact that this voluntary standard presents to the Oregon Clean Fuels Program's ability to help incentivize and catalyze methane emission reductions across Oregon farms and existing biogas sources.

Thank you.

Tim Bielenberg
Oak Lea Dairy
11314 Mill Creek RD SE
Aumsville, OR 97325

OREGON BUSINESS FOR CLIMATE

Oregon Department of Environmental Quality July 20, 2022
Attn: Cory-Ann Wind
700 NE Multnomah Street, Suite 600
Portland, OR 97232
Submitted via email to: CFP.2022@deq.oregon.gov

Re: **Public Comments – Support for Expansion of the Clean Fuels Program**

Dear Cory-Ann and the DEQ Clean Fuels Program Staff:

I am writing to express our **strong support for aggressive expansion** of Oregon's Clean Fuels Program.

Context

Oregon Business for Climate is a league of nearly 100 businesses across the state, representing almost 30,000 employees in a range of industries from manufacturing to agriculture to transportation to healthcare. We believe climate leadership is critical to the health of Oregon's industries and communities, and will help our state re-emerge as a leader thriving in the growing clean economy. To that end, **our mission is to advance urgent, ambitious, equitable climate policies and programs designed to help spur innovation and economic opportunity while effectively and responsibly reducing emissions.**

A Rare, Immediate Opportunity

With the global crisis accelerating, we can't pass on smart opportunities to address climate change. Lacking national solutions, every state needs to take meaningful action. Right now, Oregon has an opportunity to expand and strengthen our Clean Fuels Program (CFP) – one of our most effective tools to reduce our dependence on expensive, volatile fossil fuels while building a thriving, clean economy.

Success that Deserves Expansion

In the six years the state has been operating the program, it has cut *six million* tons of greenhouse gas pollution and replaced *one billion* gallons of fossil fuels with cleaner fuels that power our state's economy and our local transportation systems. The program incentivizes both the use of cleaner renewable fuels like biodiesel, renewable diesel, and ethanol for existing vehicles (the immediate solution), and the conversion to electric vehicles (the longer-term solution). **This innovative program is an economic powerhouse, leveraging market forces and spurring over $100 million per year in clean fuels production, innovative technology, and infrastructure investment.**

Benefits for Businesses and Communities

Savvy Oregon businesses with fleet vehicles know that transitioning to cleaner renewable fuels and electric vehicles is a smart move. The long-term savings are well worth it – even without counting the environmental benefits. But, in the case of electric vehicles, the upfront vehicle costs and the need for charging infrastructure can get in the way of what would be an easy investment decision. This is exactly why our CFP is so powerful. The **flow of credits generated by charging a company's fleet vehicles dramatically improves the economics of electrification** and can be used to address upfront costs. At the same time, the program **spurs market-driven investments by others** that drive down costs and expand the market for electrification and cleaner fuels.

And the **benefits extend beyond businesses**. Through the CFP, our state has been able to invest in clean fuel solutions in communities across Oregon. Public transit agencies like TriMet are now able to transition their fleet to electric buses over time, while immediately reducing their climate emissions and improving air quality by using renewable diesel for their existing diesel buses. Several school districts have bought their first electric buses, giving kids a healthier, quieter ride. The CFP has enabled nonprofits like Meals on Wheels and the Native American Youth and Family Center to receive electric vehicles so they can spend more on delivering their services and less on fuel and maintenance. Lower-income residents in Corvallis have picked up grants for electric bikes. And people are seeing electric vehicle charging stations popping up from Pendleton to Klamath Falls to Forest Grove.

As if that weren't impressive enough, the very **same program also cuts harmful local air pollution, leading to healthier neighborhoods and millions of dollars each year in healthcare savings**. Communities near highway corridors can breathe easier and see clean air benefits.

Broader Economic Benefits

The current price shock for gasoline and diesel – driven mainly by Vladimir Putin's war in Ukraine – is another wake-up call showing the clear vulnerability of Oregon's economy. Oregon imports all of its fossil gasoline and diesel fuel. Transitioning away from fossil fuels grows the market for jobs in Oregon, from electrical workers installing EV infrastructure, to jobs at renewable fuels producers like Sequential Biofuels in Salem, Alto Ingredients in Boardman, and soon NEXT Renewable Diesel in Clatskanie. It also means cleaner air and healthier lungs, while protecting us from global economic shocks, and ensuring a **much larger share of our energy dollars keep circulating here in Oregon**.

We Urge Action!

We need to use every smart, effective tool we have to quickly build an equitable clean energy future. To help accelerate progress, **the Oregon Department of Environmental Quality should boost the targets for carbon intensity reduction, expanding the potential of this powerful program**.

Forward-thinking businesses support aggressive expansion of this successful approach. Oregon faces mounting impacts due to climate change, and must do our part to address the challenge. At the same time, we can capture smart policy opportunities like this to support the health of our communities and boost our economy in the process. The Clean Fuels Program has proven it can help us move toward a

better climate future, with economic growth, and energy security. **It's time to ramp up this effective program.**

Thank you.

Sincerely,

Tim Miller
Director, Oregon Business for Climate

July 14, 2022

Cory Ann Wind
Clean Fuels Program Manager
Department of Environmental Quality
Portland, Oregon
Submitted Via Email: CFP.2022@deq.oregon.gov

RE: Oregon Fuels Association Comments to DEQ's Proposed CFP Expansion Rule

Dear Ms Wind:

Thank you for the opportunity to provide comment on the Proposed Rule to expand the Clean Fuels Program.

Without question, the Oregon Fuels Association (OFA) has been critical to the success of Oregon's Clean Fuels Program (CFP). That success has been instrumental in attracting significant capital investment and provided an opportunity for nearly every Oregonian participate in greenhouse gas reduction. Moreover, adoption of this program by locally-owned businesses has helped the program achieve new levels of political and community support. However, that support will quickly dissipate if DEQ continues to pursue overly aggressive and unnecessary regulations that will hurt small businesses and communities throughout the state.

During the Rules Advisory Committee meetings, OFA expressed concerns with the direction and process of the rulemaking, particularly around creating new, expensive, and unnecessary carbon intensity reduction targets by 2035. Again, we believe the state needs to proceed pragmatically and avoid unnecessarily attaching this successful program to untested assumptions and unrealistic targets. For example, Executive Order 20-04 calls for the Department of Environmental Quality to increase the Clean Fuels Program targets from a 10% reduction in carbon intensity in 2025 to a 25% reduction in 2035. This would more than double the current program targets in less than 10-years after the adoption of the program. Even this relatively aggressive change to the program is a better, more pragmatic option compared to the proposed rule.

OFA disagrees with the adjusted targets that exceed those outlined in EO 20-04. OFA offers the following comments to those proposed targets, as well as the process and analysis used to arrive at those targets.

I. DEQ has failed to accurately analyze the cost-effectiveness of this rulemaking.

In order to compare the cost-effectiveness of a program, it is critical to first understand and agree on baseline assumptions, including: emissions reductions achieved through existing regulatory programs, anticipated costs of the CFP as it exists today, and any benefits associated with this specific program (excluding benefits achieved through emissions reductions captured by other programs). During the RAC process, DEQ identified a few of the regulatory changes that have occurred; each of which is critical to include for purposes of understanding the baseline:

- *The Oregon Department of Agriculture adopted rules that will allow up to 15% ethanol to be blended with gasoline (E15) in the state beginning in 2022.*
- *The EQC adopted the Advanced Clean Trucks rule which will require an increasing percentage of trucks sold to be ZEV beginning in 2024.*
- *The 2021 Legislature passed HB 2021 which requires retail electricity providers to reduce greenhouse gas emissions associated with electricity sold to Oregon consumers to 80 percent below baseline emissions levels by 2030, 90 percent by 2035 and 100 percent (i.e., zero emissions) by 2040.*
- *The EQC adopted the Climate Protection Program that sets statewide enforceable limits on greenhouse gas emissions from fossil fuels, including gasoline, diesel, and natural gas.*

Each of the laws and regulations set forth above have received significant analysis. We expect, as does the public, that regulated entities under these programs will comply with the regulations and thereby meet the individual and independent reduction targets of the individual programs (which again have been analyzed and identified by DEQ). In order to establish a baseline for greenhouse gas emissions, DEQ must first review the reduction targets of those programs and include those assumptions in a "business as usual" forecast to determine the "baseline". Or put another way, if DEQ decided to do nothing with this rulemaking, what would the expected emissions reductions and the costs to businesses/consumers be? That would identify a good starting point or baseline to compare against this new, expanded regulation for the CFP.

Frustratingly, however, DEQ has not included those emission reduction expectations in the business-as-usual assumption. Instead, it appears that the agency is trying to include the reduction targets expected in other programs as part of the reductions expected under the CFP expansion rulemaking. In other words, DEQ wants to use the greenhouse gas emissions reductions identified in support of other programs to also support significantly increasing the targets in this rulemaking. This is wrong! Greenhouse gas emissions reductions should only be counted once – regardless of the overlapping nature of these programs.

If DEQ wants to use the emission reductions already acknowledged and accounted for by other programs, then DEQ must also include the anticipated costs to Oregonians, including consumers and small businesses, of those same programs. Otherwise, the public (and then Environmental

Quality Commission) are being asked compare apples (costs of reductions in this program) with oranges (benefits of all program emissions reductions).

OFA supports DEQ allocating specific emissions reductions that will result specifically from expanding the CFP and not associated with the CPP, ZEV, or other new fuel blending regulations. Once an accurate "business-as-usual" baseline is established, we recommend DEQ reconvening the RAC to determine if the proposed rule needs changed. It is imperative that the public understand the costs-effectiveness of this program, the costs associated with those additional emissions reductions, and the specific emission reduction benefits from those same emissions.

II. Cost estimates need to be transparent and understandable by the general public.

Once DEQ develops the scope of emissions reductions beyond the baseline, the agency should then calculate the anticipated cost of credits to achieve the target reductions. Then, using that credit price, DEQ should also inform the public of the average increased cost of diesel and gasoline from the program. Some estimate that the price per gallon to meet the existing standard is over 10 cents per gallon. Since the proposed program will nearly triple from today's standard, what should consumers expect in terms of increased cost per gallon? This should become part of the rulemaking record.

Additionally, DEQ should analyze and inform the public where money generated from regulated parties will go. More specifically, based on the modeling exercise, how much money will go from regulated fuel suppliers and their customers to out-of-state credit generators? We understand that Oregon neither produces nor refines most of our transportation fuels. This means that Oregonians already send money out-of-state to purchase fuel that gets them to work, school, or as discussed below, respond to emergencies. However, this proposal is asking Oregonians to pay even more for fuel and its important to know who will benefit from that increased cost and where those entities (credit generators) are located under the 37% carbon intensity target. The modeling exercise identified where the credits will likely come from. Based on DEQ's expertise, it should also know whether those credit generating activities are likely or even possible in Oregon.

III. A CI of 37% below 2015 levels may be unsafe and needs to be reviewed.

Accessible and affordable transportation systems are critical to public health and safety. Whether it's a local government putting police, ambulance, and fire vehicles on the road or it's a rural homeowner needing to escape wildfire or to operate a generator for drinking water when the power goes out, affordable and available fuels are critical to public safety.

DEQ's proposed reduction target fails to analyze, consider or even acknowledge whether public safety and non-urban populations will continue to have access to available **and** affordable technologies and fuel. In fact, OFA believes that by pushing regulatory standards to areas beyond what is available and affordable (all year round) in the transportation sector could or will create unsafe environments for Oregonians. For instance, renewable and biodiesel are known to gel in cold climates and can be unusable alternatives for diesel engines. In Oregon, those are

very large geographic regions that rely on diesel fuel for heat, school transportation, emergency response, and day-to-day driving needs. Meaning, diesel fuel is still necessary and needs to be affordable and available. Emissions reductions can and should balance our collective goals in addressing climate change, but in a way that recognizes the time frame needed to safely and equitably transition our energy economy.

According to DEQ, the reason to expand the CFP beyond a 25% reduction as called for in Governor Brown's Executive Order was to ensure that credits would be available to incentivize non-electric vehicle and non-renewable/biofuels. In other words, initial modelling demonstrates that Oregon could meet a 25% reduction target using existing technologies. But by increasing the targets to provide increased incentives to new technologies, DEQ is proposing driving compliance scenarios that cannot be equitably shared regionally, geographically, or socioeconomically. DEQ needs to do more to better understand the full implications of moving to more aggressive reduction targets as it relates to economic and geographic safety and well-being of Oregonians to ensure that the costs and benefits are shared.

IV. 37% below 2015 is not cost-effective.

Because DEQ has both admitted that Oregonians could meet a 25% reduction target with existing programs and incentives, and also failed to produce the necessary information needed to understand and analyze what the additional costs will be for a program moving from 25% to 37% above an accurate business-as-usual baseline, OFA does not believe that the new target is cost-effective and could be proposing to regulate the same greenhouse gas emissions with a multiple (and expensive) regulations. According to DEQ, the proposed rule could cost Oregon drivers between $544 million to nearly $1.3 billion in 2035 and will only deliver a fraction of that in health benefits (estimated at $84-87 million annually). The costs are significant and as demonstrated by DEQ unlikely deliver comparable benefits, especially since DEQ failed to attribute the specific reductions of this program only.

V. CI reductions of 37% below 2015 goes well beyond what other state's have adopted.

No other state has set such aggressive reduction targets. As a result, DEQ has failed to provide the technical and economic studies of comparable economic reduction measures implemented in other states that demonstrate that the new aggressive targets are either economically viable or technologically feasible.

VI. Improve diesel exemption reporting rather than focus on additional reporting obligations.

The proposed rule provisions are largely designed to benefit credit generators without doing anything for regulated fuel suppliers and their customers. One request OFA has made for years is to ease the reporting requirements for exempt fuel under ORS 468A.277. More specifically, we believe it makes more sense to create a rebuttable presumption that all dyed diesel is exempt unless reported as a covered fuel. Afterall, for many fuel distributors most of the transactions associated with the exempt uses are exempt-use dyed diesel.

Dyed diesel represents a small fraction of covered fuels sold in Oregon. Yet, the regulatory burden for dyed diesel is overly-burdensome. If the agency is truly looking for opportunities to assist Oregon's fuel suppliers as they navigate these new regulations (and the newly created CPP), DEQ needs to change the reporting and oversight for exempt fuel transactions. The most meaningful change is to allow a reporting entity to only report on non-exempt dyed diesel sales/transactions.

VII. OFA supports CFP review in 2029, but recommends a similar review occur in 2025.

OFA agrees that DEQ should regularly review the efficacy of its programs and regulations. In this case, that should mean more than a single planned review. While we agree that a review in 2029 makes sense because of the approaching 2030 intensity target of 30% below 2015 levels, we also agree that a similar review should be done in 2025 as the program reaches its statutory target of 10% below 2015 levels. As explained above, however, unlike the current rulemaking both reviews should focus on the costs and benefits of only the CFP and not count reductions that are occurring in other programs or as a result of other regulations.

Again, thank you for the opportunity to provide comment. If you have any questions or concerns, please do not hesitate to contact me.

Sincerely,

Mike Freese
Oregon Fuels Association

PACIFIC PROPANE GAS ASSOCIATION

July 21, 2022

Sent via e-mail to: CFP.2022@deq.state.or.us

Ms. Cory-Ann Wind
Oregon Clean Fuels Program Manager
Oregon Department of Environmental Quality
700 NE Multnomah Street
Portland, OR 97232-4100

Re: PPGA Comments regarding DEQ Clean Fuels Program Expansion 2022

Dear Cory-Ann:

Thank you for the opportunity to provide feedback on the Oregon Department of Environmental Quality's (DEQ) Clean Fuels Program (CFP) Program Expansion.

The Pacific Propane Gas Association (PPGA) is the state trade association representing Oregon's propane industry. Our membership includes small multi-generational family businesses and large companies engaged in the retail marketing of propane gas to Oregonians. PPGA members provide propane to the residential, commercial, agricultural, transportation and industrial markets throughout Oregon. Currently, users of propane have found value in propane's environmental benefits, versatility, and affordability.

As submitted in our comment letter following the third Rules Advisory Committee meeting, the PPGA continues to recommend removing the carveout under OAR 340-253-0320 (5)(ii), which makes a forklift fleet owner the first fuel reporting entity for fossil propane used in forklifts. We urge you to remove this provision and make the entity that owns the fueling equipment through which propane is dispensed the first fuel reporting entity for all types of vehicles, including forklifts.

The PPGA supports this change in the CFP for the following reasons.

1. **Provides consistency with treatment of fossil LPG/propane that is dispensed for use in other vehicle types.** The current rule outlines when fossil LPG/propane is dispensed for use in a motor vehicle the person that is eligible to generate credits is the owner of the fueling equipment at the facility. The PPGA believes there are advantages for the CFP to having one regulatory structure and the clarity that brings. As written, the rule promotes inefficiencies, as it creates a carveout for only one particular type of vehicle.

2. **The owner of the fueling equipment provides the best visibility for the use of LPG/propane as a forklift fuel.** To better encourage the use of cleaner fuels like LPG/propane in the forklift market we believe it is imperative the owner of the fueling

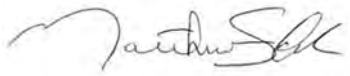
equipment have first rights to the credits. Navigating through the credit market to unlock the program's incentives is a difficult undertaking and many forklift fleet owners likely do not have the time, knowledge, or resources to work through the process of receiving credits for propane, leaving money on the table and potentially disincentivizing the production and use of lower carbon fuels. Successful transition to cleaner LPG/propane forklifts is typically driven by the propane company.

3. **More Efficient Reporting.** The PPGA believes the DEQ will receive more accurate and streamlined reporting information if the owner of the forklift fueling equipment has the first right to generate the credits in the CFP. Under this scenario there are fewer entities that are also more accustomed to reporting to administrative agencies like the DEQ. Additionally, having the forklift operator be eligible for first rights of credit generation increases the risk of double counting in the program. For example, an importer may be blending fossil LPG/propane (90%) and renewable LPG/propane (10%) and selling the (90/10) blended LPG/propane to a forklift operator. The importer may then claim 10% renewable LPG/propane credit, but the forklift operator may mistakenly account it as 100% fossil LPG/propane resulting in a double count of 10% of the gallons. Having the owner of the equipment having the first right to credit generation will avoid this situation.

We urge you to designate the owners of propane dispensing equipment as the first fuel reporting entity for all types of vehicles including forklifts.

Thank you for allowing us to share our feedback.

Sincerely,



Matthew Solak
Executive Director
Pacific Propane Gas Association

PACIFICORP

Pacific Power |
Rocky Mountain Power
825 NE Multnomah, Suite 2000
Portland, Oregon 97232

July 21, 2022

Cory Ann Wind
Clean Fuels Program Manager
Oregon Department of Environmental Quality
Submitted by email to *CFP.2022@deq.oregon.gov*

Re: PacifiCorp's comments on the Clean Fuels Program Expansion 2022 Rulemaking

Dear Ms. Wind:

PacifiCorp, d/b/a Pacific Power, appreciates the opportunity to provide these brief comments in support of the Clean Fuels Program (CFP) generally and the proposed rules pertaining to electricity in the CFP Expansion 2022 Rulemaking.

In PacifiCorp's experience, the CFP has contributed meaningfully to the advancement of transportation electrification (TE) in Oregon, and it represents an important and complementary component of PacifiCorp's broader portfolio of TE programs. Using revenues from the sale of CFP credits, PacifiCorp manages a grant program, grant matching and outreach and education programs to inform and encourage TE adoption among its customers. As an example of the impact that the CFP has had, since 2020, PacifiCorp's CFP-funded e-mobility grant program has awarded nearly $2 million in grant funding to 20 organizations throughout Oregon.

PacifiCorp supports the proposed rule changes in the CFP Expansion 2022 Rulemaking without further revision. Thank you for your continued work on the successful operation of the CFP, and for the opportunity to offer these comments of support.

Sincerely,

Zepure Shahumyan
Dir. Energy and Environmental Policy, PacifiCorp

PINESPIRE™

July 21, 2022

Oregon Department of Environmental Quality
Clean Fuels Program - Rulemaking 2022

Re: Comments on Proposed Changes to the Clean Fuels Program Regulation

PineSpire appreciates the opportunity to participate throughout the Rulemaking process and to provide comments on the proposed revisions to the Clean Fuels Regulation.

PineSpire participates in the CFP as a credit aggregator which allows us to partner with a wide range of Oregon businesses and foster broad participation in the CFP program. In our experience, the CFP is an entry point for a businesses to evaluate fleet electrification and realize the financial benefits of low carbon fuels and technologies. Our comments are focused on regulatory updates that will have an immediate impact on Oregon businesses, from mom-and-pop to national entities.

1) Expansion of Carbon Intensity Targets

We strongly support DEQ's intention to strengthen the Carbon Intensity targets. At a time of volatility in conventional fuel and low carbon fuel markets, its critical for the DEQ to provide long term market signals and regulatory certainty. Updates to the targets will continue to fuel investment in alternative fuels and alternative fleets.

2) Clarifications on Forklift credit generator

We appreciate the time the RAC and DEQ has taken to consider the role of rental fleets in the adoption and implementation of electric equipment, particularly forklifts. The current proposed rule updates provide significantly increased clarity on the rights and responsibilities of credit generators. We urge DEQ to provide further clarification about how the transition to the revised rules around forklift credit generation would be implemented as soon as practical.

In support of the draft changes, PineSpire wants to emphasize the following reasons for continuing to allow forklift fleet owners, including rental fleet owners, to generate CFP credits:

- Incentivizing rental fleet owners to invest in electric fleets and promote electric rentals encourages adoption and implementation of electric equipment at a larger scale than working only through incentivizing each individual fleet operator. Many businesses rent electric to 'test it out' before committing to converting their fleet.
- The fleet owner is making the capital investment and responsible for O&M expenses in the electric equipment and thus fleet owners receiving the CFP revenue aligns with their significant financial investments.

3) Program Administrative Efficiencies: API integration for OFRS

We applaud DEQs ongoing efforts to integrate accurate data into all aspects of the CFP program, including in the more detailed reporting requirements drafted in many sections of this rulemaking. PineSpire recommends extending this consideration into the functionality and efficiency of the OFRS platform. As the CFP participation and complexity grows over time, it is increasingly important to establish technology update processes.

There are significant opportunities to increase the efficiency of registrations and submittals that would reduce the staff burden to DEQ, allowing your team to focus on more complex tasks requiring their expertise. This would also allow participants to focus more resources on low carbon fuel technologies and adoption rather than reporting. Examples include adding the ability to have API integrations, increased functionality of managing registration statuses and corresponding with staff under specific FSEs or RUs, verifying forklift eligibility by serial number not by location (similar to other eligible vehicle classes).

Thank you for consideration of our comments.

Sincerely

Ryan Huggins
President
PineSpire

POET

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July 21, 2022

Cory Ann Wind
Oregon Department of Environmental Quality
700 NE Multnomah Street
Portland, Oregon, 97232

Submitted via email to CFP.2022@deq.state.or.us

RE: Clean Fuels Program Expansion Proposed Rulemaking

Dear Ms. Wind:

POET, LLC, the world's largest producer of biofuels, applauds the Oregon Department of Environmental Quality (DEQ) for taking steps to expand the Oregon Clean Fuels Program (CFP). In March 2020, Governor Kate Brown directed the Department of Environmental Quality through Executive Order (EO) 20-04 to amend the CFP to achieve a 20% reduction in Oregon's transportation fuels' average carbon intensity (CI) from 2015 levels by 2030 and a 25% reduction by 2035.[1] In response to this EO, DEQ is proposing to extend and increase the Clean Fuel Standards to 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035.[2] On March 31, 2022, DEQ held a Rulemaking Advisory Committee (RAC) meeting to discuss the CFP expansion. DEQ published a Notice of Proposed Rulemaking for the CFP expansion on June 29, 2022. These comments are in response to the CFP expansion rulemaking and the RAC meeting. POET supports the expansion of the CFP and looks forward to working with DEQ to meet its CI reduction goals.

About POET

POET's vision is to create a world in sync with nature. As the world's largest producer of biofuel and a global leader in sustainable bioproducts, POET creates plant-based alternatives to fossil fuels that utilize the regenerative power of agriculture and cultivate opportunities for America's farm families. Founded in 1987 and headquartered in Sioux Falls, POET operates 33 bioprocessing facilities across eight states and employs more than 2,200 team members. With a suite of bioproducts that includes Dakota Gold and NexPro feed, Voilà corn oil, purified alcohol, renewable CO_2 and JIVE asphalt rejuvenator, POET is committed to innovation and advancing powerful, practical solutions to some of the world's most pressing challenges. Today, POET

[1] Executive Order Number 20-40, Office of the Governor, State of Oregon (March 9, 2020) https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf.
[2] Oregon Department of Environmental Quality, *Notice of Proposed Rulemaking, Clean Fuels Program Expansion 2022 Rulemaking*, 13 (July 19, 2022) https://www.oregon.gov/deq/rulemaking/Documents/cfp2022pnp.pdf.

holds more than 80 patents worldwide and continues to break new ground in biotechnology, yielding ever-cleaner and more efficient renewable energy. In 2021, POET released its inaugural Sustainability Report pledging carbon neutrality by 2050.

In its discussion of expanding the CFP, DEQ has stated that "the proposed targets should allow for a wide range of low-carbon fuels to compete as a replacement for gasoline and diesel," and DEQ identified biofuels among the replacements that can help the state meet its CI reduction goals.[3] POET strongly agrees with that view. POET supports the Oregon CFP's goal of reducing greenhouse gas (GHG) emissions from the Oregon transportation sector and the effort to expand the CFP. Increasing renewable alternatives aligns with POET's mission and is essential to mitigating climate change and protecting human health and the environment.

Conventional bioethanol has the capacity to generate substantial CI reductions (and corresponding credits) under the CFP while reducing other harmful air pollutants such as BTEX compounds (benzene, toluene, ethylbenzene, and xylene) and $PM_{2.5}$.[4] POET recommends that DEQ address the below issues in the CFP to maximize, incentivize, and accurately account for biofuel lifecycle CI reductions.

Opportunities for Credit Generation

During the March 31 meeting, the RAC explored opportunities for additional credit generation as DEQ expands the CFP and discussed an ICF report entitled *Opportunities for Additional Credit Generation*. The report, drafted at DEQ's request, reviews recent technologies and identifies possible sources for CFP credit generation.

a. Upstream CI Improvements for Biofuels

ICF identified upstream CI improvements for ethanol as an avenue for increased credit generation. The report discusses domestic farm inputs and fertilizer use as well as the adoption of clean energy for use in fuel production as credit generating opportunities.[5] POET agrees with ICF that farm-level CI reductions and use of clean energy in fuel production present opportunities to reduce biofuels' CI and generate credits.

Bioethanol is poised to continue to make significant contributions to the CFP moving forward. As shown in the chart below, a recent analysis by Scully *et al.*[6] shows that bioethanol carbon intensity values have decreased over time.

