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October 2, 2025

Pamela Jones, Administrator
Environmental Improvement Board
Harold Runnels Building
1190 St. Francis Dr., Suite N4050
Sante Fe, NM 87505

Submitted electronically via: https://nmed.commentinput.com/?id=Q7EpmKPeC

RE: POET Comments on EIB 25-23 (R) – In the Matter of Proposed Adoption of 20.1.92 NMAC Clean Transportation Fuel Program

Dear Ms. Pamela Jones:

POET appreciates the opportunity to participate in the ongoing Environmental Improvement Board ("EIB") proceedings and to comment on the New Mexico Environmental Department's ("NMED") Clean Transportation Fuel Program ("CTFP") proposed rule. POET actively participated in NMED's rulemaking through the submission of comments, participation in public meetings, and engagement with NMED's staff. POET provides these comments for the EIB in response to NMED's "Petition for Regulatory Change to Adopt 20.2.92 NMAC, Clean Transportation Fuel Program," docketed on May 16, 2025 (the "Petition").

POET supports the implementation of New Mexico's CTFP and generally supports the structure and terms of NMED's proposed rule. However, POET believes that EIB should adopt two key changes to the Petition that will better attract low carbon fuel to the New Mexico market and generate the volume of program credits necessary to achieve the CTFP's ambitious goals. First, the EIB should amend the Petition to adopt the indirect land-use change ("ILUC") penalties determined by U.S. Department of Energy's Argonne National Laboratory's ("ANL") GREET model. NMED's proposed ILUC penalty for corn ethanol—nearly triple the 6.10 gCO2e/MJ penalty reflected in ANL's most up-to-date model[1]—relies on outdated studies and analysis adopted by the State of California a decade ago and will arbitrarily depress biofuel supplies and credit generation in New Mexico. Second, the EIB should amend the Petition's book-and-claim accounting provisions to allow bioethanol producers to use legally purchased renewable energy certificates ("RECs") to lower the CI of their biofuel. These proposed amendments are especially

[1] *See* Argonne National Laboratory, *R&D GREET Model*, 2024 rev. 1, https://greet.anl.gov/.

important to help accomplish New Mexico's ambitious carbon intensity ("CI") reduction goal of at least 20% below 2018 levels by 2030.

I. Overview

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 unleash the regenerative power of agriculture and cultivate opportunities for America's farm families. Founded in 1987 and headquartered in Sioux Falls, POET operates 35 bioprocessing facilities across nine states and employs more than 2,400 team members. With a suite of bioproducts including POET Distillers Grains, POET Distillers Corn Oil, POET Purified Alcohol, and POET Biogenic CO_2, POET nurtures an unceasing commitment to innovation and advances powerful, practical solutions to some of the world's most pressing challenges. Today, POET holds more than 140 patents worldwide and continues to break new ground in biotechnology, yielding ever cleaner and more efficient renewable energy. POET is also a leading champion for nationwide access to E15, a renewable fuel blend made with 15% bioethanol.

Through technological innovation, investments in carbon capture and renewable energy, and programs to reduce on-farm emissions, POET is steadily lowering the CI of its fuel to meet the ambition of New Mexico's CTFP as it grows and evolves. We see the potential for bioethanol to become a net-zero carbon liquid fuel on a life-cycle basis, operating to further decarbonize on-road transportation and serving as a feedstock for the next-generation fuels that will power the aviation industry and other hard-to-electrify sectors of the economy. But POET cannot realize this vision without appropriate regulatory incentives, grounded in the best-available science, that recognize and reward further investments in the decarbonization of our fuel.

II. Low-CI Bioethanol Will be Key to Meeting New Mexico's CI-Reduction Goals

The Clean Transportation Fuel Standard bill passed by New Mexico's legislature set ambitious targets for CI reductions in transportation fuel sold in New Mexico: at least 20% below 2018 CI levels by 2030 and at least 30% below 2018 CI levels by 2040.[2] The final rule is required to be implemented no later than July 1, 2026,[3] meaning that New Mexico could have just three and a half years to meet the requirements. This timeframe, while achievable, will require significant CI-lowering contributions from all forms of clean fuels, including bioethanol.

New Mexico's proposed timeline for achieving its initial CI-reduction goals is much shorter than the timelines of the other states with clean fuel standards. For example, the California Air Resources Board ("CARB") first approved its low-carbon fuel standard ("LCFS") in 2009 with a stated goal of reducing the CI of transportation fuel by at least 10% below 2010 levels by 2020, and in 2018 CARB approved amendments setting a goal of reducing the CI of transportation fuel by at least 20% below 2010 levels by 2030.[4] In April 2024, CARB announced the LCFS had

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