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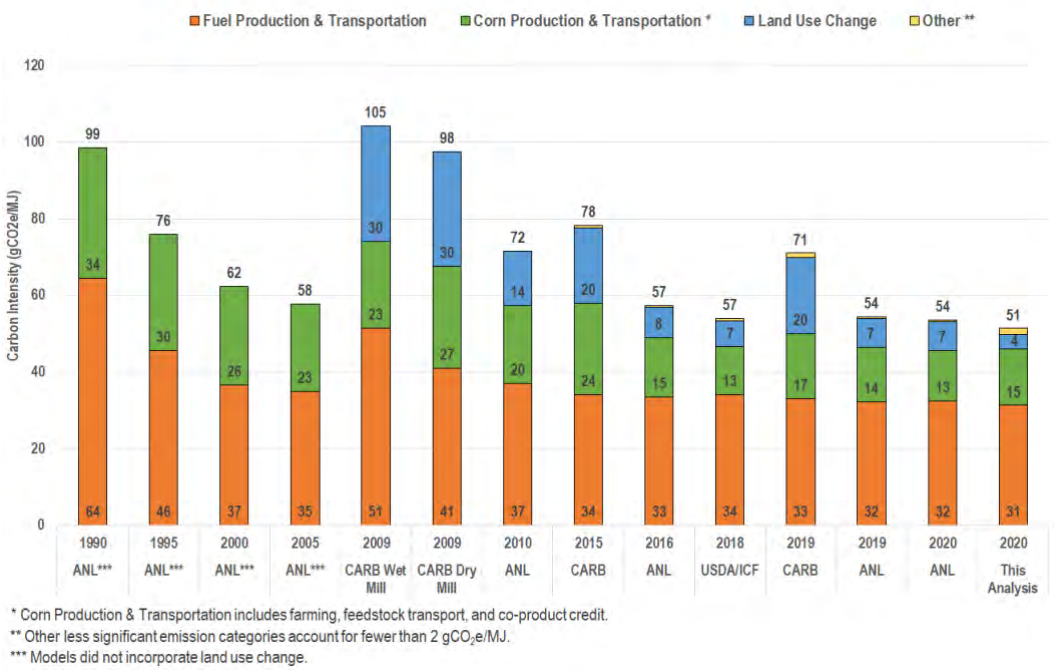
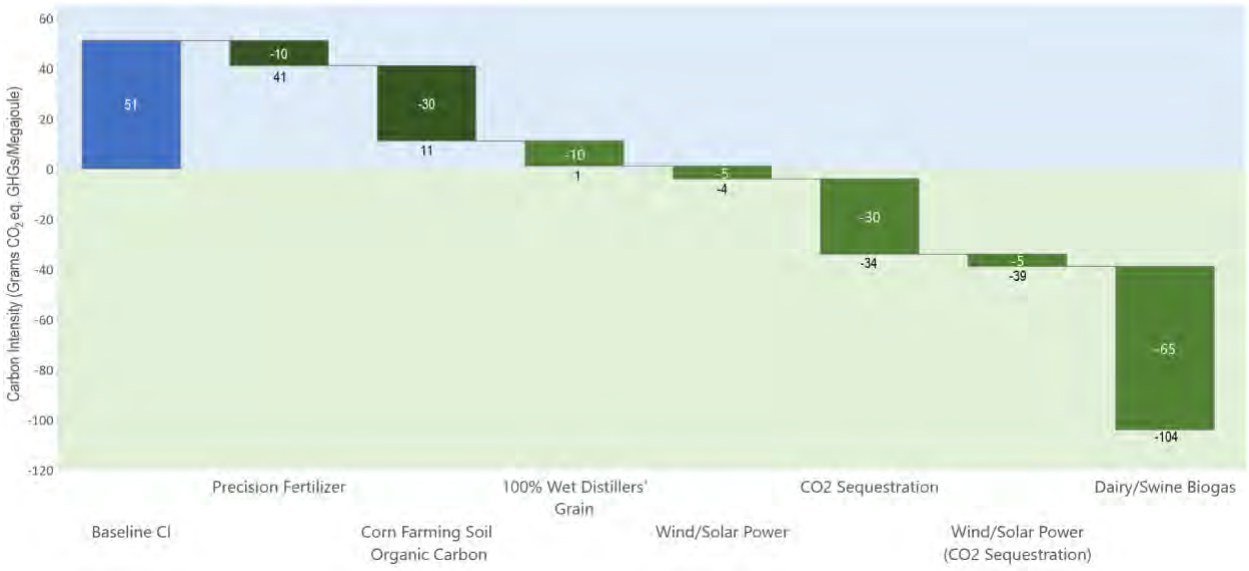
[3] Oregon Department of Environmental Quality, *Proposed Targets*, 2 (March 31, 2022), https://www.oregon.gov/deq/rulemaking/Documents/cfp2022m3Targets.pdf.
[4] *See* Attachment 1, Kazemiparkouhi, Fatemeh et. al, *Comprehensive US database and model for ethanol blend effects on regulated tailpipe emissions*, under review.
[5] ICF, *Opportunities for Additional Credit Generation*, 4 (March 2022), https://www.oregon.gov/deq/rulemaking/Documents/cfp2022m3CreditGeneration.pdf.
[6] Sully, Melissa *et al.*, *Carbon intensity of corn ethanol in the United States: state of the science*, 2021 Environ. Res. Lett 16 043001, 4 (2021), https://iopscience.iop.org/article/10.1088/1748-9326/abde08.



* Corn Production & Transportation includes farming, feedstock transport, and co-product credit.
** Other less significant emission categories account for fewer than 2 gCO_2e/MJ.
*** Models did not incorporate land use change.

The graph below shows that with technologies already being implemented or on the cusp of commercialization, bioethanol has the ability to become a zero-carbon fuel.

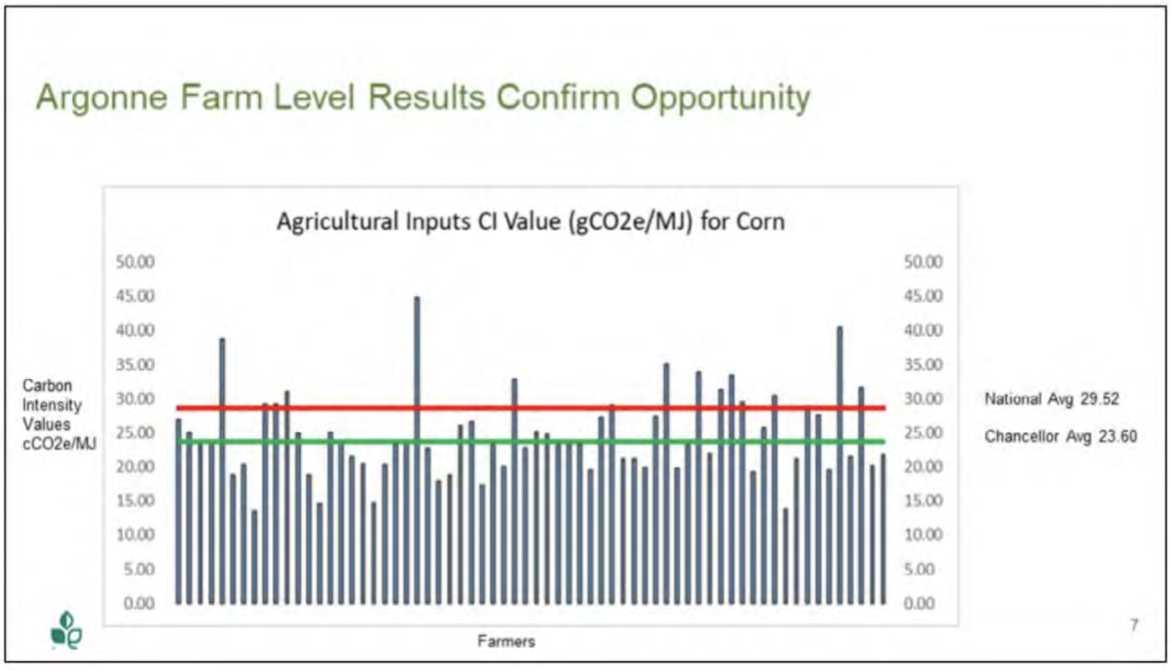


Bioethanol has been a key part of the CFP's success, bioethanol producers are working hard to lower their product's CI in ways that can meaningfully reduce national and global GHG emissions, and bioethanol is poised to remain a key element of the low carbon fuels market for decades to come.

i. Farm-Level

POET strongly agrees with DEQ that farm-level CI reductions present an effective opportunity to reduce biofuel lifecycle emissions. Incentivizing sustainable low-CI farming practices under Oregon's CFP would encourage agricultural GHG emissions reductions through currently employed strategies, such as better tillage practices, as well as practices that are not profitable in the absence of environmental credits, including nitrogen and biodiversity management. Additionally, incentivizing low-CI farming practices would support a new wave of innovations in sustainable farming.

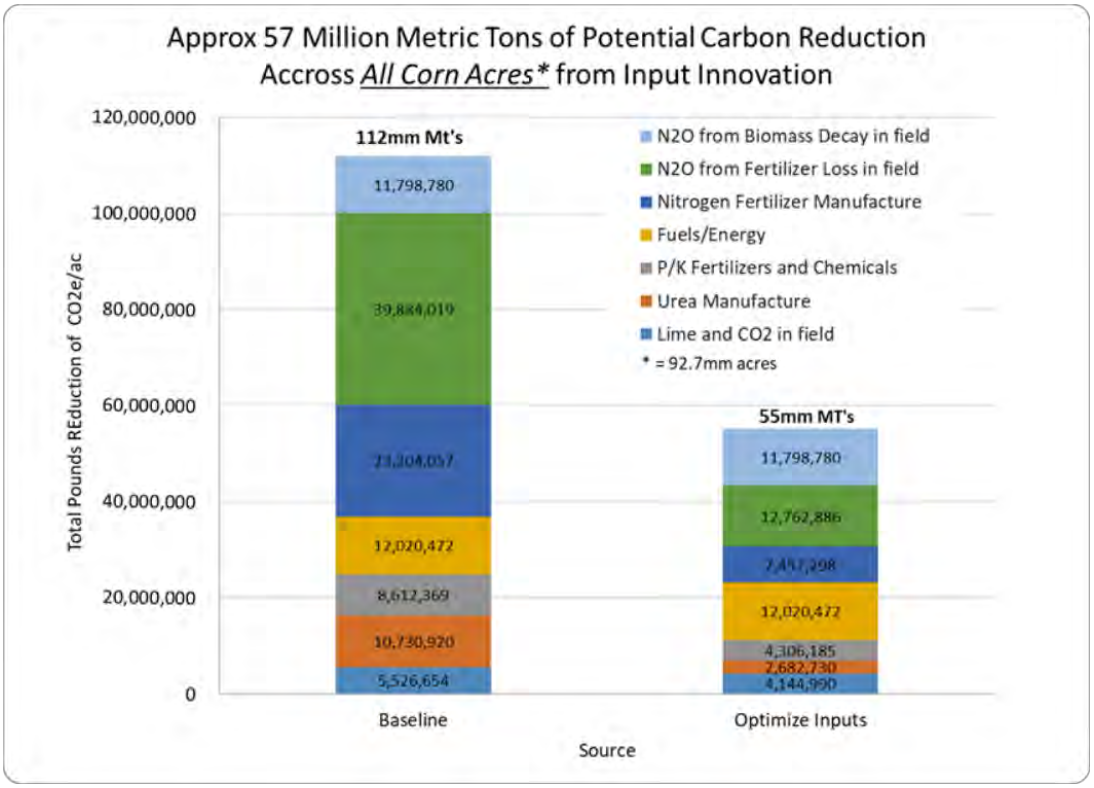
Since 1990, corn bioethanol's CI has been trending downward, in part reflecting developments in farming practices.[7] The Gradable program illustrates the potential GHG emissions reductions achievable through sustainable farming. POET worked with the Farmers Business Network and Argonne National Labs to create Gradable, a pilot program to encourage sustainable farming, validate data inputs, and calculate CI scores for agricultural inputs. Gradable's trial involving 64 area farms supplying corn to POET's Chancellor plant resulted in a 25 percent reduction in GHG emissions from corn cultivation and farm energy usage compared to the assumptions embedded in CA-GREET. The graphic below shows that Chancellor's average farm-level CI value is significantly lower than the national average:



Gradable illustrates that CI values are highly sensitive to different agronomic practices, even within the same area with similar soil types and weather patterns. This suggests that if farmers

[7] Sully, Melissa *et al*, *Carbon intensity of corn ethanol in the United States: state of the science*, 2021 Environ. Res. Lett 16 043001, 4 (2021), https://iopscience.iop.org/article/10.1088/1748-9326/abde08.

had the incentive to engage in sustainable farming practices, widespread adoption of low-CI farming practices could readily result in CI reductions. The prospect of extrapolating these lessons to the entire industry is worthy of DEQ's focus in this rulemaking process. The below graphic illustrates the potential carbon reduction possible with sustainable farming techniques.



As part of the CFP expansion rulemaking, POET encourages DEQ to include a pathway for "identity-preserved" feedstocks in its CFP expansion. Identity-preserved feedstocks can incentivize low-CI farming practices by allowing renewable fuel producers to demonstrate verifiably lower CI characteristics for their biofuel lifecycle.

Finally, other commenters may encourage DEQ to include assessments of soil organic carbon ("SOC") in farming related CIs and to credit farms that sequester carbon in the form of SOC. POET agrees that SOC is a potential tremendous reservoir to sequester CO2 emissions. However, we also understand that some have pointed to technological challenges in measuring SOC and SOC fluctuations over time. If DEQ believes that current SOC measurement methodologies are too unreliable to be included in farming CI scores, POET strongly encourages DEQ to allow for individually tailored farming CIs for other farming inputs (such as those mentioned in the above discussion of Gradable) in its rulemaking and to return to the consideration of SOC at a later date.

ii. Off-Site Renewable Energy Usage

In the CFP expansion, DEQ should encourage the use of off-site renewable energy sources in the production of lower CI fuels. To drive growth in renewable energy generation and facilitate lower-CI fuel production, POET recommends that the CFP allow producers to demonstrate use of low-CI process energy through means such as power purchase agreements and book-and-claim accounting. Recognition of off-site renewable energy production to reduce GHG emissions is common in other carbon and renewable energy markets. DEQ should use its authority to encourage more renewable energy use in the transportation supply chain. This would incentivize the generation of low-CI energy through large-scale renewables projects, thereby reducing the Oregon transportation sector's lifecycle GHG emissions.

iii. User-Defined Process Chemical Usage for Ethanol Pathways

DEQ should modify its Tier 1 simplified calculator's treatment of process chemicals used in ethanol pathways. The current DEQ calculator does not allow the pathway applicant to specify use of low-CI process chemicals, which distorts the CI value of POET's ethanol. Specifically, POET's patented BPX process uses a less carbon-intensive group of chemicals than most ethanol producers. A simple change to the Tier 1 calculator to allow user-defined process chemical usage could cure this inaccuracy. This modification would be consistent with the calculator's accommodation of a variety of other user-defined inputs from denaturant to feedstock transportation distance. As with all CI inputs, verification requirements would apply to user-defined process chemical usage, allowing the verifier and DEQ to ensure claimed CI reductions are accurate.

iv. DEQ Should Distinguish Between Electricity Usage in Wet and Dry DDGS Pathways

We also recommend a minor correction to the Oregon GREET model's treatment of wet versus dry DDGS produced at the same facility. Specifically, the OR-GREET model distinguishes between wet and dry DDGS pathways for the use of thermal energy but does not do so with regard to electricity usage. Electricity usage for production of wet DDGS is demonstrably lower than that needed to produce dry DDGS. Accordingly, POET recommends that DEQ distinguish between electricity usage in wet and dry pathways as the OR-GREET model does with thermal energy.

b. Carbon Capture and Sequestration

Another area that ICF identified for increased biofuel credit generation is carbon capture and sequestration ("CCS"). As the ICF report explains, CCS has the potential to "deliver GHG reductions for processes that produce reliable streams of CO_2."[8] "Ethanol production is the most likely near-term application for CCS because of the purity of the carbon emitted at the facility."[9] POET encourages DEQ to allow for credit generation from CCS and suggests DEQ consider the following issues regarding CCS.

[8] *Supra* note 5 at 5.
[9] *Id*. at 6.

For guidance on how to award credits to fuel producers who contract with CCS capture facilities for sequestration, DEQ should look to the federal 45Q tax credit.[10] Under 45Q, a taxpayer is eligible for a tax credit if the person "captures and physically or contractually ensures…the disposal" of the CO_2.[11] 45Q also lists requirements for contracts between fuel providers and CCS capture facilities that provide for the sequestration of CO_2.

Given the nascency of the CCS industry, a variety of business arrangements may exist between fuel producers, those generating CO_2 emissions to be sequestered, and entities sequestering CO_2. POET encourages DEQ to apportion liability for CCS to the entity in control of the sequestration activities. For example, renewable fuel producers generating LCFS credits for CCS may partner with a CCS company to ensure permanent sequestration of emissions. It would be helpful for DEQ to clarify that where separate entities control (1) the CCS capture facility and (2) the sequestration facility and activities, the party responsible for the geologic sequestration site and all related activities is liable for leakage.

If DEQ decides instead to apportion liability to the CO_2 producer, POET encourages DEQ to adopt a liability scheme similar to that under 45Q, such that the liability would be limited to a few years. 45Q establishes a "recapture period" during which the taxpayer is required to repay the tax credit if a leak occurs. The recapture period begins on the date of the first injection CO_2 for disposal in secure geological storage for which the credit was claimed and ends either (1) three years after this taxable year in which the taxpayer claimed the credit or was eligible to claim the credit or (2) on the date the monitoring requirements under 45Q end.[12]

In addition to CCS, POET believes that DEQ should grant CI credit to projects that beneficially reuse CO_2 such as the capture and use of fermentation CO_2 for commercial purposes. Indeed, the International Sustainability & Carbon Certification ("ISCC") system and Europe's Renewable Energy Directive ("RED") recognize the carbon reduction value of carbon capture and reuse ("CCR").[13] A modest change to the OR-GREET calculator could address this. For example, the RED II recognizes CCR carbon reductions when "it can be proven that the CO_2 replaces fossil-derived CO_2 which is used in the production of commercial products and services." RED II requires that an auditor affirm whether the requirements have been met.[14] Additionally, the federal Internal Revenue Service 45Q tax credit for CCS allocates credit for CCR.[15] The OR-GREET calculator could mirror the 45Q federal tax credit, awarding CI credit to entities that obtain IRS approval under the 45Q tax credit for CCR.

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[10] *See* 26 U.S.C. § 45Q.
[11] § 45Q—5(f).
[12] *Id*.
[13] *See* ISCC 205, § 4.3.7, https://www.iscc-system.org/wpcontent/uploads/2017/02/ISCC_205_GHG_Emissions_3.0.pdf; RED, Annev V (C)(15) ("Emission saving from carbon capture and replacement, eccr, shall be limited to emissions avoided through the capture of CO2 of which the carbon originates from biomass and which is used to replace fossil-derived CO2 used in commercial products and services.").
[14] Department for Transport, *Renewable Transport Fuel Obligation Guidance Part Two Carbon Sustainability*, 67, (2020), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/942790/rtfo-guidance-part-2-carbon-and-sustainability-guidance-2020.pdf.
[15] 26. U.S.C. § 45Q(f)(5) (2021).

c. DEQ Should Expand Emissions Avoidance Credits to Beyond Dairy and Swine Manure

Oregon's CFP offers avoidance credits for GHG emissions reductions associated with the installation of biogas control systems for manure management on dairy cattle and swine farms. DEQ should expand this program to include other farm animals such as beef cattle. Expanding the program to additional farm animals would incentivize fuel production entities to utilize biogas from nearby farm animals as energy sources for fuel production. Increased usage of biogas from nearby farm animals would reduce fuel production emissions, lowering lifecycle GHG emissions in Oregon's transportation sector.

d. DEQ Should Allow for Energy Allocation to Non-Fuel Products.

In response to the COVID-19 crisis, a number of bioethanol producers have entered the market for non-fuel bioethanol, and we expect the diversity of biorefined products to increase over time. In many cases, the creation of alternate types of biorefined products, including technical grade bioethanol, will require the utilization of additional processing steps and energy. We encourage DEQ to ensure that its CI model does not allocate the energy used for non-fuel product production to biofuels. Doing so would discourage biofuels producers from innovating in new markets where they could supplant petroleum products and reduce GHG emissions.

* * *

POET applauds DEQ's efforts to expand the Oregon CFP. We appreciate DEQ's consideration of these comments and look forward to engaging in a productive dialogue with the Agency on the CFP and the role biofuels play in helping Oregon achieve its GHG reduction goals. If you have any questions, please contact me.

Sincerely,

Matthew Haynie
Senior Regulatory Counsel
POET, LLC

Attachment 1

Science of the Total Environment 812 (2022) 151426

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Comprehensive US database and model for ethanol blend effects on regulated tailpipe emissions

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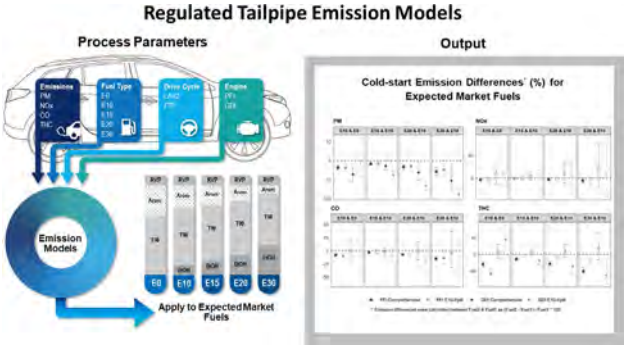
HIGHLIGHTS

- Comprehensive US database of emissions to develop models for inventory prediction
- Developed separate emission regression models for PFI and GDI engine vehicles
- Different blending behavior of ethanol below and above E10
- Different response of PFI and GDI to projected fuels
- Particulate matter levels reduction by ethanol addition

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 26 July 2021
Received in revised form 21 October 2021
Accepted 31 October 2021
Available online 6 November 2021

Editor: Anastasia Paschalidou

Keywords:
Gasoline aromatics
Ethanol
Port fuel injection
Gasoline direct injection
Regulated emissions
Particulate matter

ABSTRACT

Particulate matter (PM), oxides of nitrogen (NOx), carbon monoxide (CO), and total hydrocarbons (THC) in gasoline exhaust affect atmospheric quality, and hence human health. Ethanol produced from corn grain is a renewable resource with favorable anti-knock properties for gasoline blending. Refiners alter petroleum composition to produce a finished blend that meets specifications. Ethanol blending affects emissions from market fuels both directly and indirectly since aromatics are typically removed from the BOB as ethanol is added to reach a constant octane rating. Numerous studies have been conducted to assess the effect of ethanol blending on light duty vehicle emissions. However, few studies have examined market fuel blends directly and small studies yield insufficient information to be generally applicable. If blending of fuels for a study does not yield gasoline that adequately resembles the composition of a market blend, the generalizability of study results may be impacted by nonlinear blending effects. Most vehicle-based fuel effect studies employed fuel formulations that either facilitate examination of several fuel variables or blend ethanol into a baseline gasoline (splash blending). Such study results do not support direct quantification of emissions inventory effects. To examine real world blending implications on regulated emissions [PM, NOx, CO, THC], we compiled a comprehensive database of US emission studies, developed regression models based on fuel and vehicle properties, and used those models to estimate differences in emissions from expected market fuel compositions. We addressed nonlinear responses to ethanol composition by modeling both low (up to 10% ethanol by volume) and mid blends (split models). We used the Federal Test Procedure (FTP) and Unified Cycle (LA92) driving schedule data, with the cold-start eliciting the highest emissions. PM cold-start emissions were lower with higher ethanol content, and more so at higher blend levels but hot-running emissions showed no differences with respect to ethanol level. For all emissions, the effects differed between port fuel injection (PFI) and gasoline direct injection (GDI) powered vehicles and for NOx, CO and THC there were differences between comphrehensive and split models. NOx results varied

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https://doi.org/10.1016/j.scitotenv.2021.151426

over blend levels and THC results were scattered for the higher blends. CO emissions were lower with higher ethanol content in nearly all cases for PFI but only the hot-running GDI. Results did not differ between summer regular and premium fuels. To the extent that PFI and GDI models differ, an emissions inventory calculation should treat them separately. There is uncertainty directly associated with the regression process, and with model inputs since study methods vary and compositions are reported differently between laboratories and test methods. Small changes in modeled emissions should be considered in this light.

1. Introduction

The impact of light duty vehicle exhaust on human health typically is assessed by the quantification of species that reduce air quality through subsequent reaction in the atmosphere. Particulate matter (PM), oxides of nitrogen (NOx), carbon monoxide (CO), non-methane organic gases (NMOG) and formaldehyde (HCHO) are all regulated at the vehicle tailpipe under US Tier 2 standards, and for Tier 3 standards NOx and NMOG are combined (US EPA, 2021c). NMOG calculation relies substantially on measurement of total hydrocarbon (THC) emissions.

Following the phase-out of methyl tert-butyl ether (MTBE) as a gasoline additive, ethanol blending with gasoline was enabled by the renewable fuel standard and was widely adopted. E10, a 10% (by volume) blend of ethanol with a gasoline blendstock (BOB), is now the US norm for use in spark-ignited engines. E15 is also available in the marketplace. Ethanol has a high blending octane number and enhances the knock resistance of the BOB with which it is blended. For market fuels, the rise of ethanol fraction has been accompanied by a reduction of aromatic and olefinic content profile (US EPA, 2017).

Numerous studies have been conducted to assess the effect of ethanol blending on light duty vehicle emissions, which affect human health through changes in air quality (Clark et al., 2020; Karavalakis et al., 2018a; Manisalidis et al., 2020). Conclusions of major emission effect studies, reviewed in Section 3, have varied. Accuracy and relevance of conclusions are impacted by differences in engine technology, emissions measurement accuracy, and repeatability of fuel analyses. Typically, studies have employed fuels of varying ethanol content, each with an associated BOB. For market fuels, the BOB is a mixture of a wide range of hydrocarbons, constrained by the ability and value of refinery streams and blended to ensure that the finished E10 gasoline in the marketplace meets specifications, including volatility and anti-knock index (AKI) requirements (Clark et al., 2019). The BOB and ethanol blend in a highly non-linear fashion, and BOB composition has a profound effect on regulated emissions (Anderson et al., 2014; Foong et al., 2014). Few studies have employed market fuel blends directly, and small studies yield insufficient information to be generally applicable.

Detailed hydrocarbon analysis (DHA) of refinery streams and petroleum blends has become progressively more accurate and accessible over the last decade, leading to better understanding of gasoline composition and variability. If blending of fuels for a study does not yield gasoline that adequately resembles the composition of a market blend, predictions of regulated species may be impacted by nonlinear blending effects. In this research, we compiled a comprehensive database of published data to produce and test emissions models based on fuel properties and composition. To avoid variability due to vehicle technology and operation, we selected studies using US vehicles and two US test schedules (FTP and LA92) that each included cold-start and hot-running phases. We then identified properties representative of current and proposed market fuels, and applied the models to the market fuel properties to estimate differences in regulated emissions. In particular, we have taken into account the typical reduction in aromatic content of gasoline in response to the blending of ethanol.

2. Materials and methods

A mixed method approach was used in this study. First, we reviewed the major emission effect studies and identified studies by type and by ethanol level. We selected the studies that provide sufficient information for use in broader emissions analysis and commented on the findings of suitable studies (Section 3).

Second, we extracted the data from selected studies shown in Table 1. For each fuel and vehicle, we included in our database fuel properties such as ethanol volume, aromatics volume, 50% volume distillation temperature (T50), 90% volume distillation temperature (T90), and Reid Vapor Pressure (RVP); and vehicle properties such as vehicle model year and engine type. A vehicle was included in the study if at least two fuels with different ethanol level were tested on it. We also noted whether the vehicles were designated as flexible fuel vehicles

Table 1
Summary information of studies included in the compiled database.

Study	Tested vehicles (#)			Tested fuels (#)							Tested cycles	Modeled items
	PFI	GDI	FFV	E0	E6	E10	E15	E20	E25	E30		
CRC E-129	0	4	0	3	0	1	1	0	0	0	LA92	NOx, CO, THC
CRC E-80	7	0	7	0	1	0	0	0	0	1[c]	FTP	NOx, CO
CRC E-94-3	0	4	0	4	0	4	0	0	0	0	LA92	PM, NOx, CO, THC
CRC E-98/A-80	15	0	3	1	0	1	1[b]	0	0	0	LA92	PM, NOx, CO, THC
EPA Tier3 Cert. Fuel	3	8	0	1	0	1	0	0	0	0	FTP	PM, NOx, CO, THC
EPAct Phase 3	15	0	3	8	0	9	3	7	0	0	LA92	PM, NOx, CO, THC
Karavalakis 2014b	3	2	0	0	0	1	1	1	0	0	LA92, FTP	NOx, CO, THC
Karavalakis 2015	0	2	0	0	0	1	1	1	0	0	LA92, FTP	NOx, CO, THC
Karavalakis 2018b	0	5	0	2	0	2	3	1	0	0	LA92	PM, NOx, CO, THC
Sobotowski 2015	3	1	0	2	0	0	3	0	0	0	LA92	PM
West 2018	0	3	0	0	0	1	0	0	1	0	FTP	NOx, CO
West ETC 2012	29 (8)[a]	0	0	1	0	0	1	1	0	0	FTP	NOx, CO, THC
West SwRI 2012	75 (25)[a]	0	0	1	0	1	1	1	0	0	FTP	NOx, CO, THC
West TRC 2012	68 (22)[a]	0	0	1	0	0	1	1	0	0	FTP	NOx, CO, THC
Yang 2019b	0	1	1	0	0	2	0	0	0	1	LA92	NOx, CO, THC

[a] Emissions data were acquired at three or four instances during the extended ageing period of each automobile, and we elected to consider each instance separately (as if a separate vehicle) due to ageing and potential laboratory and fuel drift effects.
[b] The E16 fuel is displayed in closest ethanol category, E15.
[c] The E32 fuel is displayed in closest ethanol category, E30.

(FFV). We considered a vehicle to be FFV if the study stated that it was FFV or if it was tested on a fuel that was E51 or higher. We included in our database PM, NOx, CO, and THC emissions for each vehicle/fuel combination. Most studies used the Federal Test Procedure (FTP) and Unified Cycle (LA92) dynamometer driving schedules, and we noted the phase for which emissions were recorded: (1: Cold-start, 2: Hot-running, 3: Hot-start, 4: Weighted: Average of all phases).

Third, we developed and validated statistical models that estimate emissions for different ethanol fuel blends and engine types as a function of fuel properties. For each pollutant and emission phase, we ran a mixed model that allowed for a random intercept for each vehicle. The averages of runs for each vehicle, fuel and emissions species were used, decreasing the number of zero or negative emissions instances in the database. We employed the statistical program R (RStudio 1.4.1106) to determine independence of variables and establish models for emissions. We used linear space for controlling variables, but log space for emissions. This ensured that high emitting vehicles did not dominate the analysis, thereby focusing results on emissions ratios in response to fuel composition changes. We noted that the change in fuel behavior and properties when comparing gasoline (E0) and E10 typically differs from the comparisons of E10, E15 and E20. We therefore developed two separate models, using only the E0 and E10 data for the first model, and E10 and higher data for the second model (split models). We also developed combined models. The regression results and total number of data points (average of runs) and vehicles employed in each model are provided in Tables 2, 3 and S4 to S9. We discuss the modeling approach in more detail in Sections 2.1 and 2.2.

Finally, we applied the developed models to the market fuel properties to estimate regulated emissions changes with respect to ethanol level and the 95% confidence interval of those estimates (See section S1 in the supplementary material for more information).

2.1. PFI emissions models

The EPAct Phase 3 study is a major source of data for modeling regulated port fuel injection (PFI) emissions (US EPA, 2013a). The study itself offers full and reduced variable models for cold-start and hot-running phases (see Section S2 in the supplementary material, Fig. S1), and the study data have been modeled by others (Clark et al., 2021; Gunst, 2013). We reviewed the EPAct data by considering the effects of both ethanol and aromatic changes moving from E0 to E20, the lowest and highest ethanol blends considered in the study. Since the EPAct study employed two target aromatic levels, 15% and 35%, actual aromatic levels were grouped around these two values.

We first considered PM mass emissions from the EPAct study. The original EPAct reduced mixed model used standardized parameters and contained higher order terms:

$$\ln PM_{2.5} = \beta_0 + \beta_{EtOH} * EtOH_z + \beta_{Arom} * Arom_z + \beta_{T50} * T50_z + \beta_{T90} * T90_z + \beta_{T50^2} * T50^2{}_z + \upsilon + \varepsilon \quad (1)$$

where $PM_{2.5}$ has units of mg/mile, EtOH and Arom are volumetric percentages of ethanol and aromatic content in the fuel, distillation temperatures are in degrees Fahrenheit, the subscript z notes the use of standardized scales, and υ represents the random vehicle effect. The model coefficients are shown in Fig. S1 for cold-start and hot-running phases.

We developed our mixed model (denoted "EPAct Comprehensive") using ethanol content, aromatic content, and T90:

$$\ln PM_{2.5} = \beta_0 + \beta_{EtOH} * EtOH + \beta_{Arom} * Arom + \beta_{T90} * T90 + \upsilon + \varepsilon \quad (2)$$

We did not employ T50, noting that T50 showed correlation with ethanol content (see Section S3 in the supplementary material, Fig. S2), that T50 was match blended in the EPAct study in a way that it may not represent the lowered values of T50 in an ethanol market blend, and that T50 is a quixotic variable due to the nonlinear blending properties of ethanol in gasoline. Separate modeling that we conducted showed that PMI was very strongly correlated with aromatic content and T90, in agreement with Butler and Sobotowski (2021).

The EPAct Comprehensive PM model used all EPAct data for cold-start, hot-running, and weighted phases of the LA92 cycle. We developed models both by using separate data for each test run, which introduces bias for vehicles or fuels that were the subject of additional test runs, and by using average values for each fuel and vehicle combination. Model differences were small, but averages were less likely to yield zero or negative emissions values. We also ran the model on fuels at or below E10 (denoted E10− model) and on fuels at or above E10 (denoted E10 + model) to address behavioral changes at or about E10.

Note that a relative difference in emissions of an E0 fuel and a higher ethanol blend, say E20, can be estimated by taking the product of the E10/E0 ratio and the E20/E10 ratio, or else the sum of the two log differences. The two models (E10− and E10+), both linear, operate about an E10 breakpoint, and obviate the need for higher order model terms that may not be suited to extrapolation to unseen fuels.

We then applied a similar approach to develop models for CO, NOx, and THC based on the EPAct data. We included ethanol and aromatic content in all models; T90 in PM, CO, and NOx models; and RVP in THC models. These variables were selected based on their previous associations with tailpipe emissions. We removed T90 and RVP from the model if the variable was highly correlated with ethanol or aromatic content. Cold-start and hot-running emissions are traditionally combined to form a weighted average, but cold-start emissions tend to be higher than hot-running emissions and drive the average. Table 2 presents only the models for weighted emissions data for the EPAct

Table 2
Comprehensive and E10-Split models and goodness of fit data for weighted emissions of PM, NOx, CO, and THC developed using data from EPAct Phase 3 study.

Data	Item	Model	EtOH	Arom	T90	RVP	R^2	AIC	N	Vehicles
EPAct Phase 3	PM	Comprehensive	0.0138**	0.0190**	0.0062**		0.68	631.8	405	15
		E10−	0.0160**	0.0168**	0.0059**		0.71	352.7	255	15
		E10+	0.0106	0.0208**	0.0070**		0.68	488.9	285	15
	NOx	Comprehensive	0.0070**	0.0061**	−0.0001		0.87	144.6	405	15
		E10−	0.0055*	0.0066**	−0.0010		0.89	72.3	255	15
		E10+	0.0080**	0.0063**	−0.0001		0.86	130.8	285	15
	CO	Comprehensive	−0.0079**	0.0050**	−0.0025**		0.96	−96.4	405	15
		E10−	−0.0115**	0.0044**	−0.0028**		0.97	−80.4	255	15
		E10+	−0.0053**	0.0057**	−0.0023**		0.96	−31.6	285	15
	THC	Comprehensive	−0.0027*	0.0027**		−0.0461**	0.85	14.9	405	15
		E10−	−0.0037	0.0018		−0.0408**	0.85	33.2	255	15
		E10+	−0.0044	0.0035**		−0.0541**	0.86	13.0	285	15

Abbreviations: EtOH = ethanol volume %; Arom = aromatics volume %; T90 = 90% volume distillation temperature; RVP = Reid Vapor Pressure; R^2 = adjusted R-squared; AIC = Akaike information criterion; N = number of observations.

** $p < 0.05$.

* $0.05 < p < 0.1$.

Table 3
Comprehensive and E10-Split models and goodness of fit data for weighted emissions of PM, NOx, CO, and THC, developed using data from all studies with "LA92 and FTP" data from PFI, GDI, and "PFI and GDI" vehicles.

Data	Item	Model	EtOH	Arom	T90	RVP	R^2	AIC	N	Vehicles
PFI	PM	Comprehensive	0.0137**	0.0199**	0.0074**		0.70	779.3	467	36
		E10−	0.0139**	0.0174**	0.0062**		0.71	446.6	290	33
		E10+	0.0110*	0.0208**	0.0072**		0.65	571.6	321	30
	NOx	Comprehensive	0.0062**	0.0065**	−0.0003		0.93	982.5	811	205
		E10−	0.0033	0.0075**	−0.0009		0.86	318.4	321	48
		E10+	0.0078**	0.0063**	−0.0001		0.89	241.3	333	33
	CO	Comprehensive	−0.0082**	0.0054**	−0.0020**		0.94	640.4	812	205
		E10−	−0.0111**	0.0045**	−0.0021**		0.94	235.0	321	48
		E10+	−0.0046*	0.0056**	−0.0019**		0.97	76.5	333	33
	THC	Comprehensive	−0.0133**	0.0100**		−0.0877**	0.72	1631.9	732	166
		E10−	−0.0377**	0.0099**		−0.1351**	0.59	784.5	317	46
		E10+	−0.0027	0.0035**		−0.0575**	0.99	166.4	333	33
GDI	PM	Comprehensive	0.0267*	0.04300.0	0.0119*		0.62	249.5	89	18
		E10−	0.0338*	0.0336	0.0114		0.54	211.3	68	17
		E10+	0.0217	0.0850**			0.91	61.1	30	5
	NOx	Comprehensive	0.0035	0.0066	0.0016		0.71	153.8	139	29
		E10−	−0.0013	−0.0004	0.0023		0.73	110.1	84	21
		E10+	0.0046	0.0108			0.71	86.5	71	17
	CO	Comprehensive	−0.0140**	0.0094	−0.0001		0.94	130.7	139	28
		E10−	−0.0097	0.0123	−0.0002		0.94	103.1	84	21
		E10+	−0.0110	0.0096			0.95	76.0	69	16
	THC	Comprehensive	0.0008	0.0155*		0.0278	0.88	111.0	134	26
		E10−	0.0046	0.0167		0.0037	0.86	106.2	83	21
		E10+	0.0018	0.0170*		−0.0913	0.94	46.7	69	14
PFI & GDI	PM	Comprehensive	0.0138**	0.0202**	0.0079**		0.77	1037.1	556	54
		E10−	0.0164**	0.0173**	0.0070**		0.77	686.0	358	50
		E10+	0.0104*	0.0214**	0.0077**		0.73	629.3	345	35
	NOx	Comprehensive	0.0059**	0.0068**	−0.0001		0.93	1164.7	952	234
		E10−	0.0030	0.0077**	−0.0006		0.87	411.8	405	69
		E10+	0.0068**	0.0065**	−0.0000		0.87	314.5	404	50
	CO	Comprehensive	−0.0087**	0.0057**	−0.0016**		0.95	775.2	951	233
		E10−	−0.0114**	0.0048**	−0.0017**		0.95	317.2	405	69
		E10+	−0.0063**	0.0058**	−0.0017**		0.97	141.0	402	49
	THC	Comprehensive	−0.0121**	0.0106**		−0.0830**	0.76	1846.7	866	192
		E10−	−0.0294**	0.0099**		−0.1294**	0.60	939.4	400	67
		E10+	−0.0026	0.0037**		−0.0574**	0.98	201.5	398	47

Abbreviations: EtOH = ethanol volume %; Arom = aromatics volume %; T90 = 90% volume distillation temperature; RVP = Reid Vapor Pressure; R^2 = adjusted R-squared; AIC = Akaike information criterion; N = number of observations.
** $p < 0.05$.
* $0.05 < p < 0.1$.

Comprehensive, E10−, and E10+ models for PM, CO, NOx, and THC. Other models for separate EPAct LA92 phases are presented in the supplementary material (Table S4).

As an example, we compared the ability of our models and the EPAct reduced model to predict a difference between PM emissions for the LA92 cold-start and hot-running phases for two different fuels, EPAct Fuel 27 (E15, 14.9% aromatics) and Fuel 12 (E10, 34.8% aromatics) using the original EPAct model and models presented in Table S4. Results are shown in Fig. S10.

We show the ability of the EPAct Comprehensive model to predict the average cold-start, measured PM, NOx, CO, and THC emissions differences from EPAct in Fig. 1. Since the models predict differences, the predicted emissions were relative to the base fuel used in the EPAct emission model calculator (Fuel 3 — E10, 15% aromatics, 7 psi RVP, 220° T50, 300° T90) (US EPA, 2013b).

PFI vehicle emissions data are available from a wide range of ethanol studies, using splash, match, and available blends, as discussed in Section 3. We broadened the modeling database to include all studies using the LA92 and providing sufficient PFI data to yield emissions predictions (Table S5). The database was then broadened further to include all PFI FTP data, on the grounds that a model was needed that would be broadly applicable and on the grounds that working in log space provided relief for emissions absolute differences arising from FTP and LA92 differences. Both the FTP and LA92 include cold-start and hot-running (US EPA, 2021b). The data sources shown in Table 1 for PFI vehicles were added and the catalyst study (West et al., 2012) in particular swelled the count of points for gaseous emissions. Table 3 shows the models for weighted emissions data for the Comprehensive and E10-Split (E10− and E10+) models. Other models for separate LA92 and FTP phases are presented in the supplementary material (Table S6).

The coefficients in Tables 2 and 3 differ due to the addition of data. The effect of the West et al. (2012) study is best shown by the ability of the models derived from EPAct data along to predict the West et al. experimental results. Fig. 2 shows the ability of the EPAct Comprehensive model for cold-start emissions to predict measured NOx, CO, and THC differences of West et al. (2012).

2.2. GDI and combined emission models

For gasoline direct injection (GDI) vehicles there was no major foundation study and model set akin to those available from the EPAct study. However, data for modeling were available from the GDI studies shown in Table 1. We used the same modeling approach as for PFI vehicles. Table 3 also shows the coefficients for weighted emissions models of GDI vehicles. Coefficients for separate LA92 and FTP phases are presented in the supplementary material (Table S7). Table 3 and supplementary material Table S8 also show models for pooled PFI and GDI data, without regard for the differing engine technology. However, it should be recognized that the GDI data represent newer model year vehicles on average, due to the prevalence of PFI technology in earlier model years.

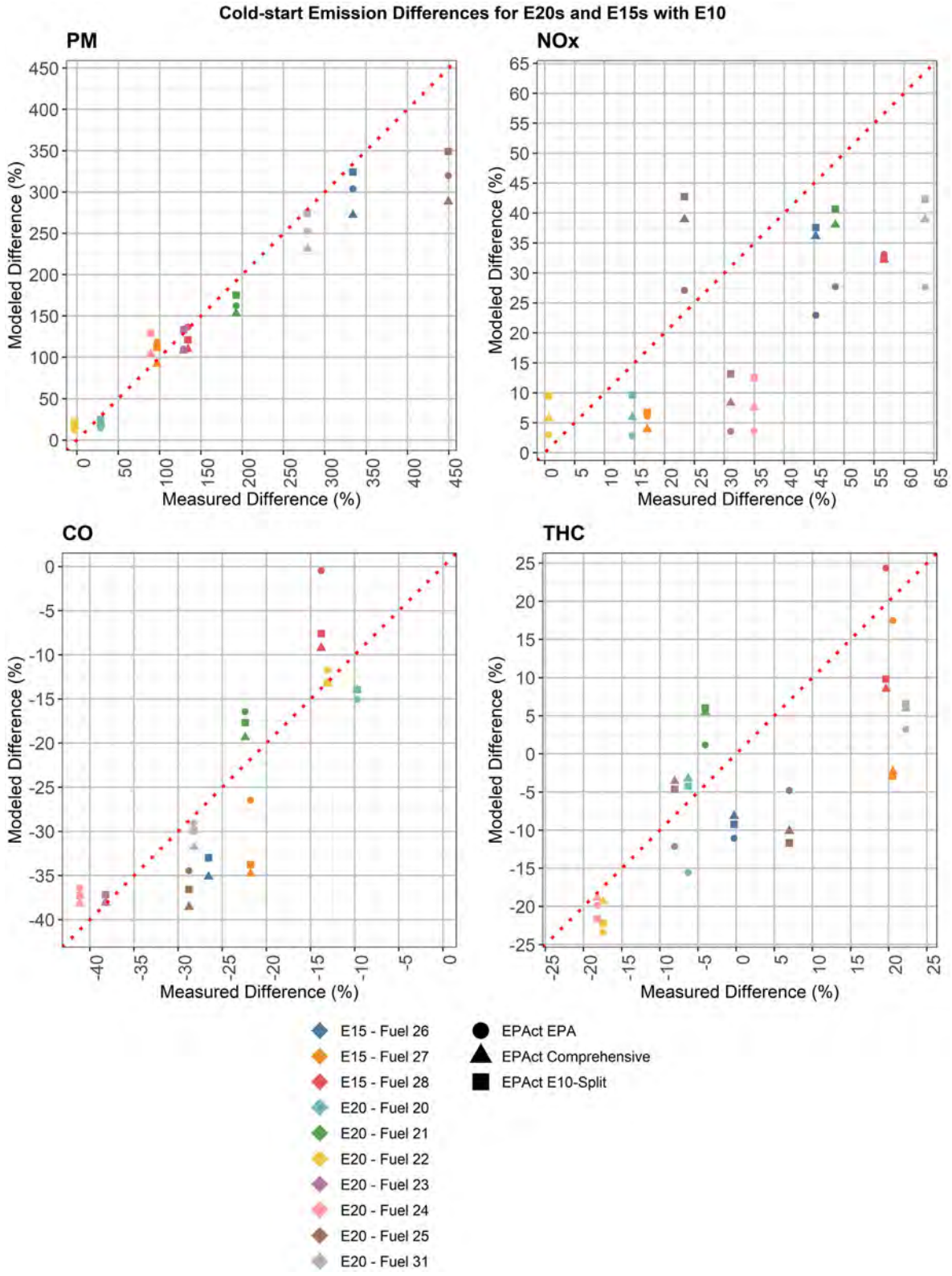

Fig. 1. Comparing cold-start measured and modeled emission differences between E15 and E20 fuels and an E10[a] in EPAct study using EPAct, EPAct Comprehensive, and EPAct E10-Split[b] models. Shapes indicate the model and colors the fuel.
[a]This is Fuel 3 in EPAct study with 15% aromatics, 7 psi RVP, 220° T50 and 300° T90.
[b]The E10-Split model represents an E10− model used to estimate the E10 to E0 difference, and an E10+ model used to estimate the E15, E20, and E30 differences from E10.

2.3. Applying emission models to market fuel properties

Conclusions should not be reached on ethanol emissions effects by using data directly from many of the studies discussed in Section 3. Splash and match blend emissions data may be useful in development of understanding and models, but do not necessarily represent real world fuel effects. Crawford et al. (2021) observed that the EPAct fuels "may also be less representative of *typical* (original emphasis) commercial gasolines

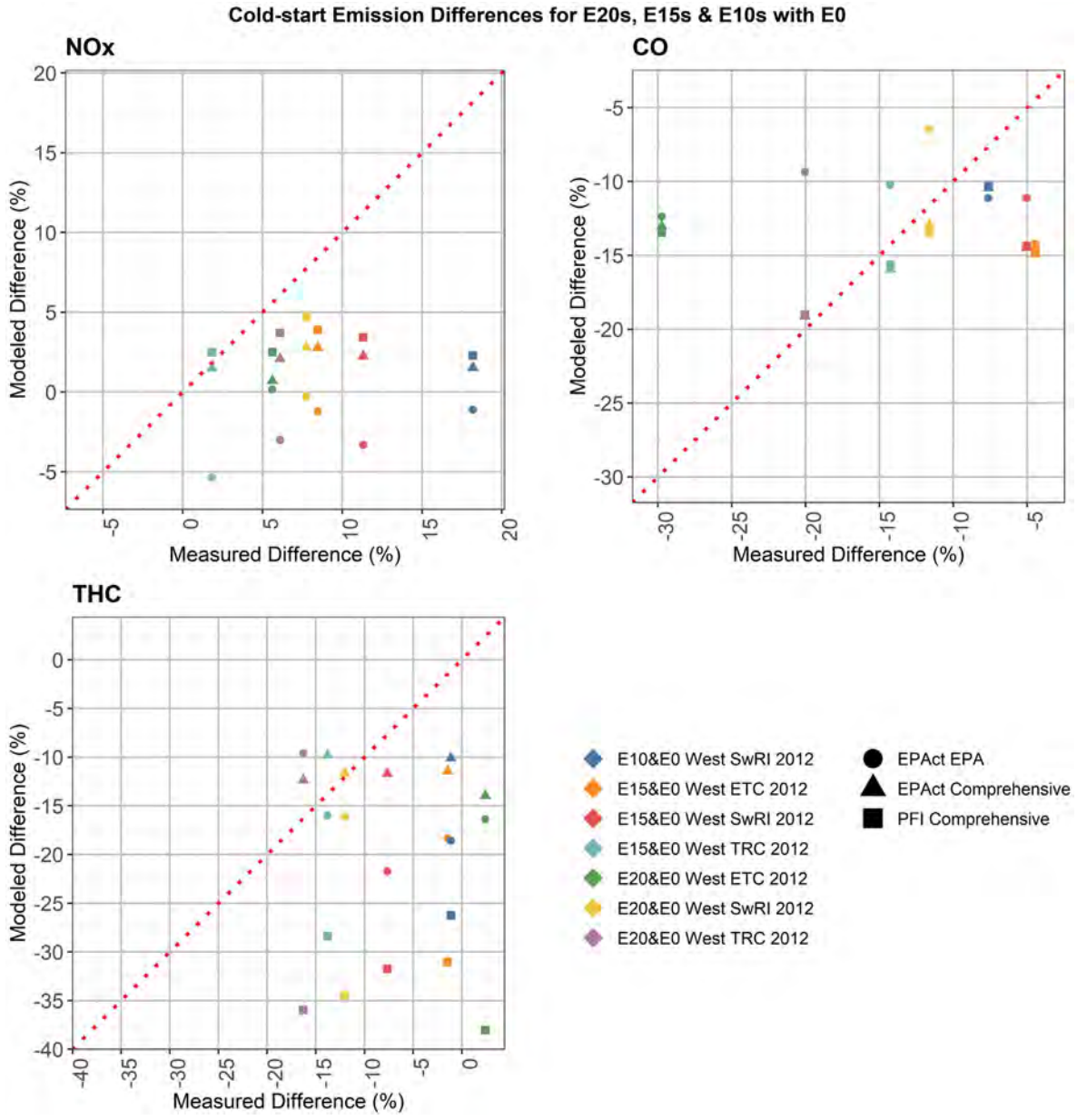

Fig. 2. Comparing cold-start measured and modeled emission differences between E10, E15, and E20 fuels and E0 fuels in West et al. (2012) study using EPAct, EPAct Comprehensive, and PFI Comprehensive models. Shapes indicate the model and colors the fuel.

found in the market." We have therefore applied our developed models to estimate emissions from the summer regular, winter regular, and summer premium fuel compositions presented in Table 4. Table 4 also contains splash blends for the specific purposes of considering higher AKI fuels and assessing aromatic effects, in addition to the oxygenate effects. Although the splash blends and premium gasoline may elicit more efficient engine performance and alter emissions profiles, the models presented above are not equipped to address the reaction of the vehicle to octane changes in a quantitative fashion.

3. Review of prior studies

There is a body of literature addressing the emissions effects of fuels using steady-state operation on engine dynamometers and examining interactive engine control strategies (Singh et al., 2021; Park et al., 2010; Dutcher et al., 2011). These studies suggest important variables to be employed in modeling, but are not readily translated to on-road emissions predictions. We used only transient chassis dynamometer-based vehicle study data with US vehicles to develop our models. These studies have addressed the effect of anhydrous ethanol at the 10% level, and several have examined E15 and E20 as well. Fewer studies have considered blends above 20%. We did not examine fuels with ethanol at or above 51% by volume (these fuels are classified as E85) and did not employ studies with a predominance of vehicles from early model years. Table 1 shows the ethanol levels for the studies we included in our database.

Prior studies and models have reached substantially different conclusions about the effects of ethanol blending on vehicle emissions. Clark et al. (2019) identified causes as the difficulty in measuring low emissions levels (and their differences) accurately, the complex response of gasoline to ethanol blending (Foong et al., 2014), the effect of using varied dynamometer test cycles, and the advances in engine technology between major studies, particularly with the step from PFI to GDI (US EPA, 2021a). Vehicle to vehicle variations, small study vehicle fleets, and few repeat runs erode the statistical certainty and general applicability of many program conclusions. In addition, vehicle control

Table 4
Proposed properties of market fuels for use with emissions models.

Fuel grade	Fuel ID	EtOH vol (%)	T50 (°F)	T90 (°F)	Arom vol (%)	AKI	RVP (psi)
Summer	E0	0	219	325	30	87	8.6
	E10	10	192	320	22	87	8.6
	E15	15	162	316	19	87	8.6
	E15S[a]	15	162	316	21	89	8.5
	E20	20	165	314	15	87	8.6
	E20S[a]	20	165	314	20	90	8.4
	E30	30	167	310	8	87	8.6
	E30S[a]	30	167	310	15	93	8.3
Winter	E0	0	189	317	27	87	12.5
	E10	10	162	312	19	87	12.5
	E20	20	165	306	12	87	12.5
Summer Premium	E0	0	242	317	33	93	8.2
	E10	10	215	308	25	93	8.6
	E20	20	188	297	18	93	8.2

Abbreviations: EtOH = ethanol; T50 = 50% volume distillation temperature; T90 = 90% volume distillation temperature; Arom = aromatics; AKI = Anti-knock Index; RVP = Reid Vapor Pressure.
[a] Splash blended from E10.

systems adapt to fuel properties, necessitating assured vehicle conditioning (Morgan and Lobato, 2014; West et al., 2012). Yan et al. (2013) echo many of these concerns in studying fuel effects on engine efficiency. Clark et al. (2021) showed that predictions from five different published models derived from the same data set yielded different emissions changes with a previously unseen scenario. This was due to interdependency and choice of property and composition variables, and effects of nonlinear model terms. Studies have also differed in reaching conclusions because blending of ethanol at low levels (below E10) has different effect than at mid levels (E15 to E30) (API, 2010).

Often it is the aromatic level in the BOB that dictates emissions changes rather than the ethanol itself (Anderson et al., 2014; Clark et al., 2021). With market fuels, aromatics are generally reduced as ethanol is added to hold octane rating constant. When splash blending is used in a study, aromatics are reduced only by dilution and octane rating rises. When match blending is used to facilitate multivariate analysis, the resulting study fuels do not usually represent a market composition and the behavioral responses to mixing are atypical. Developing a model from a combination of data from several studies provides broader coverage of controlling variables, but may not elicit the nonlinear effects and dependencies found in market fuels.

3.1. EPAct and related studies

The EPAct study is a keystone data source for PFI vehicles, with 27 fuels and 15 cars and light duty trucks (US EPA, 2013a). The vehicles were all 2008 model year and Phase 3 of the EPAct study reported emissions from E0, E10, E15, and E20 blends. It was a multivariate study, seeking to find the influence of several variables simultaneously, namely ethanol content (E0, E10, E15, and E20), aromatic content (15% and 35%), RVP and dry vapor pressure equivalent (DVPE; 7 psi and 10 psi), T50 (5 levels), and T90 (3 levels). In general, the fuels did not represent fuels sold at the pump, but were blended to match a distribution of the study variables. "It is important to note that the effects of different fuel properties are not cleanly separable. It is difficult to modify one property in an actual fuel without affecting one or more of the others. The study design and analysis of the data are structured so as to allow assessment of fuel effects as though they were independent of each other. However, in interpreting or applying the models, it is critical to consider the effects of all five fuel properties in conjunction with each other. Consideration of single coefficients in isolation can easily result in misleading conclusions." (US EPA, 2013a). We have employed the Phase 3 EPAct data set and used EPAct-based models for comparative purposes.

The EPAct study did not control distillation temperatures other than T50 and T90 in formulating the study fuels. Butler and Sobotowski (2021) have recently commented on the importance of T90 in determining PM. Anderson et al. (2014) have been critical of the use of only T50 and T90, and Darlington et al. (2016) have shown that a correlation with 70% volume distillation temperature (T70), which was not a control variable, provided a very good fit to the EPAct PM data, but led to different emissions conclusions. This difficulty centers around the fact that ethanol addition suppresses the T50 distillation point temperature in a nonlinear fashion, and so the study fuel distillation curve had to be manipulated to arrive at desired study values for T50. So, for example, the T50 values for fuels 26 and 27 (both E15) differ widely at 160 °F and 222 °F, but the two T70 values are 277 °F and 275 °F. Further, the EPAct modeling cannot account readily for the behavior of ethanol in blending with a petroleum BOB and the effect of BOB composition on that nonlinearity.

EPAct-related studies provided insight for our modeling. Gunst (2013) produced alternate emissions models that fitted the EPAct data well. Also, Butler et al. (2015) modeled the EPAct data using the Particulate Matter Index (PMI) to good advantage. PMI is based on the propensity of each species in the fuel to produce PM (Aikawa et al., 2010; Chapman et al., 2021; Crawford et al., 2021). These models, arising from the same data set, predict the emissions properties of unseen fuels differently (Clark et al., 2021).

The Butler data required DHA (performed using ASTM D6729) for computation of PMI. ASTM D6729 provided data on total aromatic content and olefin content of the EPAct fuels, and both aromatic and olefin levels differ from the original EPAct data acquired using ASTM D1319. In consequence, we addressed emissions estimates using data from both standards.

Although the final "Phase 3" EPAct models derived from the study data suggest that ethanol alone raises NOx and PM emissions, they show that emissions are reduced when aromatic and T50 reduction, in response to ethanol addition, are considered (see Section S4 in the supplementary material). Morgan et al. (2017) concluded that the EPAct study showed that ethanol raised PM, NOx, and other emissions, whereas the reduction of aromatics in response to ethanol blending may actually reverse that finding. This reinforced our decision to employ multidimensional modeling for emissions estimation.

Phases 4, 5 and 6 followed the main Phase 3 EPAct study (Whitney and Shoffner, 2014) but did not offer data appropriate for our study.

3.2. CRC E94-2, E94-3, and E129

Emissions of PM are typically influenced by both the ethanol and aromatic content of a fuel (Clark et al., 2021). PMI is expected to reflect aromatic content and molecular weight. The E94-2 CRC study (Morgan et al., 2017) used GDI vehicles. Two different AKI values and two different gasoline PMI levels (1.4 and 2.4 targets) were used to examine E0 versus E10 emissions, yet there was a single target for aromatics (25 vol%). The PMI difference was achieved in part by varying the balance of light and heavy (C10+) aromatics. We were not able to employ the CRC E94-2 data in our study because the fuel formulation strategy thwarts the use of total aromatic content as a distinguishing emissions variable.

A follow-on study, E94-3 CRC, (Morgan et al., 2018) used four GDI vehicles and four E0 fuels from the E-94-2 program, splash blended with 10% ethanol, with low and high AKI (91 and 96) and low and high PMI targets. In splash blending the ethanol is added to gasoline and that dilution is the only composition effect. We employed the E94-3 data in our modeling.

We also employed data from the CRC E-129 study that measured tailpipe emissions of four 2012–2013 GDI vehicles using ethanol splash blends and the LA92 driving cycle (Schuchmann and Crawford, 2019). The E0, low AKI, low PMI fuel from the E94-2 project composition was re-blended for E94-3, and then splash blended to produce E10 and E15.

Measured emissions from E-129 showed that E0 and E10 had substantially similar PM but PM was significantly reduced for E15. Although

NOx was lower on average for E10 and E15, there was no statistically significant difference from the E0 level. The CRC E-129 data opposed the E94-3 E-10 conclusions, where PM increased with ethanol content. However, the four GDI E129 vehicles were not the same as the E94-3 vehicles and vehicle choice is known to have effect on conclusions (Clark et al., 2019).

3.3. CRC E-98/A-80

Jimenez and Buckingham (2014) authored CRC Report E-98/A-80 and used the fifteen EPAct study vehicles (all PFI) with E0 (35.4% aromatics), E10 (27.4%) and E16 (24.6%). Some statistically significant differences were observed for PM, but it should be noted that, from inspection of fuel properties, the fuels were not related by either match or splash blending. The report showed that EPAct and Gunst models, discussed in Section 3.1, could not predict reliably the differences in regulated emissions from unseen fuels found in the studies. We have used the Jimenez and Buckingham (2014) study data in model development.

3.4. Department of energy catalyst study

A major catalyst ageing study (West et al., 2012) reported vehicle ageing and emissions measurement work on an extensive fleet at three separate facilities (SwRI, TRC, and ETC/SGS). Two locations used E0, E15 and E20 splash blended fuel, and SwRI also used E10. Eighty-two vehicles, arranged in matched sets, were operated for more than six million miles, and 55 of these vehicles were operated on gasoline (E0) and ethanol blend road fuel. Emissions data were acquired at several points during the ageing of each vehicle using certification gasoline and its splash blends for each ethanol level. Vertin et al. (2012) provided additional detail in a report addressing the research at the ETC/SRS site. There was a substantially higher NOx increase on E10 than on E15 and E20, but we noted that only one site used E10, leading to possible bias.

Different fuel was used over time, but the splash blend fuels and the baseline E0 corresponded for each test set. We assembled representative fuel properties with data from West et al. (2012) and Vertin et al. (2012), with additional information from Sluder [personal communication] (see Section S5 in the supplementary material, Tables S1 to S3). We have employed the catalyst study data for model development and model comparison. We elected to consider emissions data acquired at three or four instances during the extended ageing period of each automobile separately (as if from a separate vehicle) due to ageing and potential laboratory and fuel drift effects.

3.5. EPA Tier 3 certification fuel impact test program

An EPA study examined the difference in emissions between Tier 2 certification fuel (E0, 92.6 AKI, 32.3 vol% aromatics) and Tier 3 certification fuel (E10, 87.3, 23.8) (US EPA, 2018). Three PFI and eight GDI vehicles were used, with the transient FTP as one of the test schedules. The Tier 3 E10 certification fuel enjoyed a reduction in aromatics relative to Tier 2 E0 fuel in response to the ethanol increase, in a ratio that is typical of market fuels. The study yielded valuable data for our modeling.

3.6. Studies at University of California, Riverside

Studies at University of California, Riverside (UCR) examined both conventional vehicles and FFVs and were important in providing GDI data. Yang et al. (2019b) used a single flex fuel GDI vehicle to examine four fuels, two E10 blends, an E30, and an E78. Both E10 blends had high aromatics, at 28 and 37%, and the E30 was a splash blend of the 28% aromatic E10 with additional ethanol. Aromatics in the fuel were presented by molecular weight. We employed these data for modeling.

Yang et al. (2019a, 2019c) also reported on a study for Growth Energy (Karavalakis et al., 2018b). Five 2016 and 2017 GDI vehicles were evaluated on eight fuels. E0, E10, and E15 fuels were blended with two different aromatic levels. One fuel, E10 with 20% aromatic content, was a Tier 3 emissions certification fuel. Two additional fuels were prepared by splash blending to yield E15 and E20. Gaseous and particulate emissions were measured using the transient LA92. Data showed a strong effect of aromatic content on the PM emissions for both the cold-start phase 1 and overall LA92 results.

Karavalakis et al. (2015) studied the impact of both ethanol and butanol on emissions using two GDI vehicles, one with spray-guided injection and one with wall-guided injection. We used these E0, E10, and E20 data.

Karavalakis et al. (2014b) also reported ethanol (E10, E15, E20) data for three PFI and two GDI vehicles over the FTP and LA92. Results were mixed for THC, CO, and NOx. These data were employed in our model development. Karavalakis et al. (2014a) presented additional study data, but only E10 data were outside of the E85 fuel range. These data were not employed because we sought to model using data for at least two ethanol levels of E50 or below. Another UCR study by McCaffery et al. (2020) was not employed for the same reason.

Since Yang et al. (2019a, 2019c) and Karavalakis et al. (2014b, 2015) provided cumulative PM emission rates rather than phase-specific emission rates, we did not use their PM data in model development. We did not employ a study by Karavalakis et al. (2012) because most vehicles in the study had early model years.

3.7. Other studies

West et al. (2018) examined a Ford F150 pickup and a Mini Cooper using the FTP and the US06. The Mini was tested at its own road load and at a higher road load to explore knock. The pickup was tested with two different compression ratios. A Tier 3 certification fuel (E10) and the same fuel splash blended to E25 were used. These data were employed for GDI modeling.

Haskew and Liberty (2011) examined E6 and E32 fuels in a study of gaseous exhaust and evaporative emissions under the CRC E-80 program. The E32 was prepared from a blend of E6 and E85. Seven vehicles were used with model years of 2006 and 2007. The data, for LA92 and FTP schedule, were included in our database and were valuable in modeling blends of over E20.

Sobotowski et al. (2015) presented additional data after completion of the EPAct study. Four vehicles, three with PFI engines and one with GDI, were tested using the LA92 cycle. AKI was not held constant. Ethanol was at the E0 and E15 levels. PMI had a strong effect on PM emissions, but our modeling used the aromatic content as an input.

3.8. Studies not included in our database

We did not use data from studies that lacked fuel properties or employed unsuitable fuels (Thomas et al., 2015; Hubbard et al., 2014; Gramsch et al., 2018; Hilton and Duddy, 2009). Jin et al. (2017) used blending fuel that contained MTBE. Durbin et al. (2005) examined PFI vehicles but did not vary aromatic content as a study variable. A publication by Graham et al. (2008) described two studies, but the vehicle model years ranged from 1998 to 2003, considered to be too early for inclusion in our models. Dardiotis et al. (2015), Clairotte et al. (2013), and Suarez-Bertoa et al. (2015) reported on European vehicles and cycles, and these were not employed due to possible technology differences from US vehicles. We also did not employ a study by Ahmed et al. (2018) that used European vehicles and offered only E5 in our blend range. A recent study by Yuan et al. (2019) used on-road portable emissions measurement, and we did not employ those data.

3.9. Petroleum BOB composition and blending

For most studies considered, the ratios of emissions from two different ethanol blend levels are not representative of market fuel effects.

We applied models developed from the emission studies to estimates of properties of market blend fuels to yield a real-world representation of emissions changes. A discussion of the gasoline composition is therefore important. The petroleum BOB typically is prepared by a refinery so that the BOB yields a finished gasoline, when blended with ethanol at a terminal. The composition of the BOB plays a substantial role, along with the ethanol, in determining emissions. The BOB composition also changes with ethanol level, because it is tailored to suit that level, particularly to meet anti-knock requirements. The BOB is blended from streams at the refinery that are least valuable to the refinery as a whole, under constraint of meeting finished product specifications (Clark et al., 2020, 2021). For niche markets, a BOB could be created that in its own right offers reduced emissions, or that offers higher octane rating that leads to improved engine performance. A higher cost of the BOB and the finished fuel should then be anticipated.

Since the composition of the BOB varies widely, its nonlinear blending behavior with ethanol must be anticipated. Petroleum fuels and BOB often are described by fractional content of paraffins, isoparaffins, aromatics, napthenes (cycloparaffins), and olefins (PIANO analysis). These species are provided using diverse refinery streams, including straight naptha, reformate, alkylate, and isomerate. Octane ratings (anti-knock properties) are met primarily by reformate (high in aromatics) and alkylate (high in isoparaffins) in the BOB, along with the blended ethanol. The aromatics are produced primarily by reformers that improve the properties of low-octane napthas at refineries. Sjöberg et al. (2016) and Sjöberg and Vuilleumier (2017) have discussed influence of fuel composition on engine knock behavior.

A report from the American Petroleum Institute (API, 2010) provides insight into the nonlinearity of the blending behavior. Gasoline is characterized by a distillation curve, presented as temperatures at which each percentage of the fuel is evaporated following an ASTM D86 procedure. Ethanol blending serves to depress that curve such that the 40% evaporation temperature, T40, is substantially reduced even with blends as low as E10 (Anderson et al., 2014; API, 2010; CONCAWE, 2012; Jiao et al., 2011). T50 is difficult to predict for E10, because the location of the depression depends on the BOB composition, but T50 is always suppressed for high ethanol blends. Ethanol also suppresses the evaporation of aromatics in the blend (Ratcliff et al., 2019; Ratcliff et al., 2021). Hence T50, a parameter commonly used to describe E0, becomes quixotic in blend studies (Andersen et al., 2010; Anderson et al., 2014).

Ethanol also raises the RVP of the BOB to higher values than would be expected from the ethanol and BOB volatility. Ethanol raises the AKI of a blend more than would be expected: moreover, that synergistic "blending octane number" is affected by the BOB composition (API, 2010; Foong et al., 2014; Gaspar et al., 2019; Yuan, 2018). Splash blending of ethanol invariably raises the AKI of the fuel, which can change the control strategy of a modern engine operating under high load, and hence affect efficiency and emissions (Stein et al., 2013). Whether the engine benefits from the AKI depends upon the vehicle and cycle that are employed, adding to the complexity and variability of data analysis.

Studies derive confidence limits for model predictions from the statistical fit to the data that were used, but do not consider the application of the model to unseen fuels. Analysis of properties or compositions of fuels may have high uncertainty. For example, different ASTM standardized methods return values for olefin or aromatic content that differ substantially (Beens et al., 2003). Uncertainty in model input data is addressed in the supplementary material section S6. Uncertainty in gasoline or BOB composition is less critical if the fuels being considered are all splash blended from the same baseline composition.

3.10. Vehicle fleet

The US light duty vehicle fleet has an average age of nearly 12 years (Bureau of Transportation Statistics, 2021). An automotive technology trends report presents the substantial change in propulsion system design since 1975 (US EPA, 2021a). We excluded vehicles with EPA Tier 1 and early Tier 2 emissions technology as being unrepresentative of the current fleet. The gasoline engine market consisted historically of PFI engines, but now PFI and GDI vehicle sales are similar in count. These two injection technologies have substantially different fuel and air mixing strategies and fuel evaporation environments, and GDI engines are associated with elevated PM levels (Kalwar and Agarwal, 2020; Leach et al., 2013; Saliba et al., 2017; Zhao et al., 2002; Zhu et al., 2016). For these reasons, we have modeled PFI and GDI emissions separately and compared their reactions to fuel composition effects.

3.11. Market fuel composition

The fungibility of reformate, alkylkate, and ethanol in raising anti-knock properties is well known, but the precise blending practice is dictated by refinery economics, availability of feedstocks and other finished blend property constraints. We present the rationale for determining the properties of fuels with elevated ethanol content, and with both a regular octane rating of 87 and elevated octane ratings associated with splash blending from an 87 octane E10 base. Elevated octane rating is advocated to raise future GDI engine efficiency (Johnson et al., 2015; Miles, 2018; Szybist et al., 2021; vom Lehn et al., 2021).

McCormick et al. (2017) presented octane changes when ethanol was added to a surrogate mix of isooctane, heptane, toluene, and 1-hexene. From graphical representation, RON increased by 0.6 and motor octane number (MON) increased by 0.28 per percent increase of ethanol. Waqas et al. (2017) showed higher values for octane blending into FACE research fuels and recognized that aromatics in the base fuel hinder the octane enhancement by ethanol. Gaspar et al. (2019) presents that ethanol has blending octane rating [(RON + MON) / 2] into a gasoline surrogate of 129.5 for E20 and 119 for E30. This is substantially higher than the octane rating for ethanol alone.

Stratiev et al. (2017) presented various methods for modeling gasoline RON and MON from hydrocarbon, ethanol, and MTBE blends, and determined that a modified model of Zahed et al. (1993) offered a best fit. From the coefficients and data in Stratiev et al. (2017), the addition of 1 volume of ethanol (RON = 114.0, MON = 98.3) would enable the removal of 1.14 volumes of reformate (RON = 100.2, MON = 89) to keep the blend AKI constant. Naturally, 0.14 volumes of an AKI-neutral component would be needed to account for the difference. The reformate used had a 67.7% aromatic content, and so this implied that a 1% ethanol addition could facilitate a 0.77% aromatic removal while maintaining the same AKI. Rankovic et al. (2015) examined the effect of blending ethanol, reformate (111 RON) and isoparaffins (trimethyl pentane, 104 RON) into a 91 RON gasoline (34.1% aromatics) and a 71 RON naptha and gasoline blend (21.3% aromatics). They found that ethanol boosted RON substantially more on a volume percent basis than the reformate and the isoparaffins, suggesting that ethanol addition enables high reformate or alkylate removal from a blend. Yuan (2018) presents extensive additional blending detail.

Historical data for conventional summer gasoline are presented by the US EPA (2017), and show that the change from 0.84% ethanol blending in 2000 to 9.28% in 2016 corresponded to a 6.74% reduction in aromatics. This equates to 0.8% aromatic reduction per percent of ethanol added, in fair agreement with the findings from the model presented by Stratiev et al. (2017). The EPA report also shows a high variation in aromatic content across the nation.

An expected refinery pathway in the US to produce an E0 gasoline, in contrast to an E10 gasoline, would be to increase dependency on the reformer. Aromatics from reformate are also widely used as octane enhancers internationally, but regulation of benzene and total aromatic content varies. This yields a higher octane, higher aromatic, market product than an E10 BOB, to compensate for the loss of the ethanol anti-knock benefits. Likewise, a higher ethanol blend BOB would call for reduced reformer dependence (Clark et al., 2021).

Fuel properties most reasonably are anchored to today's E10 fuel formulations, which dominate the US market. Texas data for summer 2017, averaged across field tests for finished regular unleaded E10 of all grades, have average aromatics, at 26.8% by volume (ASTM D1319, 26.1% by volume for all gasoline) (Eastern Research Group, 2017). Similar Texas data for summer 2020 have average E10 aromatics at 20.33% by volume (ASTM D5769, 21.0% all gasoline) (Eastern Research Group, 2020). EPA data for 2016 show ethanol-adjusted aromatics at 21.8% for summer conventional gasoline and 17.1% for summer reformulated gasoline (US EPA, 2017). The EPA report shows that for 2016, conventional gasoline sales were almost three times the reformulated gasoline sales, and that premium sales were only 10.5% of total sales. We have devoted most effort to examining gasoline that represents an average summer regular conventional gasoline.

Table 4 shows estimated properties of an average conventional summer regular E10, with projections of E0, E15, E20, and E30 fuels, based on the discussion above. Table 4 also includes estimated properties for fuels that would be splash blended from the E10, denoted E15S, E20S, and E30S. For this splash blending of ethanol, aromatics decrease proportionally solely due to dilution as the ethanol is added. Yang et al. (2019a, 2019c) showed an increase of AKI of 2 for 5% more ethanol addition to E10, and an increase in AKI of 3.7 for 10%. The API blending study shows substantial variation in ethanol blending octane rating and an average AKI rise of 8 for an E0 to E30 splash blend. The CRC E94–3 study showed increases in AKI of 3.6, 3.1, 2.6, and 1.9 for 10% addition of ethanol to E0 (Morgan et al., 2018). These splash data suggested the elevated AKI values for the E15S, E20S, and E30S. T90 values for the splash blends are lowered due to the dilution of heavy components, as shown in the API blending report (API, 2010) and the analyses of Yang et al. (2019a). Additional discussion of AKI effect is addressed in the supplementary material section S7.

Our RVP for blended fuel did not consider RVP waivers and was set at 8.6 psi (US EPA, 2017) except for the winter fuel. API (2010) data suggest small RVP decreases for splash blending ethanol in the E10 to E30 range.

Recently, in an appendix to the latest version of the MOtor Vehicle Emission Simulator (MOVES3) document, properties are presented for E0 "Low Biofuel #1," compared to a reference E10 (US EPA, 2020). There is a 6.1% increase in aromatics (by volume) in summer and 6.7% in winter associated with the reduction of 9.9% of ethanol. Further, this is shown as requiring new sources of alkylate and isomerate. US refineries have existing available reformer capacity (Tamm et al., 2018) that is more likely to be used if an E0 is sought, raising the aromatic content of an E0 further. Based on the refinery blending model, historical data, and the availability of reformer capacity, a present day E0 could be expected to have 7.7% to 8% higher aromatics (by volume) in comparison to a conventional summer E10 (US EPA, 2020) also present an E0 "Low Biofuel #2," with very little additional aromatic content than the E10 reference fuel. This fuel specification, adopted for MOVES 3 modeling, requires an aspirational increase in alkylate production, noting the available US reformer capacity. In contrast, the recent study to support change from Tier 2 to Tier 3 certification fuel (so that certification fuel is "more representative of in-use fuel") reduced aromatics by 7.7% for an increase in ethanol of 10.15%, aligning well with the aromatic levels that we estimate (US EPA, 2018).

More limited ethanol effects research was performed on conventional winter fuels and on premium summer fuels, representing lower and higher aromatic levels, respectively. Based on E10 adjusted data, winter fuels track summer fuel historical trends with approximately 3% less aromatic content, and premium fuels track approximately 3% higher (US EPA, 2017). These data were used, although the Texas survey data (Eastern Research Group, 2020) showed a smaller aromatic content increase for premium fuels, and highest aromatic content for mid octane blend. Proposed winter gasoline RVP was 12.5 psi and premium summer fuel was 8.2 psi (US EPA, 2017). US EPA (2017) reports E200 and E300 rather than T50 and T90 — we were hesitant to translate between the two approaches and used Texas data for the premium E10 and Clark et al. (2019) for the winter E10. Only E0 and E20 winter regular and premium summer fuels were considered additionally, and the aromatic differences with ethanol content were intentionally set to be the same as for summer regular fuel, as shown in Table 4. Due to lack of data we did not go beyond E20. Blends are presented above with best estimates of typical properties based on tradeoff between ethanol and aromatics, but the models are available to estimate emissions for fuel properties chosen by a user. In particular, the database includes splash blending study data where aromatics are higher than for the market blend estimates, and experimental study data where ethanol and aromatics were varied independently. This broadens the estimation capability of the models.

4. Results

4.1. PFI and GDI emissions models

The EPAct study, a major source of data for modeling regulated emissions, showed a wide scatter of the data, accounting for the vehicle to vehicle variations. However, we found that the E0 to E20 change results in greater PM increase during cold-start and hot-running phases when the aromatics change simultaneously from 15% to 35%. Conversely, PM is actually lower for E20 compared to E0 during cold-start when the aromatics are simultaneously reduced (Fig. S3). This difference is also clearly seen when we consider only high T90 values, which most likely correspond to elevated quantities of heavier aromatics (Fig. S4). We also observed greater cold-start NOx increase for 35% aromatics E20 compared to 15% aromatics E0 (Fig. S5). CO cold-start emissions were lower on average for all E20 fuels compared to E0 (Fig. S6). Differences in THC emissions are not apparent (Fig. S7).

As an example, we compared the ability of our models and the EPAct reduced model to predict difference between PM emissions for two fuels (Fig. S10). The E15 fuel, with reduced aromatics, would be expected to have lower PM emissions than the E10 fuel. For cold-start our EPAct E10-Split (E10+) model matched the original measured average difference closely, while our EPAct Comprehensive model and original EPAct models predicted slightly lower reductions for the E15 fuel than was found experimentally (see supplementary material Section S8, Fig. S10). For hot-running PM the EPAct Comprehensive model prediction is closer to the measured emission ratio.

We also show the ability of our EPAct Comprehensive and E10-Split models to predict differences between E15 or E20 and E10 regulated emissions (Fig. 1). Our EPAct Comprehensive model behaves similarly or shows an improvement in estimated differences for PM and NOx compared to the original EPAct model for most fuels. For CO and THC, the models behave similarly but some fuels show better fit with the original EPAct model and some show better fit with our models. As an example, Fig. 2 shows the ability of the PFI Comprehensive model for cold-start emissions to predict measured NOx, CO, and THC values of West et al. (2012). It shows that the modeled NOx results, driven by a larger database, generally underpredicted the splash blend measurements of West et al. (2012). This stresses the importance of using a large database rather than data from a single study to derive emission models. The modeled THC reductions ranged from agreeing with West et al. (2012) data to predicting higher reductions than they measured. For CO the measured differences showed more variation than the modeled differences, but if averaged across all cases showed similar reduction.

Table 3 shows results for the PFI, GDI, and combined PFI and GDI models developed using the entire dataset. The combined PFI and GDI models introduce bias because the quantity of PFI data substantially exceeds the quantity of GDI data. As discussed in Section 3.10, to the extent that PFI and GDI models differ, an emissions inventory calculation should treat them separately and combine the two predictions in proportion to their presence or vehicle miles traveled within the fleet.

Further, the coefficients in Table 3 are limited in accuracy if they are extrapolated to high ethanol blends due to lack of high blend data. The catalyst study (West et al., 2012) did not include PM measurements, reducing the count of tests for the model input and causing the PM and gaseous emissions PFI models to have different fleet bases.

4.2. Emissions estimates based on market fuel properties

Figs. 3 through 6 present estimates for market fuels and splash blends, denoted with an S (e.g., E15S), of our PFI, GDI, and combined models, developed using both FTP and LA92 study data. Cold-start and hot-running data are shown separately rather than weighted to emphasize the cold-start influence. The E10-Split model represents an E10− model used to estimate the E10 to E0 difference, and an E10+ model used to estimate the E15, E20, and E30 differences from E10.

The summer fuel PM cold-start results in Fig. 3 show a marked difference between PFI and GDI PM, with market fuels showing PM reductions with higher ethanol blends for all PFI and GDI vehicles, with the exception of the E0 to E10 GDI split model. The estimates from the combined PFI and GDI models are close to those from the PFI models due to the dominance of PFI vehicles in the assembled database. In Fig. 3, the E20 to E0 PM change estimates may be made either with the comprehensive model or by combining the steps or ratios of the E0 to E10 (E10− model) and E10 to E20 (E10+ model), and these two approaches may be compared. For PFI market blend PM cold-start, the PM change from E0 to E10 is similar to the change from E10 to E20, suggesting no breakpoint in behavior above and below E10. For GDI, the trends above and below E10 differ, providing evidence for the need to split the modeling at the E10 breakpoint. Relative to the combined model for the GDI market fuels, the split modeling ascribes no PM reduction below E10 and higher PM reduction above E10. However, it is important to recognize that the GDI data are few in number, arise from different studies that did not cover all blend levels, and are subject to the numerous uncertainties arising from vehicle effects, blending strategies, analyses, and measurements. This uncertainty is clearly reflected in the wider confidence intervals for GDI vehicle estimates. The PM hot-running emissions, which are far lower in g/mile values than cold-start emissions, showed no clear percentage differences between market fuels (Fig. 4).

The market fuels behaved differently than the fuels that are splash blended from E10, which have less aromatic reduction. Splash blended fuels showed no differences in cold-start PM emissions for PFI vehicles and a reduction for GDI vehicles with higher ethanol blends (Fig. 3). These results reflect directly the higher PM coefficients for aromatic contribution than for ethanol contribution. Hot-running PM emissions were higher with higher splash-blended ethanol fuels for PFI vehicles (Fig. 4).

There are differences in the NOx cold-start emissions changes for the comprehensive models versus the split models. The cold-start NOx emissions comprehensive models show a small reduction for ethanol market fuels between E0 and E10, E10 and E20, and E10 and E30 with PFI vehicles, and no difference when using the split models (Fig. 3). Splash blended fuels showed a small increase in NOx emissions between E10 and E15S, and E10 and E20S for PFI vehicles. However, it must be stressed that these percentage changes are small, and also subject to uncertainty. No differences were observed for cold-start

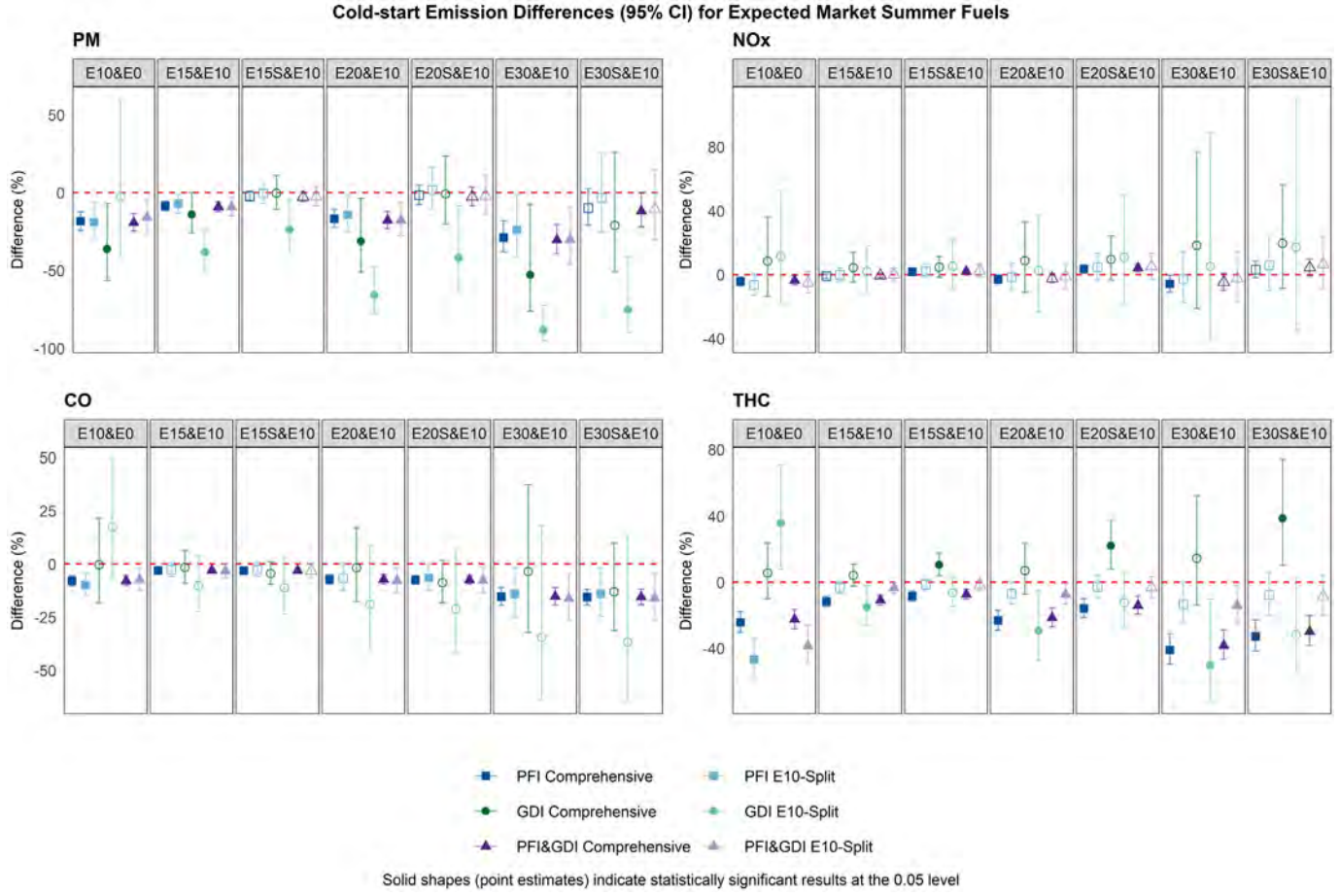

Fig. 3. Cold-start PM, NOx, CO, and THC emission estimates for PFI and GDI vehicles for summer market blends and splash blends modeled using the Comprehensive and E10-Split[a] models. Coefficients for the corresponding weighted models are shown in Table 3. Splash blends are denoted by "S".
[a]The E10-Split model represents an E10− model used to estimate the E10 to E0 difference, and an E10+ model used to estimate the E15, E20, and E30 differences from E10.

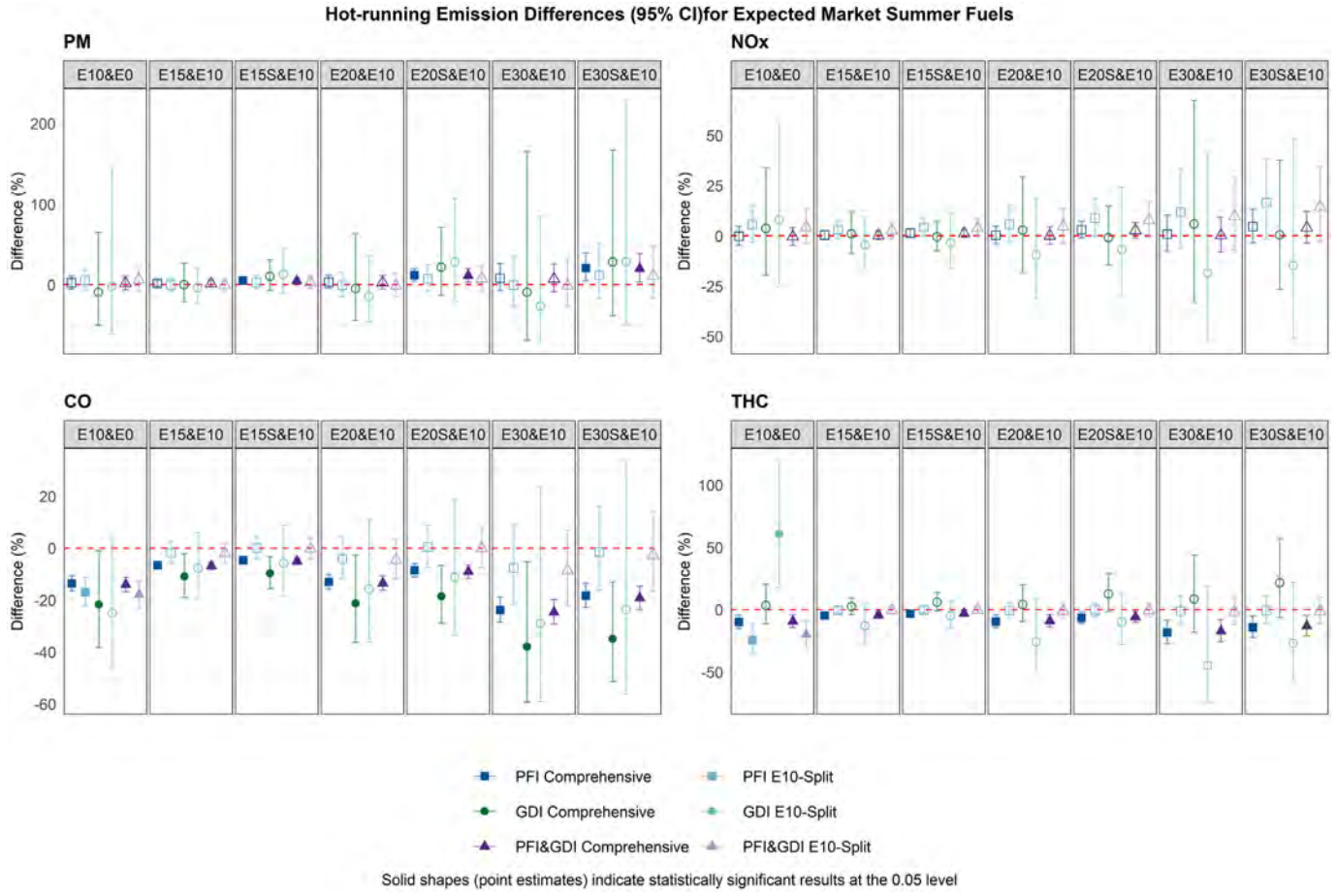

Fig. 4. Hot-running PM, NOx, CO, and THC emission estimates for PFI and GDI vehicles for summer market blends and splash blends modeled using the Comprehensive and E10-Split[a] models. Coefficients for the corresponding weighted models are shown in Table 3. Splash blends are denoted by "S".
[a]The E10-Split model represents an E10− model used to estimate the E10 to E0 difference, and an E10+ model used to estimate the E15, E20, and E30 differences from E10.

emissions of GDI vehicles, and hot-running emissions of PFI and GDI vehicles (Figs. 3 and 4).

In almost all PFI cases, higher ethanol blends have lower CO emissions for market and splash blends, as shown in Fig. 3. The comprehensive model and the E10-Split models differ for E15 versus E10, and E20 versus E10, but both suggest a reduction for E10 versus E0, and E30 versus E10 in PFI vehicles. No differences were observed for cold-start emissions of GDI vehicles. Hot-running emissions show higher percentage reductions for PFI and GDI comprehensive models (Fig. 4), but their absolute values are known to be lower.

Figs. 3 and 4 show that THC predictions also differ substantially between GDI and PFI vehicles. There is also justification for using the split models instead of the comprehensive model for both cold-start and hot-running phases for GDI and PFI alike. The E10-Split model shows a reduction in THC cold-start and hot running emissions between E0 and E10 for PFI vehicles, and no difference at higher blends. The E10-Split model shows an increase in THC cold-start and hot-start emissions between E0 and E10 for GDI vehicles, but higher blends showed a decrease for cold-start and no difference for hot-running emissions.

Figs. 5 and 6 show the results for the only two concentration steps considered for the winter regular (reduced aromatics) and summer premium (increased aromatics) fuels. The general pattern for cold-start and hot-running emissions is in sympathy with the results for the summer fuel PM, NOx, and CO emissions in Figs. 3 and 4 for PFI and GDI vehicles; and for THC for PFI vehicles. The premium market fuel PM emissions show a similar pattern of change as the winter fuels. This is due to the linear nature of the models, supported by the good fits of the models to the data. Although the winter, summer regular, and summer premium fuels have different aromatic levels, similar aromatic reductions are likely in response to ethanol addition, leading in turn to similar emissions changes. This implies comfort in estimating emissions when blending is considered based on a single BOB, because possible inaccuracy in the BOB aromatic analysis does not imply variable conclusions about the relative PM emissions. Although more complex models, with nonlinear terms, may offer a better fit to the data or obviate the need for two models split at the E10 point, blending outcomes would be affected by analytic inaccuracy and extrapolation may become unreliable.

5. Discussion

A substantial body of emissions data for ethanol blends in PFI vehicles exists in the literature, in addition to the traditionally employed EPAct data set. Many studies do not employ BOB compositions or blending strategies reflecting real world practice, so that it is difficult to capture real world nonlinear blending effects. However, models developed from the study data may be applied to estimated market fuel compositions to assess effects of major variables on blending. PFI studies that used the LA92 or FTP test schedules at certification temperatures and at ethanol blend levels from E0 to E30 were identified as a basis for regression modeling of distance specific NOx, PM, THC, and CO. We limited our study to US vehicles and test cycles, and did not use studies employing older vehicles because few are represented in the fleet and would in most cases have very high milage relative to the time when they were studied. Vehicles in our study represented Tier 2 federal standards, with a few Tier 3 federal standards, and all the vehicles were

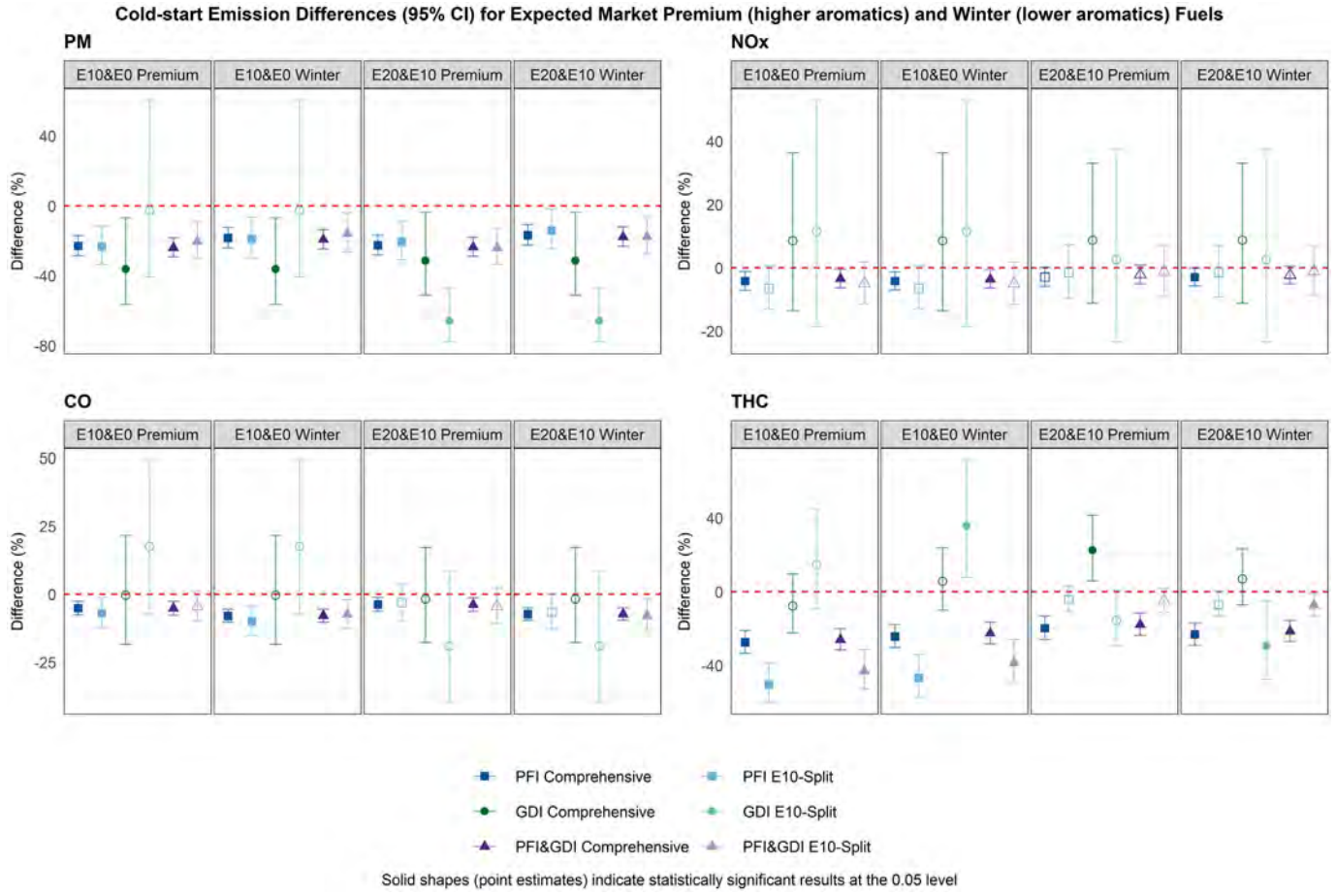

Fig. 5. Cold-start PM, NOx, CO, and THC emission estimates for PFI and GDI vehicles for market premium and winter blends using the Comprehensive and E10-Split[a] models. Coefficients for the corresponding models are shown in Table 3.
[a]The E10-Split model represents an E10− model used to estimate the E10 to E0 difference, and an E10+ model used to estimate the E15, E20, and E30 differences from E10.

equipped with three way catalysts. The technology for PFI vehicles was substantially similar, and vehicles may be expected to react in similar ways to fuel changes. Since the model is fundamentally relative in its predictions, higher and lower emissions levels should not affect conclusions. The major technology divide is between PFI and GDI vehicles. Fewer data exist for GDI vehicle modeling, and study plans for both GDI and PFI varied widely.

Regression is possible across a range of vehicle model years, with different emissions levels, if the emissions are considered as a ratio or a percentage change. This is afforded by using logarithmic space for emissions. Review of combined PFI data revealed that NOx, PM, and CO were best described using ethanol fraction, aromatic fraction, and T90 as independent variables, where T90 serves in most cases to describe the molecular weight distribution of the aromatics. For THC prediction RVP was employed instead of T90. T50 was not employed because it was correlated with ethanol content (Fig. S1) and is known to vary in a manner that is difficult to predict, by introducing a local, steep slope in the ASTM distillation curve (API, 2010). As emphasized by US EPA (2013a), the coefficients in emission models should not be interpreted in isolation.

Model formulation was found to be affected at a low level by the specific method used to determine aromatic content and by the selection of individual emissions test run data versus the use of average emissions values for each vehicle and fuel combination. A large count of regression models was prepared to cover the LA92, FTP, cold-start, hot-running, and weighted emissions. In many cases there was a difference in emissions response to ethanol addition in the E0 to E10 range, and for blends above E10, termed "E10+". The same is true for dependency of properties of the fuel, such as T90 and RVP. Extrapolation of low level blend data to higher level blends is therefore questionable. Rather than considering a nonlinear model, two separate models were considered, as well as a comprehensive model.

Models showing good fit with the combined data set were applied to expected composition of market fuels. Summer, regular grade, conventional market fuel composition was based on current E10 Texas and national compositions, although composition is known to vary widely. Aromatic content was modeled in response to ethanol level (E0 to E30) from consideration of the changes in reformate needed to hold AKI constant. Variation in T90 was determined primarily from an API property study (API, 2010). In addition, splash blends based on E10 were considered, and aromatic change was by dilution for these fuels. Winter regular grade conventional fuels and summer premium grade conventional fuel estimated properties (E0 to E20) were also used with the models.

For the summer regular fuel, and for both the comprehensive and split (E10−, E10+) models, PFI PM cold-start emissions were substantially reduced by ethanol addition. E20 PM emissions were 35.2% of E0 emissions by the comprehensive model and 33.1% by the split models (Fig. 3). Further reduction occurred for the E30 composition that was selected. The splash blends showed PM reductions relative to E0, though smaller, but were on a par with E10. Market fuel hot-running emissions, typically far lower than cold-start emissions, showed no differences with respect to ethanol level (Fig. 4). For GDI vehicles, the PM reductions were higher, with E20 showing over a 65% E10-Split (E10+) model reduction with respect to E10 (Fig. 3). This leads to the conclusion that PFI and GDI data should not be mixed to form a unified model for PM.

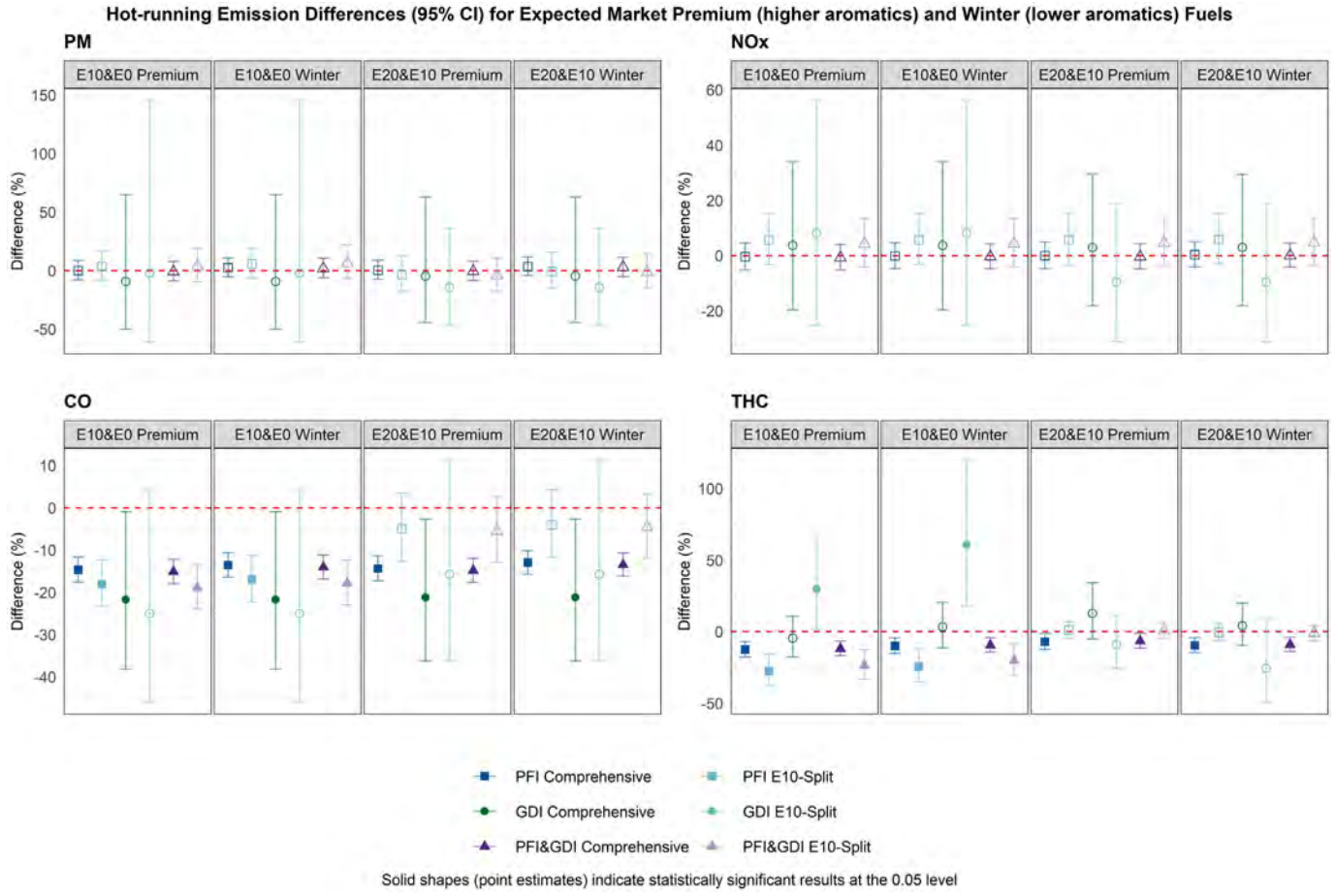

Fig. 6. Hot-running PM, NOx, CO, and THC emission estimates for PFI and GDI vehicles for market premium and winter blends using the Comprehensive and E10-Split[a] models. Coefficients for the corresponding models are shown in Table 3.
[a]The E10-Split model represents an E10− model used to estimate the E10 to E0 difference, and an E10+ model used to estimate the E15, E20, and E30 differences from E10.

All of the ethanol market fuel blends, except E15, showed lower cold-start NOx than for E0 for PFI vehicles with the comprehensive model but no differences with split models (Fig. 3). No differences were observed for GDI cold-start (Fig. 3) and PFI and GDI hot-running emissions (Fig. 4). The CO cold-start emissions were lower for higher ethanol blends for PFI vehicles but not different for GDI vehicles. But hot-running CO emissions were lower for both PFI and GDI comprehensive models.

For both cold-start and hot-running emissions, THC results were scattered for the higher blends. For PFI vehicles E10 THC was lower than E0, and vice versa for GDI, emphasizing the difference between the two engine technologies.

Results for the market and premium fuels did not differ in conclusions from the summer regular fuel in terms of ethanol blending trends. Although the baseline E0 fuels have different aromatic content, the blending comparisons are similar insofar as the aromatics are reduced from the E0 level in a similar fashion to the summer fuel change.

Our models presented above represent the most complete data sets known to the authors under selective constraints for emissions certification level, test cycle, and test temperature. The source data include different study blending strategies and are not balanced in test runs across the fuels or across the study variables. The reported aromatic levels were determined by different standardized methods. While these circumstances introduce some bias in weighting data describing fuels, the use of multiple sources blunts effects attributable to the design, execution, and analysis of one single study and supports the interest of achieving a defensible fit. The database contained both conventional and FFV vehicles, which may react differently to fuel composition changes (Schulz and Clark, 2011), but separate modeling with only the conventional fleet produced little change (Table S9). Although we presented final results in terms of market fuels, the models may be applied by the reader to any pair or set of fuels to estimate emissions differences. Although our data are derived from the US FTP and LA92 cycles, on-road emissions estimation would require assessment of vehicle speed and load and the proportion of cold-start behavior, as embodied in emissions inventory models such as MOVES (US EPA, 2021d) or CARB (2021). Likewise, inventory translation would be required for estimation outside US borders (Davison et al., 2021; Fontaras et al., 2014).

Results of ethanol studies demand care in application to real world inventory. One should not compare directly the emissions from study fuels having different ethanol levels unless those study fuels reasonably represent formulations expected in the marketplace: general results rather should be the basis for a multidimensional model. Given such a model, one should not consider the emissions model coefficient for ethanol in isolation from the influence of other composition changes imposed by the refiner and associated with changing the ethanol content. Absent availability of a study that embraces expected market fuel compositions, it is best practice to combine a multidimensional model with the projected fuel composition to yield a good faith estimate of the net direct and indirect ethanol blending effects.

In this research we compiled a comprehensive database of published data to produce and test emissions models based on fuel properties and composition. We then identified properties representative of current and proposed market fuels, and applied the models to the market fuel properties to estimate regulated emissions. In particular, we have taken into account the typical reduction in aromatic content of gasoline in response to the blending of ethanol.

6. Conclusions

We compiled a comprehensive database of US emission studies, developed separate regression models for different engine types based on fuel properties, and used those models to estimate emissions from expected market fuel compositions. Our results showed that for summer regular grade conventional fuels, cold-start PM was reduced by ethanol addition, and more so at higher blend levels but hot-running emissions showed no differences with respect to ethanol level. For all emissions, the effects differed between port fuel injection (PFI) and gasoline direct injection (GDI) powered vehicles and for NOx, CO and THC there were differences between comprehensive and split models. NOx results varied over blend levels. Hot-running emissions, which are very low for modern vehicles, varied in direction and effects were small for market blends of up to 20% ethanol. CO emissions were reduced by ethanol in nearly all cases for PFI but only the hot-running GDI, and THC results were favorable for ethanol with the exception of some GDI results. To the extent that PFI and GDI models differ, an emissions inventory calculation should treat them separately and combine the two predictions in proportion to their presence or vehicle miles traveled within the fleet.

There is uncertainty directly associated with the regression process. Model inputs also carry uncertainty since study methods vary and compositions are reported differently between laboratories and test methods. Although we presented final results in terms of market fuels, the models may be applied by the reader to any pair or set of fuels to estimate emissions differences.

Our fuel effects estimates were derived from US studies, but with appropriate inventory model adjustment would be applicable to other markets with stringent regulation of vehicle emissions and fuel specifications. Emerging international economies may reflect less advanced vehicle technology, with implications for emissions effects.

Funding

This work was conducted by scientists and engineers at Environmental Health & Engineering, Inc. along with N. Clark, with financial support from POET, LLC and Growth Energy.

Data availability statement

The data that support the findings of this study were extracted from published studies and reports and are publicly available.

CRediT authorship contribution statement

Fatemeh Kazemiparkouhi: Data curation, Formal analysis, Methodology, Validation, Visualization, Writing – original draft. **Tania M. Alarcon Falconi:** Project administration, Resources, Supervision, Validation, Visualization, Writing – review & editing. **David L. MacIntosh:** Conceptualization, Supervision, Validation, Writing – review & editing. **Nigel Clark:** Conceptualization, Formal analysis, Methodology, Validation, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank Nadeem Istfan, Melissa Scully, Laura Travis, Julianne Meehan, and Katie Rubstello for their assistance with creating the database.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.scitotenv.2021.151426.

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July 21, 2022

Cory-Ann Wind
Clean Fuels Program Manager
Oregon Department of Environmental Quality
Submitted by email to *CFP.2022@deq.oregon.gov*

Dear Ms. Wind:

As Oregon approaches 50,000 registered electric vehicles, and US electric vehicle sales hit a new record halfway through 2022, PGE expects that extending the Clean Fuels Program will continue the program's support for and accelerate of the transition to electric vehicles. PGE was pleased to serve as part of the advisory committee for the Clean Fuels Program Expansion 2022 Rulemaking and appreciates that DEQ has incorporated feedback from PGE into the proposed rules. PGE supports the extension of the Clean Fuels Program.

Clean Fuels Program helps accelerate Transportation Electrification

The Oregon Clean Fuels Program has created significant incentives and value to drive forward transportation electrification. Since 2019, PGE's CFP-funded Drive Change Fund (DCF) has awarded $6.8 million in grant funding to 39 organizations. The 2019 and 2020 grants funded an estimated 65 EVs and 28 e-bikes being placed in service. PGE ran the third cycle of DCF in 2021, awarding $2.25 million to community transportation electrification projects. PGE's Electric School Bus Fund funded six electric school buses in 2020 and seven buses in 2021. PGE collaborates with Pacific Power on the Oregoin' Electric statewide electric transportation outreach campaign, funded by Clean Fuels funds. PGE also has run CFP-funded pilot projects related to vehicle to grid charging, pole charging, and smart charging using vehicle telematics. Clean Fuels credits also offer a significant incentive for businesses and fleets to install EV chargers and switch to electric vehicles.

Role of Renewable Energy Certificates

As renewable generation proliferates and addressing climate change become increasingly urgent, public policies advancing clean electricity are evolving toward a stronger focus on greenhouse gas (GHG) reduction rather than accounting for specific types of renewable generation. Oregon's clean electricity law, HB 2021 (2021), and Oregon's Climate Protection Program are two examples that use absolute GHG targets. We appreciate that the proposed rules recognize that tracking renewable energy certificates for voluntary clean energy claims such as incremental crediting should not interfere with decarbonization policies focused on greenhouse gas reductions.

Non-residential credit generation:

For non-residential credits, DEQ's proposed rules provide that:

> *"The owner of the electric-charging equipment may generate the credits. If the owner of charging equipment is not registered and that charging equipment is part of an electric vehicle supply equipment network, then the network service provider may register until and unless the owner registers*. (proposed OAR 340-253-0330(3)(a)).

PGE has previously commented on the importance of keeping the owner of the charging equipment in control of clean fuels credits. We understand this paragraph to ultimately

mean that if the owner wishes to generate the clean fuels credits at any time, they have the right to do so, regardless of whether the service provider has registered first. If this is not the effect of this passage, we request that DEQ clarify the language or its intent. The owner should be able to make decisions about how to utilize the CFP credit value from their EV chargers, including to participate in utility programs that may require the CFP value to reduce program costs to utility customers.

Reporting charging based on a single meter: PGE appreciates that DEQ has added language to OAR 340-253-0500 to allow electric vehicle chargers on a single dedicated circuit or panel to be registered under a single meter. PGE expects and encourages that nonresidential electric vehicle chargers will increasingly be on a separate meter from the meter serving the premises to facilitate managed charging. This rule change will simplify CFP reporting for fleets.

Lastly, we wish to express our thanks and recognition to the staff of the Clean Fuels Program. This small team manages a complex program and market while engaging stakeholders in program design changes to extend the program's benefits.

Thank you for consideration of your comments,

Sunny Radcliffe
Director, Environmental Policy and Government Affairs
Portland General Electric

RED TRAIL ENERGY, LLC **"Our Farms, Our Fuel, Our Future"**

PO Box 11 Richardton, ND 58652 (701)-974-3308 FAX (701)-974-3309

July 21, 2022

Oregon DEQ
Attn: Cory-Ann Wind
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

Electronic submittal only via: CFP.2022@deq.oregon.gov

Re: Proposed Rulemaking Changes Comment from Red Trail Energy

To The Clean Fuels Standard Program Staff,

We thank you for this opportunity to comment on the proposed rulemaking for the Clean Fuel Standard (CFS). Red Trail Energy is a farmer owned North Dakota renewable ethanol producer. We have just completed commissioning and startup of our Carbon Capture and Sequestration (CCS) infrastructure. This is an independent, self-funded $39,000,000 investment project that is now online and working to sequester a projected 180,000 metric tons of CO2 annually. This project has drawn our community together to reinvest in our local economy, the environment for our global neighbors and future energy needs of generations to come.

The Oregon CFP does not currently have in place a readily available CCS protocol and Quantitative Methodology, however, the current provisions allow for recognition of an equivalent protocol. Our project is governed by Class VI permit primacy by the state of North Dakota. As such we have ample and sufficient protocol requirements for the operation of our project, including well monitoring and adverse event mitigation. We would appreciate DEQ recognition of these requirements as equivalent under your present and future final rule.

We are currently unable to submit a pathway application to DEQ for the inclusion of CCS in our existing certified fuel pathways until such a time that an administrative process is established, and a CCS protocol is recognized. As such, we would very much support and appreciate the opportunity to recognize the real-world carbon mitigation we are preforming now in future credit generation when these necessary administrative tools are incorporated into the program. DEQ has the authority to allow for this administrative action and should include it in this rulemaking for final implementation.

There are two main items we wish to request be explicitly recognized in your proposed amended rule.

1. The recognition of existing equivalent state permitting and legal responsibility in your forth coming CCS protocol.
2. The opportunity for CCS retroactive eligibility and credit generation for volumes of fuel produced and sold in the CFP market today incorporating CCS technology.

On Behalf of Red Trail Energy, I can be reached for further questions or discussion on these important inclusions in the CFP rule.

ss/ David Burns

Compliance Officer
Red Trail Energy, LLC

July 21, 2022

Cory Ann Wind
Oregon Clean Fuels Program Manager
Department of Environmental Quality

RE: Comments on Oregon's Clean Fuels Program Expansion 2022

Rinchem Company, Inc. appreciates the opportunity to comment on the proposed Clean Fuels Program rulemaking. We are a chemical management services company with a presence in several cities in Oregon, and we currently use dozens of electric forklifts and pallet jacks to carry out daily operations at our Hillsboro facility.

We would like to express our concern about the current version of the regulation that puts electric forklift fleet owners first in line to generate credits. Our experience with the program, explained below, is an example of why this decision can result in unintended, detrimental consequences.

In January 2022, I was made aware of the Clean Fuels Program and the incentives it could offer our company for our choice to operate electric equipment as opposed to diesel or propane. We were pleased to see that the credit revenue would help offset utility and maintenance costs for running our eMHE, and would bring down our total cost of ownership, so we moved forward with engaging in the program. We appointed an aggregator who helped facilitate submitting our facilities and equipment for approval, however, after several weeks of review by the DEQ, I was informed that our largest location was already registered and that our participation was blocked. We were told we had to come to an understanding and arrangement with the current aggregator assigned to the facility, but I had never engaged with anyone on this program prior, nor had anyone at our company, so this was a surprise to me.

After significant investigation, we found that a couple of our past leased units, which were no longer used at this location, still appeared in the CFP reporting system, and they were preventing both our facility and the rest of our owned electric equipment from participating in the program. This obstacle was disappointing because we had already begun planning on future expansion and investment in additional zero-emission deployments with these funds in mind.

Fortunately, our designated aggregator navigated this situation with the DEQ team, and after much back-and-forth, the eMHE leasing company and other aggregator agreed to stop reporting the obsolete equipment. It bears noting that the leasing entity never had insight into our operations, so they must have made assumptions, which calls into question the quarterly

energy data submitted to DEQ. Ultimately, it was disconcerting to find out that equipment we made a capital contribution towards operating, in terms of

paying for our lease and paired maintenance package, was claimed by an unknown aggregator, and that we saw no financial benefit nor reward for us deploying zero-emission technology.

In the current draft, first credit generation rights for using electric forklifts are laid out as follows:

For electricity used to power forklifts, the forklift fleet owner may generate the credits. If the forklift is being operated by a person other than the owner, the owner may generate the credits if they have detailed usage and charging data, otherwise the operator of the forklifts may generate the credits.

Given our experience, we suggest DEQ considers how likely it would be that fleet owners who do not also operate equipment actually have access to "detailed usage and charging data." Leasing/rental companies and their aggregators are far removed from the daily operations of any given warehouse, and operators of leased equipment have little motivation to provide important details about shifts, seasonality, or work days, every quarter to an unknown aggregator that will share none of the credit proceeds. We observed the heavy administrative burden our situation caused, including to Oregon state administrators, so we also wonder how sustainable managing similar scenarios would be at scale, if the current draft language is adopted.

Ultimately, facility operators should be at the forefront of receiving CFP credits as they are the most accurate source of usage and charging data, and they constitute the key decision makers proliferating the deployment of eMHE in warehouses.

Sincerely,

Jason Bushman
Facility & Asset Manager
Rinchem Company, Inc.

July 21, 2022

ELECTRONIC MAIL TO: CFP2022@deq.state.or.us

Oregon Department of Environmental Quality
Attn: Cory Ann Wind
700 NE Multnomah St., Room 600
Portland, OR 97232-4100

Re: Notice of Proposed Rulemaking, Clean Fuels Program Expansion 2022

Rivian Automotive, LLC, ("Rivian") appreciates the opportunity to comment on the proposed changes to the Clean Fuels Program ("CFP" or "the program") regulation. Oregon's CFP is a proven emissions reduction tool and a powerful enabler of transportation electrification. To date, the program has served a key role in the state's portfolio of complementary climate policies. We believe the program can and must continue to enable electrification and the resulting emissions reductions. As a manufacturer of electric vehicles ("EVs"), Rivian broadly supports the proposed rulemaking including provisions to extend and increase stringency in the program and allow advance crediting for certain electric vehicle supply equipment ("EVSE"). At the same time, we continue to encourage the Department of Environmental Quality ("DEQ") to weigh additional reforms to the CFP that will help grow Oregon's electric vehicle (EV) market with benefits for program effectiveness and the state's climate goals.

Keeping the World Adventurous Forever

Founded in 2009, Rivian is an independent U.S. company on a mission to Keep the World Adventurous Forever. Rivian's focus is the design, development, manufacture, and distribution of all-electric adventure vehicles, specifically pickups, sport utility vehicles, and commercial vans. Key to the success of our mission, these vehicles will displace some of the most polluting vehicles on the road today.

Rivian brought the first electric truck to market last year when we launched the R1T pickup from our manufacturing facility in Normal, Illinois, followed shortly thereafter by the R1S SUV and a commercial fleet electric delivery van for Amazon. All our vehicles are considered medium duty for regulatory purposes and satisfy ZEV requirements under both ACCI and the Advanced Clean Trucks rule ("ACT"). The R1T and R1S provide all-electric options in segments where added utility is a necessity. The R1T has an EPA-certified 314-mile range and 11,000lbs of towing capacity, while the R1S is a seven-passenger full-sized SUV. Rivian is also building a network of DC fast and Level 2 chargers across the country, including at sites on public lands.

Rivian Supports the Proposed Changes to the CFP

Rivian's mission to Keep the World Adventurous Forever is made manifest in our commitment to the environment and addressing climate change. We strongly support ambitious programs of greenhouse gas ("GHG") emissions reductions, including clean fuels policies like the CFP. In the CFP notice of proposed

rulemaking, DEQ describes many changes to the program. Rivian's interest focuses on the recommendations for overall stringency, a program review, and changes to the advance crediting provisions. We also recommend continued deliberation on other opportunities to strengthen the CFP's electricity provisions. We take no formal position on other issues.

DEQ proposes to strengthen and extend the CFP. Rivian welcomes this, including the target for a nation-leading reduction in carbon intensity ("CI") of 37 percent by 2035. Oregon's credit bank has grown in recent years, a sign of the market's success in meeting the program's current requirements.[1] But the growing credit bank also shows that greater stringency is possible. Tightening the CFP's requirements would draw new investments into the clean fuels market, including in the development of electricity as a transportation fuel, that will enhance the contribution of the CFP toward achieving Oregon's climate targets. DEQ should move ahead with its proposal for new CI targets.

Given the proposed increase in post-2030 stringency, DEQ's proposal to conduct a program review seems appropriate. To the extent that conducting this review in 2029 would provide adequate lead-time to enact changes beginning in 2030, we do not take issue with the timeline. However, it seems reasonable to assume that reviewing the program somewhat earlier could provide more actionable recommendations and provide staff with time for in-depth evaluation and stakeholder consultation. DEQ should consider the benefits of a CFP review conducted prior to 2029.

Rivian generally supports expanding the program's advance crediting provisions to certain EVSE projects funded by the federal Bipartisan Infrastructure Law. Advance crediting allows credit-earning entities to claim credits before they would normally be generated, supporting upfront investments in clean transportation technology such as EVs and now, under this proposal, charging infrastructure. A well-developed network of direct current fast charging ("DCFC") stations is crucial for the long-term success of the EV market but presents a challenging business case today. Installing DCFC stations requires significant capital investment at the outset. Allowing advance crediting for such infrastructure under the CFP—especially when coupled with federal funding support—will directly address this challenge and only accelerate investments in DCFC in the state.

However, Rivian believes DEQ should not limit eligibility for EVSE advance crediting only to projects already receiving federal funding support. While the opportunity to "stack" two sources of funding could prove particularly helpful for installations in low-utilization but high-need areas, such as rural or low-income communities, other DCFC projects that do not receive federal funding could also merit advance crediting support. A highly visible and extensive DCFC network, deployed as soon as possible, will inspire confidence in the driving public that EVs can take them anywhere they need to go. DEQ should finalize this proposal but without federal funding qualifications as part of the rulemaking.

Rivian Continues to See Value in Refining the CFP's Electricity Provisions Further in a Future Rulemaking

DEQ recently closed a rulemaking regarding electricity provisions within Oregon's CFP and we recognize

[1] Oregon Department of Environmental Quality, *Quarterly Data Summaries*, available at www.oregon.gov/deq/ghgp/cfp/Pages/Quarterly-Data-Summaries.aspx.

that the scope of the upcoming rulemaking is now well defined. Nonetheless, there is considerable potential benefit in weighing additional reforms that would grow Oregon's EV market, align the CFP with other climate and transportation policies in the state, and thus maximize the impact of the program. Rivian looks forward to continuing discussions on these topics.

Reconsider the Role of Automakers in the Program

DEQ should assess how automakers could play a more direct role in the CFP. This might include introducing automakers as eligible credit generators for residential EV charging. Using telematics, automakers can report the most accurate data reflecting actual EV usage and charging behavior. Providing automakers with an opportunity share in base credit generation in exchange for data provision would create a direct and compelling incentive for manufacturers to accelerate efforts to build and sell highly utilized EVs in the state. Such an approach could also improve program efficiency and bring automakers' expertise in EV market development more firmly to the fore.

The latter goal could also be supported by including automaker representation on the equity advisory committee. EV manufacturers are uniquely positioned to understand customer behavior and the factors affecting EV market growth. With representation on the committee, the industry could help shape incremental credit revenue investment priorities that maximally benefit the climate, public health, and EV drivers in all communities. DEQ should provide automakers greater opportunity to participate in the CFP.

Reevaluate Guidelines for Credit Revenue Investment

If utilities continue to serve as the primary credit generator for residential charging, DEQ should adopt more defined investment requirements governing their spending of proceeds. While DEQ currently requires utilities to demonstrate that their spending of credit revenue aligns with certain principles, Rivian believes that a more targeted approach is appropriate and would drive electric vehicle market growth with greater impact. For instance, utilities could use their credit revenue to fund a statewide EV purchase rebate, directly and tangibly supporting EV sales. Rivian recommends that DEQ require CFP revenue be reinvested to further grow the CFP by growing EV market share.

Continue Examining the Issue of Take-Home Fleets

The CFP provides clear allocation guidelines for electricity credits generated by fleets when charging takes places in non-residential contexts. At workplaces or fleet dispatching centers, the owner of the charger—often the fleet operator—earns the credits, an important benefit for fleets seeking to electrify their operations. However, some fleet EVs, including medium-/heavy-duty ("MHD") vehicles like pickups and vans as well as light-duty ("LD") cars and trucks, might charge at private residences. In general, Rivian believes that the fleet should be eligible to earn at least a share of the residential credits generated in such circumstances. These credits should be empirically determined and verified. As just one possibility, EV manufacturers, in partnership with fleets and DEQ, could leverage telematics data to unlock the value of residential credits for owners/operators while avoiding double-counting.

While recognizing all residential charging could certainly benefit many LD fleets, our view is that this is even more important in the context of the newly adopted Advanced Clean Trucks ("ACT") rule for MHD vehicles. When California adopted this regulation, the California Air Resources Board assumed that

commercial MHD vehicle owners/operators would realize charging credit revenue from the state's Low Carbon Fuel Standard as part of their cost-benefit calculations for the rule and the affected parties. This recognized the important contribution of charging credit revenue in supporting the business case for MHD fleet-switching. DEQ should recognize all residential charging by implementing a method for manufacturers and vehicle owners to report, and take credit for, empirical charging data.

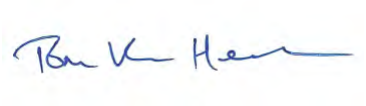
Rivian greatly appreciates DEQ's thoughtful consideration of this issue to date—specifically during workshops in the winter of 2022. We also acknowledge the complexity of this challenge and the need to continue the discussion. Ultimately, this issue merits careful examination in search of a solution for both LD and MHD fleets. Rivian stands ready to support these efforts.

Conclusion

Rivian strongly supports Oregon's drive to address climate change through a suite of policies, including extending and expanding the CFP. We also welcome proposals to extend advance crediting to certain DCFC infrastructure projects and to conduct a program review toward the end of the decade, though we encourage staff to consider the benefits of conducting this review earlier than 2029. Going forward, we continue to believe that additional reforms to the program's electricity provisions would benefit the CFP, the EV market, and the state's overall climate strategy.

Please contact me with any questions. Once again, Rivian thanks staff for their hard work and thoughtful engagement with stakeholders. We look forward to continuing our work together to realize the fullest benefits of the CFP.

Sincerely,



Tom Van Heeke
Senior Policy Advisor
Rivian Automotive, LLC

RPMG
1157 Valley Park Drive, Ste. 100
Shakopee, MN 55379

July 21, 2022

Cory-Ann Wind
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232

Electronic submittal only via: CFP.2022@deq.oregon.gov

Re: RPMG Comments on Clean Fuels Program Expansion 2022

Dear Cory-Ann,

RPMG, Inc. (RPMG) is a biofuel marketing company active in the Oregon fuels marketplace, representing our owner and marketing partner biofuel facilities located throughout the Midwest. We would like to again thank DEQ for giving us the opportunity to serve on the Oregon Clean Fuels Program (CFP) Advisory Committee as part of this rulemaking process.

We are supportive of DEQ's efforts to develop a scientifically robust and sustainable program that promotes and rewards innovation in the transportation fuel industry. RPMG is appreciative of the discussion throughout this rulemaking on the importance of a fuel-diverse approach to meeting the state's transportation fuel GHG reduction targets.

It is necessary to stress the importance of maintaining a fuel and technology neutral program. Let the market place sort out the best energy source to meet consumer demand, at the best price and with the lowest achievable (including negative) lifecycle carbon intensity fuel. We thank the agency for their acknowledgement and support for biofuels as a highly effective credit contributor to the current and future success of this program.

The CI scores of Midwest ethanol is on a downward trajectory. Facilities are employing carbon reducing and energy efficiency technologies of all varities at an escalating rate. As Oregon moves from E10 to E15, and uses more E-85, the industry will continue to supply the market with lower and more competitive CI fuels—just as the program was designed to do.

The proposed rules have a variety of potential program adjustments highlighted and RPMG's comments focus on select aspects.

Carbon Intensity targets of 20% in 2030 and 37% in 2035

DEQ is proposing in this rulemaking to extend the annual compliance targets of the program to 20% in 2030 and 37% in 2035. As a credit contributor to the CFP and supporter of reducing transportation fuel carbon emissions, RPMG supports this proposal. Long term investment strategy requires long term goals and thoughtfulness in balancing an appropriate investment signal and achievable emission reduction goals.

Transitions to low carbon emission technology is underway in every facet of our industry and we stand ready to supply a reliable and consistent energy commodity to contribute toward achieving these targets.

Further, DEQ is proposing to conduct a review of the Clean Fuels Program in 2029 to be submitted to the Environmental Quality Commission. The purpose of the review is to provide an update of the program's metrics and recommend whether additional changes should be made to carbon intensity targets for 2030 and beyond. This proposal is sound to ensure the program stays on track and is providing the envisioned benefit to constituents and stakeholders.

Post-Verification Credit Generation Adjustment

RPMG supports the proposal to allow for post Verification additional credit generation for Fuel Pathways demonstrating an Operational CI score for the Verified period of 1 gCO2e/megajoule or more below the approved CI value. The post Verification credits should be deposited to the Fuel Pathway Holder where that entity is an OFRS reporting entity or to the initial reporting entity where this entity is not a registered OFRS Account Holder.

Carbon Capture and Sequestration

The Oregon CFP does not currently have in place a readily available CCS protocol and Quantitative Methodology, however, the current provisions allow for recognition of an equivalent protocol. We would recommend DEQ state recognition of equivalent protocols in the final rule.

The rule in effect today does in concept allow for CCS fuel pathway and project crediting. However, there is not a process by which to functionally submit a pathway or project application for DEQ to consider the inclusion of CCS technology.

Until such a time that an administrative process is established, and a CCS protocol is recognized, this remains a barrier to technology and investment implementation. As such, we would very much support and appreciate the opportunity to recognize the real-world carbon mitigation occurring now in future credit generation when these necessary administrative tools are incorporated into the program. DEQ has the authority to allow for this administrative action and should include it in this rulemaking for final implementation.

In summary, there are two main items we request to be explicitly recognized in your proposed amended rule:

1. The protocol for determining equivalence of existing permitting or quantification methodology for CCS.

2. The opportunity for CCS retroactive credit eligibility and generation for fuel produced incorporating CCS technology and sold in the CFP market today.

Simple Updates for Reporting

RPMG supports the proposal to clarify and revise various updates for reporting.

The call for Product Transfer Documents to bear the state of destination for fuel transfers in OAR 340-253-0100 is justified.

The revisions to modify “Position holder sale” to be “Position holder sale without obligation” and insert a corresponding “Position holder sale with obligation” to OAR 340-253-0040 are consistent with other obligation transfer types.

The addition of a transaction type for gallons reported as “Production for Import” in OAR 350-253-0040 is necessary for the reporting scheme of opt-in out of state producer reporting in OFRS, as recommended in RAC meeting proceedings, and should be added to the final regulation.

Clarification of language for changes of Ownership, Control or Bankruptcy provisions is useful for establishing expectations and protocols for said situations in entity strategic planning.

Section 340-253-0400(9) adds a requirement consisting of “… A fuel producer must inform DEQ within fourteen calendar days after it becomes aware that its operational carbon intensity will exceed its certified carbon intensity on one or more pathways. RPMG believes this new requirement is ambiguous and unnecessary. We suggest it be struck from the final rule, and if not, then additional clarity needs to be added to the regulatory language to avoid creating an enforcement risk. If it were to remain as written, it is unclear in regard to what constitutes the expected procedure for “informing” DEQ, what constitutes an entity “becoming aware”, at what interval of time within a 24-month data period or within the Verification proceedings a fuel pathway holder may “become aware” and have certainty a CI “will exceed” the certified value.

In Closing

RPMG looks forward to continuing to work with agency staff to improve the adoption and implementation of this important regulation.

Thank you,

Jessica W. Hoffmann
Regulatory and Compliance Manager
RPMG Inc.

From:	Scott Shurtleff
To:	CFP2022 * DEQ
Subject:	Public Comment Re: Clean Fuels Program Expansion
Date:	Tuesday, July 19, 2022 4:03:18 PM

DEQ Clean Fuels Program Staff,

Thank you for your ongoing efforts with Oregon's Clean Fuels Program (CFP). I commend you for the results to date of reducing 6 million tons of emissions from the original baseline. I also commend DEQ for creating carbon intensity scores for different fuels which include the land use and production processes for the fuel. As a result of your efforts, the CFP is one of Oregon's most important and cost-effective tools to reduce emissions from transportation fuels.

The latest U.N. Intergovernmental Panel on Climate Change (IPCC) report contains dire warnings that "it's now or never if we want limit global warming to 1.5 DegC" and that "any further delay in concerted global action will miss a brief and rapidly closing window to secure a livable future".

The CFP is off to an excellent start, but we need much more ambitious emissions reductions that are aligned with climate science. The IPCC report states that greenhouse gas emissions must be reduced by 43% by 2030. We need the clean fuels program targets to match the IPCC target. **Please strongly consider setting more aggressive targets than are currently proposed.**

Further, **I urge DEQ to prioritize electrification as much as technically feasible**. Electrification will allow further reduction in GHG emissions as we continue to decarbonize electricity generation in Oregon.

Finally, **it is vital that we prioritize equitable outcomes with CFP**. The policies must provide affordable transition paths to clean fuels vehicles for low-income populations. Clean fuels infrastructure and public charging stations must be made accessible to frequently underserved populations, such as low-income and rural communities.

Thank you for your consideration,

J. Scott Shurtleff
SW Portland
EcoFaith Recovery

July 19th, 2022

Cory Ann Wind
Oregon Department of Environmental Quality (DEQ)
700 NE Multnomah Street, Suite 600
Portland, OR 97232
Submitted electronically via CFP.2022@deq.state.or.us

RE: 340-253-0330 Credit Generators: Providers of Electricity (6) Electric Transportation Refrigeration Units.

Dear Ms. Cory-Ann Wind,

Smart Charging Technologies LLC ("SCT") appreciates Department of Environmental Quality (DEQ) Staff's commitment to well-organized stakeholder meetings with ample opportunities for public input. The following comments are presented to the Public Hearing held on July 19th, 2022.

We are of the opinion that favors having the charging equipment infrastructure owner have the first right to generate credits. We see obvious drawbacks to the current regulation that gives the first right to generate credits to the eTRU owner:

- Considering eTRUs mobility across many warehouses, where the eTRUs are stationary and going thru loading/unloading or overnight charging, the entity that bares the cost of electricity used to power the eTRU is the charging equipment infrastructure owner. It is only fair that the entity that bares such cost is allowed to recover it in a hassle-free manner by being the credit generator. Otherwise, it becomes a major challenge for the infrastructure owner, where the eTRU is stationery and charging, to recover the cost of charging (electricity cost and operating costs) from the, potentially many, eTRU owners.
- eTRUS mobility scenarios are very similar to non-residential charging, eCHE, eOGV, and eGSE, where these vehicles may visit many facilities/charging stations. For these applications, the charging infrastructure owner gets the benefit of generating CFP credits. Reference is made to (340-253-0330 Credit Generators: Providers of Electricity: (3) For non-residential charging (a), (7) Electric Cargo Handling Equipment, (8) Electric Ocean-Going Vessel, (9) Electric Ground Support Equipment). We see no reason why eTRUs are any different.
- Currently the plugs' location is at the loading decks, in which the eTRU will be plugged in for loading and unloading, but the eTRU may need to move to the back parking area and can't stay plugged in there. The facility owner has no incentive to have chargers in the back parking area. And many times, these eTRUs will be setting there with cargo overnight running diesel.
- Additionally, there are additional complexities due to requiring owners to register eTRUs at every facility they stop at. For example, an eTRU owner has 150 eTRUs visiting 12 facilities. This means there must be 1800 registration records; many of them just to capture a single or few visits per facility. This is prone to errors and hard to manage. Not to mention the charging claims, from each

location and for each eTRU, the eTRU owner must submit each quarter. It is not practical for the owner to register each eTRU at each facility they visit and prevents effective participation of eTRUs.

- Finally, it is worth mentioning that other regulatory bodies are moving in the direction of having the "Charging Site Host" to be the credit generator from electricity transportation applications. Reference is made to Canada's Clean Fuel Regulations article "Electricity — charging-site host 101(1)".

For all the above, we strongly recommend having the charging equipment owner have the first right to generate credits from eTRU charging.

Thank you for taking our comments into consideration. We look forward to continued participation and discussion.

Sincerely,

Khalid Rustom, PhD.
General Manager, Energy Program

July 21, 2022
Submitted via email to CFP.2022@deq.oregon.gov

Cory Ann Wind
Oregon Department of Environmental Quality
700 NE Multnomah St., Room 600
Portland, OR 97232-4100

RE: Oregon Clean Fuels Program Expansion 2022 - Proposed Rule

Dear Ms. Wind,

SRECTrade respectfully submits the following comments in response to the Notice of Proposed Rulemaking published June 29, 2022:

About SRECTrade
SRECTrade is a technology driven platform and service provider providing equitable access to complex regulatory markets. As the largest third-party manager of environmental commodities in the United States, we accelerate deployment of clean energy assets while minimizing the time, cost, and risk of participating in such complex regulatory programs. SRECTrade is a wholly owned subsidiary of Xpansiv, the global ESG Commodity Marketplace. Xpansiv built and operates the largest carbon market in the world. Collectively we fund budgets to deploy and operate zero-emission equipment and energy generation, while helping ensure broader ESG commitments are met with carbon offsets, renewable energy, and digital fuels.

Clarify forklift definitions
The proposed rules define forklifts as a vehicle that "…Is used to move and lift cargo and goods by means of pronged device Inserted under the load." This definition might unnecessarily exclude lifts that do not employ pronged devices such as Class II Code 6: Low Lift Platforms, Class III Code 1: Low Lift Platforms, Class III Code 3: Tractors, and Class III Code 6: High Lift Platforms. SRECTrade recommends amending the definition under Section 340-253-0040 (51).

Clarify registration requirements for eOGV and eTRU
The proposed rules do not include specific equipment registration requirements for eOGV or eTRU. SRECTrade recommends extending the registration requirements proposed for off-road electrical and hydrogen vehicles under Section 340-253-0500 (5)(b) to eOGV and eTRU.

Expand eCHE eligibility beyond ports and Intermodal rail yards
The proposed rules exclude eCHE that operate at locations other than ports and Intermodal rail yards. SRECTrade recommends removing this exclusion from the definition of eCHE under Section 340-253-0040 (48).

Facilitate exchange-based trading of CFP credits
SRECTrade encourages DEQ to better enable exchange-based trading of CFP credits by creating an account capable of clearing exchange-based transactions. The current and proposed rules prevent any means of trade facilitation - instead exchange participants would need to directly settle transactions on their own. A clearing account would provide a more secure and cost-efficient means of settling exchange-based transactions.

Credit exchanges remove barriers to market entry, enable better pricing transparency, and accelerate adoption. This greater access and efficiency will increase confidence in the CFP market and ensure that clear pricing signals translate to investments In and greater utilization of low carbon fuels. Such benefits have been recognized in California's Cap and Trade Program and Low Carbon Fuel Standard, which have enabled clearing service providers to create registry accounts to facilitate settlement.

To achieve this, SRECTrade recommends the following:

- Add rule language that creates a new category of program participant, Clearing Service Provider (CSP), for the purposes of enabling spot and futures exchanges clearing services. A CSP would take temporary custodial ownership of CFP credits for clearing purposes.
- Require entities seeking to provide clearing of futures to be a licensed Derivatives Clearing Organization (DCO) registered with the Commodity Futures Trading Commission (CFTC). **Entities seeking to provide spot clearing of credits are not regulated by the CFTC and should not be subject to this requirement.**
- Set no time limit for clearing service providers to hold CFP credits. This would enable greater transparency and price discovery by giving sellers time and flexibility to find fair market value.
- Enable CSPs to designate multiple users to administer account functions on their behalf, including by entities other than the CSP itself.

Enable Software to Interact with the Oregon Fuels Reporting System

SRECTrade strongly encourages DEQ to implement an Application Programming Interface (API) for the Oregon Fuels Reporting System (OFRS). The OFRS is the primary interface for all program Interaction: fuel reporting, pathway and asset applications, credit transactions, verification, and enforcement, etc. However, the current state of the OFRS will impede and limit program success. The manual input and spreadsheet uploads currently required are labor intensive, costly in both time and money, and error prone for users, verifiers, and DEQ staff.

APIs are used across many registries today with great effect. With a registry API, third-party developers can build software tools that perform the same tasks (or a subset of tasks at DEQs discretion) as a current OFRS user but with greater efficiency, precision, and connectivity to other data sources (e.g. metering equipment). APIs would allow DEQ to outsource future Innovation of the OFRS to the private sector, while maintaining full control over security and user functionality.

SRECTrade recognizes that back-end Improvements to the OFRS can be considered and implemented outside of the rulemaking process. Therefore, we encourage DEQ to hold a workshop to solicit stakeholder input on OFRS user experience and Its criticality to meeting the needs of the CFP.

SRECTrade appreciates the opportunity to comment on the expansion of the CFP and looks forward to continued engagement with DEQ staff.

Sincerely,

Michael Saxton
Managing Director, Clean Transportation
SRECTrade, Inc.

From:	steve katz
To:	CFP2022 * DEQ
Subject:	clean fuels program
Date:	Tuesday, July 19, 2022 1:17:25 PM

I would like to express my support of the clean fuels program expansion.
Transportation provides one of the largest sources of particulate matter and greenhouse gases in the state. It is essential to reduce these substances for no other reason than the health of our population. If these health care costs are calculated into the equation for cpf, it is cost effective to expand cfp.
Some time ago then Pres. Obama had cash for the junker program. It is time for a new program of cash for gas powered vehicles to encourage EVs and plug in hybrids. I myself have a plug in hybrid, Volt, and it has proved to be the best fit for my family. I have found that most trips by car are less than 15 miles./day.
Every night I plug my vehicle into a 110 outlet, in the PGE low cost times, after 9 PM, and I have more than enough charge for the next day. I realize that many people do not have access to an outdoor charging outlet. If landlords had an economic incentive to install these outlets in their off street parking areas, people would use them for charging their vehicles. Some security measures would have to accompany these outlets, i.e. codes?
My idea is to keep it simple and easy for people to make a difference.. Many people would like to do the correct climate action, but find it difficult and expensive to do so.
Furthermore publicity concerning time sensitive use of electricity, would be helpful for the environment in 2 ways. First,it would encourage people to use off hour power and would also allow PGE, Pacific power etc not build any additional power generating facilities.
Thank you for attention to my comments
Steve, 6835 sw 60 ave
Ptld. Or.
'

Steve Katz
say no to plastic if possible

240 Route 10 West
P.O. Box 206
Whippany, NJ 07981-0206

www.suburbanpropane.com

Paul Rozenberg
Senior Manager, Government Affairs & Corporate Communications

prozenberg@suburbanpropane.com
(p) 973.503.9915
(c) 862.217.9643

July 12, 2022

VIA ELECTRONIC MAIL
Cory Ann Wind
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

RE: Comments on Clean Fuels Program Expansion 2022 Proposed Rules

Dear Ms. Wind:

Suburban Propane Partners, L.P. ("Suburban Propane") writes in regards to the Clean Fuels Program Expansion 2022 Proposed Rules, published on June 29 ("Proposed Rules"). Suburban Propane has been serving customers for more than 90 years and is the nation's third-largest propane retailer with operations in 42 states. In Oregon, we currently have 30 employees at seven locations serving more than 6,900 customers.

We generally support the provisions in the Proposed Rules, which provides for carbon intensity targets through 2035. However, we urge the Department to amend OAR 340-253-0100(1)(b)(B), OAR 340-253-0310(1)(b), and OAR 340-253-0320(5)(a)(ii) by making the entity that owns the fueling equipment through which fossil propane is dispensed the credit generator for all types of vehicles, including forklifts.

Currently, OAR 340-253-0320(5)(a)(i) provides that "[f]or fossil LPG that is dispensed for use in a motor vehicle, the person that is eligible to generate credits is the owner of the fueling equipment at the facility." However, OAR 340-253-0320(5)(a)(ii) creates a carveout specifically for forklifts, which states "[f]or fossil LPG that is dispensed for use in a forklift, the person that is eligible to generate credits is the forklift fleet owner or operator." This promotes inefficiencies, as it creates a carveout for only one particular type of vehicle. Rather than standardizing the entities that would be designated as credit generators, the provision muddies the waters by creating an exception to credit generation for propane dispensing equipment owners for no discernible reason.

Go Green with Suburban Propane

In addition, designating forklift fleet owners as the credit generator does a disservice to those entities. Navigating through the credit market to unlock the program's incentives is a difficult undertaking. Outside of major companies, forklift fleet owners likely do not have the time, knowledge, or resources to work through the process of receiving credits for propane, leaving money on the table and potentially disincentivizing the production and use of lower carbon fuels.

Rather, forklift fleet owners would benefit from having the entity that owns the propane dispensing equipment as the credit generator, consistent with other vehicles. Fuel retailers and dispensers, including Suburban Propane, have experience with clean fuel standards and their related credit markets.

Based on the foregoing, we urge you to amend OAR 340-253-0100(1)(b)(B), OAR 340-253-0310(1)(b), and OAR 340-253-0320(5)(a)(ii) by removing the carveout for forklifts and designating propane dispensing equipment owners as the credit generators for all types of vehicles. If you would like, we would be happy to set up a meeting with your team and Suburban Propane leadership to discuss this and other Clean Fuels Program-related matters. Thank you for your consideration.

Sincerely,

Paul Rozenberg
Senior Manager, Government Affairs &
Corporate Communications
Suburban Propane Partners, L.P.

RE: Clean Fuels Program Expansion 2022

TO: Cory Ann Wind, Oregon Department of Environmental Quality

We are writing to express our support for the Oregon Department of Environmental Quality's (DEQ) expansion of the Clean Fuels Program, and to encourage DEQ to consider additional pathways to achieve compliance, including **expressly including pathways for innovative carbon removal technologies to contribute** to the reduction of greenhouse gasses under the program.

This letter's signatories represent different parts of the emerging carbon removal ecosystem, including leading buyers of carbon removal and technology developers. Together, our companies are committed to tackling climate change. Oregon is taking strong steps toward emissions reductions through promotion of clean energy and clean fuels. But achieving net zero emissions by 2050 will require both radical emissions reductions and the permanent removal of significant amounts of carbon from the atmosphere every year. As Oregon considers updates to foundational policies like the Clean Fuels Program to mitigate emissions in the transportation sector, it is well-positioned to align its policy with emerging opportunities to permanently remove carbon, accelerating the development of these innovative solutions and strengthening the state's ability to meet its ambitious goals - including improving opportunities for compliance both in the medium- and long-term.

Enabling High-Quality, Technology-Neutral Carbon Removal

Carbon removal technologies are rapidly advancing. Existing policies that consider only fossil fuel-aligned carbon capture and storage fail to recognize the breadth of cutting-edge technologies that will ultimately be necessary to meet both Oregon's and the world's net zero goals. DEQ is well-positioned to develop a comprehensive rule that enables emerging technologies to participate in the Clean Fuels Program.

We strongly encourage DEQ to consider opening an additional tech-neutral pathway for credit generation through carbon removal. Rather than limit technologies able to create credits under this pathway, we encourage DEQ to define carbon removal within the Clean Fuels Program as any carbon removal that is**:**

1. **Durable:** Removes carbon from the environment for at least 1,000 years. A carbon emission is functionally permanent, and, therefore, any removal effort must similarly be permanent.
2. **Additional:** Demonstrably results in net new carbon being removed, rather than taking credit for removal that would have occurred otherwise.
3. **Verifiable:** Uses scientifically rigorous and transparent methods for monitoring and verification, and takes into account net removal using a cradle-to-grave LCA.

4. **Safe:** Legally compliant and actively engaging with the public to determine and mitigate possible risks, negative externalities, and environmental justice concerns.
5. **Goal Aligned:** Approved carbon removal for the Clean Fuels Program should be defined to include only those removals that support Oregon's long-term climate goals.

Justification for Carbon Removal

The Clean Fuels Program leaves room for carbon capture and sequestration, including innovative pathways. The rule notes that "DEQ may specify a protocol for measure and reporting" information including annual reports of greenhouse gas emissions reductions, project operations, and ongoing monitoring results "in its approval of such an application." These carbon capture projects need not be tied to fossil fuel production, and in fact *should not* be. Enabling carbon capture projects to participate - in line with a pathway allowing direct air capture credit creation in California - would address Oregon's goals of overall emissions reductions and promoting cleaner transportation fuels by encouraging the development of technologies and projects that are not designed solely to enable fossil fuel production to continue.

Furthermore, these projects can address potential credit deficit and price issues throughout the lifetime of the Clean Fuels Program. Modeling by ICF of illustrative compliance scenarios shows credit deficits over the lifetime of the rule. Overcompliance and resulting credit banking can address some portion of these deficits, but in all scenarios the credit bank is depleted or nearly depleted in the medium- to long-term. Lessons from other jurisdictions bear out the consequences of failing to incorporate alternative credit generation pathways. For example, British Columbia British Columbia does not include CCS or carbon removal as a credit pathway and has run a credit deficit from 2017-2021. The average credit price jumped from $250 in 2020 to nearly $450 in 2021 due to a credit shortage. B.C. recently set a new target of a 20% reduction in fuel carbon intensity by 2030. However, from 2013-2019, B.C.'s program achieved only a 5.7% reduction (0.8% per year) and missed the 8% reduction target.

It is imperative for the success of the Clean Fuels Program that carbon removal technologies **both directly and indirectly associated with transportation fuel production** are able to contribute and participate in the Clean Fuels Program.

Incorporating technology-neutral carbon dioxide removal credit generation in the Clean Fuels Program will firmly establish the state as a leader in the climate space, and streamline alignment with California as it considers potential pathways for emerging technologies through updates to its Low Carbon Fuel Standard. Taking a technology-neutral approach avoids any unintentional preclusion of viable carbon removal projects and greatly increases the likelihood of Oregon meeting its goal of net zero emissions by 2050.

Timeline for Rule Review
DEQ proposes reviewing the rule in 2029, providing an update on the program's metrics and recommendations for additional changes. We urge DEQ to consider a nearer-term review, and use the opportunity to think more broadly about additional credit creation pathways as a mechanism for ensuring compliance in *all* program years. Alternatively, we suggest that DEQ commit to a partial review that includes such considerations within the next two years.

Conclusion
We appreciate the opportunity to submit comments, and look forward to collaborating with the DEQ and other stakeholders on our proposal.

Sincerely,

Nan Ransohoff, Head of Climate
Stripe

Ben Turner, CEO
Origen

Peter Reinhardt, Co-Founder and CEO
Charm Industrial

Casey Leist, Sr. Director, Carbon Finance
CarbonCure

Tom Green, CEO and Co-Founder
Vesta

Marty Odlin, CEO and Founder
Running Tide

Rahul Shendure, CEO
CarbonBuilt

Mary Yap, Co-Founder and CEO
Lithos Carbon

Josh Santos, Co-Founder and CEO
Noya

Karan Khimji, Carbon Lieutenant
44.01

Ben Tarbell, Co-Founder and CEO
Ebb Carbon

Paul Gross, Co-CEO and Co-Founder
Remora

The Nature Conservancy

The Nature Conservancy in Oregon
821 SE 14th Avenue
Portland, OR 97214-2537

tel 503 802-8100
fax 503 802-8199
nature.org/oregon

July 21, 2022

Comments on DEQ Clean Fuels Program Proposed Rules

Submitted by: Laura Tabor, Climate Action Director

Thank you for the opportunity to provide comments on the Department of Environmental Quality's (DEQ's) draft proposed Clean Fuels Program expansion rules. The Nature Conservancy (TNC) appreciates the information provided throughout DEQ's rulemaking process and your consideration of public comment on this important program.

Addressing the climate change crisis is a core component of TNC's work to create a world where people and nature can thrive, and we recognize the important contributions this program has already made in reducing Oregon's greenhouse gas emissions. It also has a role to play in meeting the state's emission reduction goals, as shown in draft modeling from the Oregon Global Warming Commission.[1] Ambitious emissions intensity targets at least as stringent as those proposed in DEQ's draft rules are essential to getting Oregon on track to meet its 2035 goal of reducing emissions 45% below 1990 levels and aligning with the reduction trajectory needed to limit global temperature increases to 1.5 degrees Celsius.

We also urge DEQ to maximize the clean air, climate, and health benefits of the program by achieving these new targets through electrification as much as feasible, and to prioritize equitable economic outcomes by encouraging credit-generating utilities to fund affordable and accessible public charging infrastructure in underserved areas such as low-income communities, Black, Indigenous, and communities of color, and rural communities.

The Clean Fuels Program has demonstrated that it is possible to achieve meaningful emissions reductions "without any significant rise in retail or wholesale fuel prices" relative to neighboring states.[2] We commend DEQ for analyzing the program's ability to go beyond the direction of Executive Order 20-04 and hope to see the proposed targets of 20% below 2015 levels by 2030 and 37% below 2015 levels by 2035 maintained if not strengthened in the final rules. Now it is time to step up program targets in line with emissions goals with the necessary safeguards and incentive structures to ensure equitable access to clean and affordable transportation for all Oregonians.

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[1] Oregon Global Warming Commission Meeting Materials, July 2022. Roadmap to 2035 Update.
[2] Oregon Clean Fuels Program Review, February 2022. https://www.oregon.gov/deq/ghgp/Documents/CFP-ProgramReview.pdf p. 4

June 29, 2022

Oregon DEQ
Attn: Cory-Ann Wind
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

RE: Clean Fuels Program Expansion 2022

Dear DEQ & Environmental Quality Commission

Thank you to DEQ for this opportunity to provide public comments on the Clean Fuels Program Expansion 2022.

My transportation company, TITAN Freight Systems, currently uses renewable diesel for nearly all its Oregon operations. We no longer use fossil fuels. Throughout Oregon, we have reduced our carbon emissions by over 60% and workplace poisons by 30%. And renewable diesel made those accomplishments easy. Without the Clean Fuels Program, this transition would not have been possible as the price for renewable diesel would have been prohibitively more expensive than petroleum diesel.

While the price difference between renewable diesel is very near the same price as petroleum diesel in the Portland area, it is significantly higher priced in other parts of Oregon. The Clean Fuels Program Expansion will counter these negative headwinds and lower the cost to enable renewable diesel and other low carbon fuels to be available to all Oregonians.

Oregon is currently 26% above the 51 mtco2 2020 target set by the Oregon Legislature. Our targets have been aspirational. The Clean Fuels Program Expansion will change these targets to actionable and attainable.

We must make plans that leave fossil fuels in the dust if we want to alleviate the impacts of climate change. It is my fervent belief that the benefits of the Clean Fuels Program Expansion will be one of our best and most immediate resources for making meaningful progress to lessen the effects of a warming Oregon for all communities.

I wholeheartedly support this expansion.

Thank you for your consideration.

Sincerely,
TITAN Freight Systems
Keith Wilson
President & CEO
TITAN Freight Systems

UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

POLICY INSTITUTE FOR ENERGY, ENVIRONMENT, AND THE ECONOMY

21 July, 2022

State of Oregon, Department of Environmental Quality
Regarding: Clean Fuels Program Expansion 2022

Dear Oregon DEQ Clean Fuels Program team:

Thank you for the opportunity to comment on the ideas and materials related to the Clean Fuels Program (CFP) regulation in Oregon. The University of California, Davis Institute of Transportation Studies, along with the Policy Institute for Energy, Environment, and the Economy has been engaged in research, policy analysis, and technical assistance relating to alternative fuel policy for well over a decade. This letter provides comments on the proposed changes to the Clean Fuels Program regulation with the CFP Expansion 2022 Rulemaking. We emphasize that neither UC Davis, nor the Policy Institute for Energy, Environment, and the Economy take any formal positions regarding regulatory action and we are not requesting any specific actions or outcomes. We provide these suggestions as guidance, based on our long history of research and engagement on these topics. Please find several comments below, in no particular order.

Target Setting and Mid-Term Review

In its most recent workshop, DEQ staff requested feedback on a set of specific questions related to the CFP. Among them were whether the proposed targets (20% in 2030 and 37% in 2035), as well as 2029 for a program review, are appropriate . While we have not performed detailed modeling on compliance scenarios for Oregon's proposed program, the Policy Institute was deeply involved in the research leading to the Driving California's Transportation Emissions to Zero report, and many of the key themes of that report may be instructive in the case of Oregon. In general, the maximum medium-term targets, e.g., those for 2030 and 2035, depend heavily on the rate of EV deployment and the associated retirement of ICE vehicles from the fleet. By the early 2030's, EV mandates, if successful, would likely make EVs the dominant source of credit generation in California; Oregon faces a similar situation. Once EVs comprise the majority of new vehicle sales, CFP targets can and must accelerate more rapidly in order to maintain a functional balance of credit and deficit generation in the CFP market. Modeling work presented in *Driving California's Transportation Emissions to Zero* indicated suggested targets for their LCFS program of 24% in 2030 and 54% in 2035, alongside successful EV rollout. Oregon probably cannot match that deployment rate, since it lags California in EV penetration, but this indicates that the significant jump in post-2030 CFP targets aligns with this recent research, if EV adoption meets Oregon's expectations.

The compliance scenarios developed by DEQ and presented in the ICF report show a strong understanding of potential program dynamics through that time period. Specifically, the rate of EV deployment will likely be most strongly dependent on policy actions like the adoption of the Advanced Clean Cars 2, and Advanced Clean Trucks rules. The CFP magnifies the operational cost advantages of EVs, but ultimately the rate of EV deployment will not be highly responsive to changes in CFP targets. The deployment of commercially available alternative liquid fuels, such as hydrotreated renewable diesel (RD), however, is likely to be sensitive to the CFP target, so the primary impact of different 2035 target levels is likely to be reflected in varying deployment rates of alternative liquid and perhaps gaseous fuels. Research conducted by UC Davis colleagues demonstrates that by 2035, the ability of liquid alternative fuels, particularly RD, to provide improvements in air quality, specifically PM and NO_x emissions, will be significantly limited by the deployment of advanced, low-emission diesel vehicles.[1] It is important to note that the GHG impacts of low-carbon liquid fuels would not be affected by the new lower emission diesel vehicles, only the air pollutant impacts. While the GHG benefits of renewable diesel post-2030 are likely to be significant, there are a number of competing uses for the limited supplies of feedstock used to make such fuel, highlighted in earlier comments throughout the stakeholder process. Sustainable aviation fuel (SAF) is currently made from similar feedstock in similar facilities as RD and given feedstock and production capacity constraints, increases in the production of one of these fuels are likely to trade off, at least in part, with decreases in the other. Planned and possible SAF and RD capacity deployments in North America are sufficient that it is unlikely that Oregon will experience an absolute shortage of RD to meet any 2035 CFP target. Rather, higher targets will tend to prioritize Oregon over other jurisdictions for the available RD supply, and encourage producers to emphasize RD over SAF in their production.

DEQ staff have requested guidance on their proposed 2029 mid-term review of the CFP. A mid-term review of the program would offer an opportunity to evaluate CFP performance and make adjustments. As suggested above, the best timing for a review likely depends on expected policy actions and activity in related economic sectors. A mid-term review may be most effective when it occurs in the wake of revisions to policies such as EV incentives or mandates, electricity supply policies, tailpipe emission standards, etc., and in particular as information becomes available on those policies' impact on EV adoption. Aligning a CFP review with related work and/or in a timely fashion to make adjustments to real-world trends allows staff to consider the total impact of a full portfolio of policies, and minimizes the risk that such a review would rapidly be rendered out of date by changes in policy or market trends.

ILUC Adjustments for Corn Ethanol

Current practice under the CFP assigns corn ethanol an indirect land use change (ILUC) value based on analysis done using the CCLUB model. This diverges from the practices used by the

[1] Modeling Expected Air Quality Impacts of Oregon's Proposed Expanded Clean Fuels Program

California Air Resources Board (CARB) for its LCFS, where corn ethanol ILUC values are estimated using the GTAP and AEZ models, and from the CFP approach for other feedstocks, which aligns with the CARB method. ILUC modeling is a highly complex process, and as such, subject to significant uncertainty, regardless of the model used. Numerous studies have attempted to estimate the magnitude of ILUC impacts on corn ethanol production, usually in volumes expected under US RFS mandates. Many estimates produced over the last decade fallin the range of 10-20 g CO_2e/MJ[2]; a recent retrospective study, however, estimated U.S. domestic land use change from the RFS only (leaving aside the international component) at closer to 30 g CO_2e/MJ, a result that sparked a critique by other researchers and a response.[3] Maintaining a lower ILUC adjustment for corn ethanol than that used in other North American jurisdictions will have the effect of creating a higher incentive for using this fuel in Oregon and extending the timeframe over which it continues to generate CFP credits. A rationale for DEQ's methodological departure in the case of corn has not been given; the current program expansion would extend that decision for an additional 10 years, and maintain this source of misalignment with the California LCFS program.

Tracking Systems for Environmental Attributes

During the stakeholder engagement process, several comments reflected the need for a simple, effective framework for tracking environmental attributes of energy delivered through common-carrier systems, following the example of Renewable Energy Certificates (RECs) in the electricity markets. In particular, stakeholders identified a need for this capability in natural gas and renewable natural gas (RNG) markets. The MRETS system has been proposed as a solution that allows for transparent third-party tracking and verification of environmental attributes. While we have not conducted any research into the MRETS system, we agree that a transparent, third-party tracking and verification system offers significant potential benefits to fuel carbon performance standards like the CFP. As DEQ staff consider whether and how to integrate such environmental instrument tracking into their program, it is important to maximize the transparency of compliance reporting to the greatest extent possible, to make clear how both fuel and revenue flow through such systems. We hope there is a way to adequately protect proprietary business information while still providing critical data to inform future energy policy decisions.

New EER (Energy Efficiency Ratio) Applications

[2] Recent work by Life Cycle Associates related to the development of Washington's Low Carbon Fuel Standard provides an overview of estimates in this space. https://ecology.wa.gov/DOE/files/be/be3e311f-34de-4001-a055-b6dd07d25ead.pdf

[3] Links to the relevant documents appear in a blog post by one of the study authors, Prof. Aaron Smith: https://asmith.ucdavis.edu/news/environmental-outcomes-us-renewable-fuel-standard-reply

DEQ staff have, throughout the rule development and consultation process, indicated an openness to adding additional pathways for vehicle and equipment types that are not currently identified in the CFP. This aligns with current best practices in climate policy: new combinations, e.g., electrification of existing vehicle types, can offer an efficient and relatively low cost pathway to zero or near-zero emissions over the long run. The proposed addition that new applications cover new vehicle/fuel combinations (not already covered by an EER, which reflects the relative efficiency of alternative fuel powertrains compared to conventional internal combustion equivalents, and is accounted for in credit calculations) would prioritize new use cases and thus do more to expand the pool of alternative vehicles/fuels covered creditable under the CFP, than would smaller adjustments to EERs within existing vehicle categories. That said, collecting information on the range of real-world EERs within existing vehicle categories is critical to improving on existing EERs, and this provision could choke off that source of information.

The second EER-related proposal pertains to limiting electric requests to use cases that are not already mostly using electricity as a fuel.[4] At present, EVs represent an exceedingly small fraction of most vehicle and equipment fleets, so the common assumption made in crediting that the alternative fuel displaces the fossil reference approximately aligns with reality.[5] Given the rapid expansion of EVs into a wide variety of markets, however, this assumption will not hold forever and CFP credit calculations must reflect this or risk issuing an amount of credits that exceeds the actual emissions-reducing value of a vehicle. Electric forklifts provide an example: historically, most forklifts were powered by propane, natural gas, or other conventional fuels, but policy support, combined with rapid improvements in lithium ion battery technology have led electric forklifts to become the preferred technology for new equipment sales, especially in jurisdictions that offer policy incentives. A 2022 vehicle inventory in California found that around 40% of forklifts were battery electric.[6] Informal discussions with stakeholders indicate that electric forklifts represent a significant majority of total sales within California. As such, each additional electric forklift becomes more likely, on average, to displace activity that would have otherwise been done with another electric forklift. The credits generated would not, in this case, actually match the real emission reduction each additional vehicle provides. DEQ will need to balance the desire to maximize incentives that support transitions to zero-emission transportation against the need for CFP credits to accurately reflect reduced emissions.

DEQ staff asked for input on the specific question of what party should be the default generator of credits in the case of electric forklifts: the vehicle owner or the charging equipment owner or operator. DEQ's current practice gives the charging equipment owner first priority for credit

[4] While electricity is the most likely application at this time, this proposal might be broadened to be more inclusive of all fuel types.
[5] An adjustment to the crediting can be made, whereby powertrain efficiency is recognized, but the displacement is not, as is the case for electricity used to charge guideways that existed before the program went into effect.
[6] https://ww2.arb.ca.gov/sites/default/files/2022-04/Draft_2022_LSI_Workshop_April_ADA.pdf

generation, aligning with a general guideline operating within programs like the CFP and LCFS: where a common energy carrier such as electricity or natural gas is used as a vehicle fuel, credits are generated at the point where the energy is transferred to the vehicle. Some stakeholders claim that since the vehicle owner has primary control over the decisions regarding whether to purchase an electric or conventional vehicle and pays for fuel, they should have priority access to the incentive that arises from such a purchase. In practice, in the absence of barriers, the value of the credit should flow wherever along the supply chain it is needed to move the fuel into the marketplace. However, sometimes such barriers exist. The stakeholder meetings brought forth evidence of different situations where other parties may have more information about the actual charging of the vehicle, or make decisions about the vehicle or fueling purchase. Issuing credits to owners so as to align with the need to provide incentives, when the value would not otherwise flow to those parties, would align with program goals.

Hydrogen CI Threshold for Advance Crediting

DEQ is proposing that hydrogen used to generate advance credits from charging infrastructure must have at most a rated CI of 117 gCO_2e/MJ. This threshold matches the CI of 'compressed' hydrogen produced in Oregon from central steam methane reformation of biomethane (renewable feedstock) from North American landfills (116.76 gCO_2e/MJ) in the Carbon Intensity Lookup Table (but not 'liquefied' hydrogen produced in Oregon from the same feedstock, which has a rated CI of 149.70 gCO_2e/MJ, so the approach does not necessarily include all non-fossil hydrogen). By reserving the advance crediting benefit for lower CI hydrogen options, DEQ would prioritize development of those options over broader market development for the fuel, regardless of feedstock and production process. While we have not conducted research on the suitability of this threshold, the approach aligns with the CFP stated goal of push toward lower carbon fuels.

Program Cost Estimates

The proposal discusses the difficulties in estimating costs for a policy like the CFP where a market-based mechanism provides the incentives, since there is flexibility for lowest cost compliance options, perhaps yet unknown, to reach the market. Still, the proposal's discussion of program costs could move toward a fuller accounting from the estimate pegged to the final year of the program only, by including verbiage that makes clearer that a full estimate would include intervening year costs, which might not be completely clear to any unfamiliar with the program.

Once again, we appreciate the opportunity to provide comments on this rulemaking, and would be happy to discuss these issues, or any others related to the Clean Fuels Program, in more depth. If you have any questions, please do not hesitate to reach out to us at jwitcover@ucdavis.edu.

Signed,

Julie Witcover, Ph.D.
Assistant Project Scientist, Policy Institute for Energy, Environment, and the Economy
University of California, Davis, California, USA

Jin Wook Ro, Ph.D.
Postdoctoral Scholar, Policy Institute for Energy, Environment, and the Economy
University of California, Davis, California, USA

Submitted Via ODEQ Comment Submittal Form

July 21, 2022

Cory-Ann Wind
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite 600
Portland, OR 97232-4100

Re: Comments on Proposed Oregon Clean Fuels Program Amendments

Dear Ms. Wind:

On behalf of Valero Marketing and Supply Company, Diamond Alternative Energy, Valero Renewable Fuels, and other wholly-owned subsidiaries of Valero Energy Corporation involved in producing and marketing fuels used in Oregon (hereafter collectively and respectively "Valero"), I appreciate the opportunity to provide these comments to the Oregon Department of Environmental Quality ("ODEQ") regarding proposed amendments to the Clean Fuels Program ("CFP").

As one of the largest producers of renewable transportation fuel, Valero is committed to lowering the carbon intensity of our fuels. Through its Diamond Green Diesel joint venture, Valero operates the largest renewable diesel plant in the United States, with a current annual capacity of 700 million gallons that will expand to 1.2 billion gallons annually, making it the predominant renewable diesel producer in the United States and the second largest in the world. Valero is also the world's second largest corn ethanol producer, with 12 ethanol plants in the U.S. and a total annual production capacity of 1.6 billion gallons per year. Valero is among the leading producers of ultra-low-carbon cellulosic ethanol and we are aggressively pursuing measures to reduce the carbon intensity of our ethanol production through carbon sequestration. Although Valero is not currently participating in the Oregon transportation fuels market, we are considering selling our renewable fuels for use in Oregon if the clean fuel regulations are balanced, competitive and based on sound science.

Valero agrees with and incorporates as its own the comments submitted by the Western States Petroleum Association. Based on our unique role in the fuels manufacturing sector, Valero offers the following additional remarks.

Like ODEQ, Valero believes that the program should be robust and clear, as well as implementable for both participating entities and ODEQ. To accomplish these goals, the program

should be amended to better incentivize investments including expanding indirect accounting and allowing displacement credit for co-products that displace conventional fuels in non-transportation uses and to enhance regulatory certainty, reflect technology and data updates, and improve administration and accountability.

It is crucial that Oregon adopt a consistent, technology-neutral program that accounts comprehensively for carbon emissions on a full lifecycle basis. ODEQ should ensure that the CFP assumptions and approaches do not result in distorted or exaggerated depiction of the emissions of biofuels while ignoring the adverse impacts of other transportation fuel technologies (for example, impacts of strip-mining for metals used in batteries for electric vehicles).

Based on the varied roles Valero plays in manufacturing and supplying both traditional and renewable fuels to various markets, Valero is uniquely situated to identify programmatic improvements aimed at ensuring CFP carbon reduction targets are met. With the broad impact the Oregon CFP has, it is important that the program is continually improved to better ensure carbon reductions are achieved and that programs function efficiently and with transparency. With this in mind, Valero offers the following comments to improve the next iteration of the Oregon CFP program.

Comments on Further Considerations of Oregon's CFP

I. Program Improvements to Incentivize Investment

Valero urges ODEQ to increase the availability of indirect accounting within the low carbon transportation sector. These changes would better encourage the use and production of low carbon fuels by providing sufficient regulatory certainty for participants to increase their investments and send long-term market signals to investors.

a. Expand indirect accounting within the transportation sector

The CFP currently allows reporting entities to use indirect accounting mechanisms for low-carbon intensity ("CI") electricity supplied as either a transportation fuel or to produce hydrogen for transportation purposes. ODEQ should extend indirect accounting to feedstocks such as low carbon electricity, low carbon hydrogen, or renewable natural gas utilized in the production of renewable transportation fuels such as renewable diesel and low CI ethanol as doing so would aid in further decarbonization of the grid and further encourage investment in low-CI fuels.

The ODEQ should also make considerations that best fit its market and the goals of the CFP and look for specific opportunities to drive technological advancement in the transportation fuels sector. Valero requests that ODEQ expand the permissibility of book-and-claim accounting for feedstocks or utility inputs for the production of biofuels, such as "dispatchable" low-CI electricity supplied to an independently-operated grid and low-CI hydrogen or renewable natural gas injected into regional pipeline networks. Additionally, indirect accounting should be available to low-CI electricity, low-CI hydrogen, and renewable natural gas used in the production of biofuels.

b. Allow credit for displacement co-products not used for transportation fuel

Valero requests that ODEQ allow for credit for displacement co-products not used for transportation fuel. Co-products from the renewable transportation fuel process that are used outside of the transportation sector, such as renewable diesel sold as heating fuel, displace fossil fuels in various uses and should receive credit for doing so by accounting for this displacement in the fuel producer's CI score. The inclusion of non-transportation uses for co-products would incentivize the use of these fuels, resulting in further carbon reductions, and would not take away from the goal to decarbonize the transportation sector. However, for co-products that are also a transportation fuel, whether sold in Oregon or not, ODEQ should continue to use the volumes as part of the allocation factor.

II. Amendments to Streamline Implementation

Robust but streamlined implementation is critical to the continued success of the ODEQ program. Examples of streamlining measures include adoption of clear regulatory language, adequate agency staffing to implement the program, transparency in how guidance is established and decisions are made, and flexibility to avoid absurd, or overly punitive results. To improve program implementation, Valero recommends that ODEQ prioritize adoption of the following streamlining measures.

a. Increase flexibility for operational CI calculations

Valero recommends that ODEQ enhance regulatory certainty for complying with, and clarify the enforceability of, the CFP program by adopting (1) a force majeure clause for operational CI calculations and (2) a de minimis threshold for variations in operational CI score.

First, Valero requests that ODEQ include a force majeure clause to prevent penalization of reporting entities where operational CI scores are affected by emergency situations. For example, during a period where a production facility is forced to shut down due to extreme events such as earthquakes, fires, or hurricanes, the utility usage for subsequent start-up should be excluded from the annual pathway calculations. The start-up period should be measured as the time it takes to return daily production rates to the same rate immediately prior to the shutdown. To prevent any fraudulent claims, ODEQ should ensure there is sufficient verified data to support the force majeure event timeline.

Second, Valero proposes adding a de minimis threshold for operational CI score variations to encourage flexibility within the CFP program. ODEQ should establish an acceptable threshold range for CI scores where an entity would not be considered out of compliance for a minor exceedance of the certified CI score for example, the lower of 0.2 gCO2e/MJ or 1.0%. This would add helpful flexibility both in force majeure circumstances and in other circumstances that result in insignificant variations.

b. Establish a lookback period aligned with the statute of limitations

ODEQ should consider establishing a maximum lookback period for historical CIs, credits, and deficits. Nothing in the CFP regulation prevents ODEQ from going back to previous versions of the regulation or models. Therefore, if an error is discovered, there is no limit to how far back ODEQ can go to revise this error. Expressly limiting historical lookbacks to a period aligned with the statute of limitations would provide more stability and market certainty. It would also reduce the resource demand on auditors and ODEQ staff, which in turn would facilitate a more focused and in-depth review during the annual audits. Because audits are conducted annually, the risk that an issue would fail to be identified and addressed is minimal.

This type of lookback period is consistent with periods used by many agencies, including the Environmental Protection Agency ("EPA"), the Internal Revenue Service ("IRS"), and the Department of Health and Human Services ("HHS"). For example, EPA has multiple lookback periods aligned with the relevant enforcement limitations period, including ones for regional haze assessments and stationary source review.[1] Additionally, the IRS has a defined lookback period for assessing tax-exempt entities during excess benefit transactions,[2] and HHS has a five-year lookback period for Medicaid eligibility.

c. Update the program elements to reflect technology and data advancements

Valero supports updating program elements to reflect technological and other advancements, including:

- ***Update the indirect land use change factors to include best available data.***

  Some of the current Indirect Land Use Change (ILUC) factors used by ODEQ, such as that for soybean oil used in renewable diesel production, are based on modeling that is several years old and out of date. Understanding that ILUC modeling is complex and the model inputs are not available in a world-wide, clear, standard, and concise format, Argonne National Laboratory has completed ILUC modeling for the feedstock/fuel combinations that ODEQ has regulated. ODEQ should adopt the ILUC factors in the Argonne GREET model and use updated Argonne ILUC factors as they are released.

- ***Update the electricity pathways to include a full lifecycle analysis of carbon emissions related to EV battery production and disposal.***

  Electricity used as transportation fuel generates CFP credits based on either lookup table values or specific pathway approvals. However, neither the lookup table values nor the pathway review process properly accounts for the energy consumption and corresponding carbon emissions associated with mining the minerals used in electric vehicle battery production, mineral processing, battery assembly, or in disposal of spent batteries. This oversight is wholly at odds with the comprehensive lifecycle analysis conducted to determine the carbon intensity of other forms of transportation fuel, and it yields a distorted

[1] 40 C.F.R. § 51.308(g)(3); 40 C.F.R. § 68.42(a).
[2] 26 U.S.C. § 4958.

picture of the true carbon footprint of "fueling" electric vehicles (as does the use of the phrase "zero emission vehicles" to describe electric vehicles that rely on batteries containing minerals such as lithium, nickel, and cobalt that are produced and processed outside the United States in an energy-intensive manner). Data is available to support development of a fair and transparent assessment of these energy impacts, as shown in the Argonne GREET model. It is arbitrary to overlook these emissions for purposes of determining carbon intensity scores that result in credit generation, and such omissions may result in misleading the public about the impacts of their transportation choices.

- ***Update emission factors on the same timeline as Oregon CI for grid electricity.***

  Valero requests that ODEQ update the emission factors for grid electricity for all regions on the same schedule as ODEQ updates the Oregon CI for grid electricity. After establishing a cohesive timeline, ODEQ should then update the associated GREET and Tier 1 models to account for the grid emission factor changes.

- ***Update ODEQ's Data Management Systems***

  ODEQ's Fuel Reporting System should allow for data to be uploaded for reporting, either via a formatted Excel file or in an XML format. System improvements make it easier for all participants to provide accurate data and may streamline work for the limited ODEQ staff.

III. Amendments to Improve Effectiveness of Implementation

Valero recommends that ODEQ add any administrative procedure language for staff practices that are not currently documented in the CFP regulation or guidance and to ensure transparency, fairness, and consistency. Specifically, guidance regarding ODEQ's interpretation of regulatory provisions should be provided to the regulated community as well as to auditors. Officially outlining and cataloging the procedures behind implementation of the CFP will not only aid in ODEQ's ability to run the program smoothly, but will also assist other jurisdictions in using Oregon's CFP as a model.

* * * *

Valero appreciates the opportunity to provide feedback at this critical stage of the CFP amendments development. Should you have any questions, please contact me

Sincerely,

Deepak Garg

Deepak Garg
VP Fuels Regulatory Planning & Assurance

From:	Spyral Starecase
To:	CFP2022 * DEQ
Subject:	Updates to Carbon Policies
Date:	Wednesday, June 29, 2022 10:17:47 AM

Hi, I just want to express my support for this effort to decrease carbon emissions as much as possible. I heartily appreciate those who are working hard on trying to ameliorate the carbon issues we have and am grateful for your efforts.

Regards,

Veronica Torina

PS. I'm a Beaverton resident

WSPA
Jim Verburg
Director, Fuels

July 21, 2022

Sent via e-mail to: CFP.2022@deq.state.or.us

Ms. Cory-Ann Wind
Oregon Clean Fuels Program Manager
Oregon Department of Environmental Quality
700 NE Multnomah Street
Portland, OR 97232-4100

Re: WSPA Comments regarding Draft DEQ Clean Fuels Program Expansion 2022 Regulation

Dear Cory Ann:

Western States Petroleum Association (WSPA) appreciates the opportunity to provide the Oregon Department of Environmental Quality (DEQ) with comments on the draft Clean Fuels Program (CFP) Expansion 2022 Regulation, dated June 29, 2022. WSPA is a non-profit trade association that represents companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas, and other energy supplies in Oregon and four other western states.

General Comments

Legal and Technical Basis for CI Targets

WSPA continues to have both legal and technical concerns with the proposed CI target reduction target of 37% by 2035. The DEQ proposal to establish carbon Intensity (CI) reduction targets more stringent than the 10% reduction authorized under statute appear to exceed the statutory authority of the promulgating agency pursuant to ORS 183.400(4). In addition, the CFP Expansion Regulation may have been proposed for adoption without sufficient evaluation of mandatory considerations and potentially violate both the Oregon and United States constitutions. Please see Attachment A "Legal Comments" for further details.

Aside from legal considerations, from a technical standpoint, the DEQ proposal to establish carbon Intensity (CI) reduction targets 12% more stringent than the Governor Executive Order of 25% reduction by 2035 including a significant CI reduction of 17% over 5 years from 2030 to 2035 clearly highlights the extreme dependence on projected EV sales and unknown availability of biofuels.

WSPA believes that a 37% target reduction by 2035 will be very challenging and could potentially result in volatility in the LCFS program and transportation energy sector. At minimum pending any potential legal aspects concerning the proposed CFP regulations and EO 20-04, WSPA suggests that DEQ set the 2035 CI reduction target at 25% which is in line with the Governor's Executive Order (EO) 20-04 target and utilize the proposed 2029 program review as an opportunity to consider more stringent targets through 2035.

Future Program Review

WSPA appreciates that DEQ will conduct a program review in 2029. However, WSPA believes that DEQ should conduct program reviews on an annual basis, starting in 2023. A program review in 2029 will not provide enough time to regulated entities and to the CFP credit market for a smooth transition if adjustments to the targets for the years 2030-2035 are needed in 2029. A regular

program review would provide regulated entities assurance that the program continues to be feasible and to Oregonian residents that costs will be reasonable.

Inaccuracies in Supporting Modeling Study

As part of this regulatory process, DEQ commissioned University of California at Davis (UC Davis) to perform a modeling study of the expected impacts on air quality in Oregon due to the proposed regulatory changes.[1] The UC Davis air quality modeling study builds on the compliance scenario assumptions developed by DEQ and ICF in terms of what combination of vehicles and fuels may occur in the future to achieve compliance with more stringent standards by 2035. Our review indicates that there are several issues with the UC Davis study that likely overstate the already minor air quality benefits of the CFP expansion. Even without consideration of this likely overstatement, the UC Davis study shows no major air pollutant improvement with the 37% CI reduction compared to the 25% CI reduction. Thus, DEQ should not claim incremental co-benefits for justifying the 37% CI reduction versus the 25% CI reduction.

The main concerns with the study relate primarily to the emissions inventory used to estimate air quality impacts and the lack of information on assumptions for the "Business as Usual" (BAU) case. More specifically, UC Davis researchers did not account for existing mobile source regulations in Oregon that will lead to emission reductions regardless of whether the CFP is expanded. As a result, emission reductions due to an expected increase in electric vehicle use were incorrectly attributed to the CFP expansion, instead of the regulations that will require electric vehicles to be sold in Oregon (i.e., the study fails to properly account for existing regulatory programs in the BAU case used as a point of reference in estimating air quality impacts).

Direct Cost of Complying with the Proposed Targets

Assuming a low inflation rate of 2% per year, the maximum CFP credit price in 2035 would be $298, so the costs of the program could be as high as $1.6 billion in 2035. If more than 5.4 million deficits are generated in 2035, the maximum cost would be even higher, particularly if EV adoption does not meet the projections of the illustrative compliance scenario. WSPA requests that the Fiscal Impact Statement (FIS) provide an assessment of potential program costs for circumstances beyond the low inflation rate (best case) scenario.

Indirect Costs or Cost Savings to Fuel Consumers

As noted above, WSPA has significant concerns regarding the viability of the 37% CI target for 2035. This aspirational CI target (based solely on illustrative compliance scenario modeling) has not been subject to thorough study of impacts to not only the electricity grid, power generation capability (and resource mix), and types of vehicles, (in particular heavy duty vehicles), but the impacts on Oregon residents have also not been factored in (as acknowledged by DEQ staff during the DEQ RAC Meeting #4). Specifically, not considered were the possible increased costs to Oregon residents for transportation and energy - from the purchase of EVs to the cost of fuels and/or electricity (for home and vehicle). WSPA requests that these impacts on Oregon residents be included in the FIS.

[1] https://escholarship.org/uc/item/6pz348mc.

Specific Comments

§ 340-253-004030 – Definitions – Renewable Hydrogen

WSPA suggests that the definition of "Renewable Hydrogen" be expanded to allow renewable fuel gases. In doing so, the CFP would recognize in the regulatory language a variety of options for renewable feeds to a hydrogen unit. Beyond simply a narrow definition of biomethane, renewable hydrocarbons such as biogenic ethane, biogenic propane, biogenic butane, biogenic pentanes, or a mixture of thereof can be processed by a steam methane reformer and will generate renewable hydrogen. An example of such an application would be the processing of the light hydrocarbons (offgas) from a renewable diesel plant through a steam methane reformer to produce renewable hydrogen. Such light hydrocarbons contain biogenic propane and other biogenic hydrocarbons.

§ 340-253-0630(1)(c) – Quarterly Reports

WSPA recommends that the date of December 31 under paragraph (1)(c) be changed to a date in January, for example January 15, to provide additional time for reporting around the end of year holiday period.

§ 340-253-0630(2)(e) – Quarterly Reports

WSPA opposes the proposed language in paragraph (2)(e) that would allow DEQ to create new transaction types. New transaction types should only be created during a rulemaking to: (1) allow a thorough review before the new transaction type is created, (2) provide all parties time to update their contracts, and (3) allow for computer systems, including OFRS, to be thoroughly tested.

§ 340-253-0640(6)(a) – Specific Requirement for Reporting Under This Division

This section states:

> *" For reporting liquid fuels that are being transferred in and out of a commingled storage tank or that are commingled in production or in transport, the reporting entity may mass balance transfers out of that commingled tank or system by fuel pathway code based on the gallons input into that tank or system in the current or prior quarter. Liquid gallons reported under a specific fuel pathway code may only be reported as transferred out of commingled storage if they were put into a tank two or more quarters prior if the reporting entity demonstrates to DEQ that the tank has not fully turned over by the quarter it is reporting the volume being transferred out*."

As written, the regulatory language does not allow for fuel suppliers to meet this reporting requirement under current supply chain logistics and terminal operations (i.e., there is no apparent mechanism to notify DEQ if a tank has been fully turned over). In addition, DEQ would have no ability to verify reported information. WSPA urges DEQ to simplify the regulatory language in this section. Considering that CFP credits do not expire, it appears unnecessary to treat fuel that was created earlier in the year differently from fuel created more recently.

Furthermore, tracking volumes by fuel pathway code at the individual storage tank level is unnecessary and adds complexity to an already complex program with no benefit. Managing these inventories for each reporting entity in aggregate achieves the same level of compliance assurance.

§ 340-253-8010 – Oregon Clean Fuel Standard (Tables 1-3)

As stated above, WSPA suggests that DEQ consider revising the post-2030 CI targets reset to be consistent with Governor's Executive Order (EO) 20-04 with a 2035 CI reduction target of no more stringent than a 25% reduction.

WSPA appreciates the opportunity to provided comments on this important draft regulation. If you have any questions regarding this submittal, please contact me.

Sincerely,

James Verburg
Director, Fuels
WSPA

cc: Jessica Spiegel - Senior Director, Northwest Region – Western States Petroleum Association

Tanya DeRivi – Vice President, Climate Policy – Western States Petroleum Association

Sophie Ellinghouse – Vice President, General Counsel and Corporate Secretary – Western States Petroleum Association

Attachment A: Legal Comments for Draft DEQ Clean Fuels Program Expansion 2022 Regulation

WSPA

ATTACHMENT A
Legal Comments

Attachment A: **Legal Comments for Draft DEQ Clean Fuels Program Expansion 2022 Regulation**

WSPA is concerned that the new carbon intensity standards in the proposed Rules exceed EQC's authority, are proposed for adoption without evaluation of mandatory considerations, and potentially violate both the Oregon and United States constitutions.

1. The Rules appear to exceed EQC's statutory authority.

Per Oregon Statute, administrative rules that exceed the statutory authority of the promulgating agency are invalid. ORS 183.400(4)(b). To be valid, rules must be authorized by statute and not depart from the standards expressed or implied in the law being administered.[1] The Rules appear to conflict with both requirements.

First, while ORS 468A.266 arguably allows EQC to adjust the 2025 goal for a 10 percent reduction in carbon fuel emissions, the rulemaking materials fail to explain how the law allows EQC to double the reduction standard in 2030 and almost quadruple the 2025 emission-reduction requirement five years after that.[2] There is no evidence that such authority is implied in ORS 468A.266. Rather, the new standards are a departure from the measured approach in the Clean Fuel Program (CFP) law, which contemplates the EQC's delaying and deferring compliance with even the 10 percent standard.[3]

Even if the grant of authority in ORS 468A.266 were sufficiently broad enough to allow EQC to adopt the drastic new emission-reduction standards, the statute itself would likely be invalid because it would violate the Oregon Constitution's separation-of-power principles. The statute would be essentially a delegation of legislative power because it fails to provide the EQC with policy standards or meaningfully limit its exercise of power.[4]

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[1] *Industrial Customers of Nw. Utils. v. Oregon Dep't of Energy*, 238 Or App 127, 130, 241 P3d 352 (2010) (In determining whether rules are within an agency's authority, the court "consider[s] whether the agency's adoption of the rule exceeded the authority granted by statute and, further, whether the agency departed from a legal standard expressed or implied in the particular law being administered, or contravened some other applicable statute." (internal quotation marks and citation omitted).

[2] In 2020, Governor Kate Brown issued Executive Order 20-04, which instructed state agencies to adopt a number of policies designed to significantly reduce the state's GHG emissions. Among them was an extension of the CFP with targets of at least 20 percent in 2030 and 25 percent in 2035.

[3] ORS 468A.266(2) (allowing delay of 10 percent reduction goal if EQC determines that "extension is appropriate."); ORS 468A.271 and 468A.272 (requiring monitoring of availability of clean fuels necessary to meet standards); ORS 468A.273 and 468A.274 (allowing deferral of compliance).

[4] "It is a fundamental principle of constitutional law that in delegating powers to an administrative body, the Legislature must prescribe some rule of law or fix some standard or guide by which the actions of that body, in administering the law, are to be governed and made to conform." *Van Winkle v. Fred Meyer, Inc.*, 151 Or 455, 466, 49 P2d 1140 (1935); *see also Savage v. Martin*, 161 Or 660, 698, 91 P2d 273 (1939) (the statutes must "establish a sufficient basic standard and a definite and certain policy and rule of action for the guidance of the agency created to administer the law."); *Demers v. Peterson*, 197 Or 466, 469-70, 254 P2d 213 (1953). Further, the standards in the statutory scheme must "circumscribe an agency's exercise of delegated powers." *State v. Long*, 110 Or App 599, 602, 823 P2d 1031, *aff'd,* 315 Or 95, 843 P2d 420 (1992) (citations omitted).

2. The Rules were drafted without evaluation of mandatory considerations.

In addition to being within a statutory grant of authority, administrative rules must also be consistent with standards therein.[5] A failure to evaluate mandatory considerations is a violation of "applicable rulemaking procedures," and the rule is subject to invalidation under ORS 183.400(4)(c).[6]

The CFP law requires EQC to evaluate multiple factors prior to adopting low-carbon-fuel standards or other CFP rules. ORS 468A.266(5) states that the commission must evaluate:

> (a) Safety, feasibility, net reduction of greenhouse gas emissions and cost-effectiveness;
> (b) Potential adverse impacts to public health and the environment, including but not limited to air quality, water quality and the generation and disposal of waste in this state;
> (c) Flexible implementation approaches to minimize compliance costs; and
> (d) Technical and economic studies of comparable greenhouse gas emissions reduction measures implemented in other states and any other studies as determined by the commission.[7]

While the DEQ did commission a study to model the air quality impacts from the new emission standards, there does not appear to be a demonstration of compliance, or an evaluation of these statutory factors in the rulemaking materials. For example, aside from California, the rulemaking does not appear to address the clean-fuel standards of other states. Nor do the materials include analysis of the feasibility problems and unintended harmful consequences (e.g., impacts on food prices) that were raised in comments by industry members and unaffiliated experts.[8] The rulemaking notice did estimate that a maximum cost of compliance in 2035 of $1,254,350,314, but said there "isn't sufficient data or the ability to accurately predict future behavior to determine" an actual compliance cost—or even attempt to explain how a $1.25 billion cost meets the "cost-effectiveness" standards in ORS 468A.266(5). If challenged under ORS 183.400, the Rules are not likely to be upheld.

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[5] *Industrial Customers of Nw. Utils.*, 238 Or App at 130 (In determining whether rules are within an agency's authority, the court considers "whether the agency departed from a legal standard expressed or implied in the particular law being administered, or contravened some other applicable statute.") (internal quotation marks and citation omitted).

[6] *Western States Petroleum Ass'n v. Envtl. Quality Comm'n*, 296 Or App 298, 310, 439 P3d 459 (2019) ("in this case, we consider only whether the documents indicate that EQC engaged in any evaluation of the statutorily mandated factors in adopting the LCFS rules. * * * [W]e conclude that petitioners' assertion that EQC failed to evaluate the statutorily mandated factors in adopting the LCFS rules is a proper procedural rulemaking challenge under ORS 183.400(4)(c).")

[7] The statute also requires the EQC to "the low carbon fuel standards of other states" before adopting its own standards. ORS 468A.266(3).

[8] *E.g.,* Feb. 11, 2022, comment by Dr. Julie Witcover; Apr. 14, 2022, comment by Dr. Richard Plevin; multiple comments by Western States Petroleum Association, Oregon Fuels Association, bp, etc.

3. The Rules may violate the Commerce Clause of the United States Constitution.

The Commerce Clause of the United States Constitution has a "dormant" [9] aspect that prohibits states from unduly burdening interstate commerce. *Pike v. Bruce Church, Inc.*, 397 US 137, 142, 90 S Ct 844, 25 L Ed 2d 174 (1970). A law violates this prohibition if it creates a burden on interstate commerce that is not justified by the putative local benefits. *Id*. Laws found to violate this prohibition often concern "inconsistent regulation of activities that are inherently national or require a uniform system of regulation." *National Ass'n of Optometrists & Opticians v. Harris*, 682 F3d 1144, 1148 (9th Cir 2012) (citations omitted). "A classic example of this type of regulation is one that imposes significant burdens on interstate transportation." *Id.* (citations omitted); *see also National Pork Producers Council v. Ross*, 6 F.4th 1021, 1031-32 (9th Cir 2021).

Fuel standards and markets are inherently national in nature. Meeting the country's fuel needs would likely not be possible if each state had their own unique standard.[10] Moreover, while there *may* be sufficient alternative fuels to allow compliance with Oregon's fuel standards, there would likely be a grossly insufficient supply if every other state adopted standards as stringent as Oregon.[11] Federal courts will likely subject the Rules' burden on fuel commerce to a more rigorous evaluation because all other interstate trade is dependent on the supply of fuel. Because DEQ has failed to demonstrate that the Rules would lower overall emissions—and even if they did, such a benefit would be global, not local—it is possible that the Rules would be found to violate the Dormant Commerce Clause if challenged in federal court.

[9] The Commerce Clause of the United States Constitution states that "Congress shall have Power * * * [t]o regulate Commerce * * * among the several States." US Const Art I, § 8, cl 3. "Though phrased as a grant of regulatory power to Congress, the Clause has long been understood to have a 'negative' aspect that denies the States the power unjustifiably to discriminate against or burden the interstate flow of articles of commerce." *Oregon Waste Sys., Inc. v. Dep't of Envtl. Quality of State of Or.*, 511 US 93, 98, 114 S Ct 1345, 128 L Ed 2d 13 (1994).

[10] This is likely why the Oregon legislature requires EQC to consider other states' regulations prior to adopting new fuel standards. ORS 468A.266(3) & (5)(d).

[11] In conducting *Pike* balancing-test analysis, courts evaluate the effect of the law under the hypothetical scenario of every other state adopting the same rule.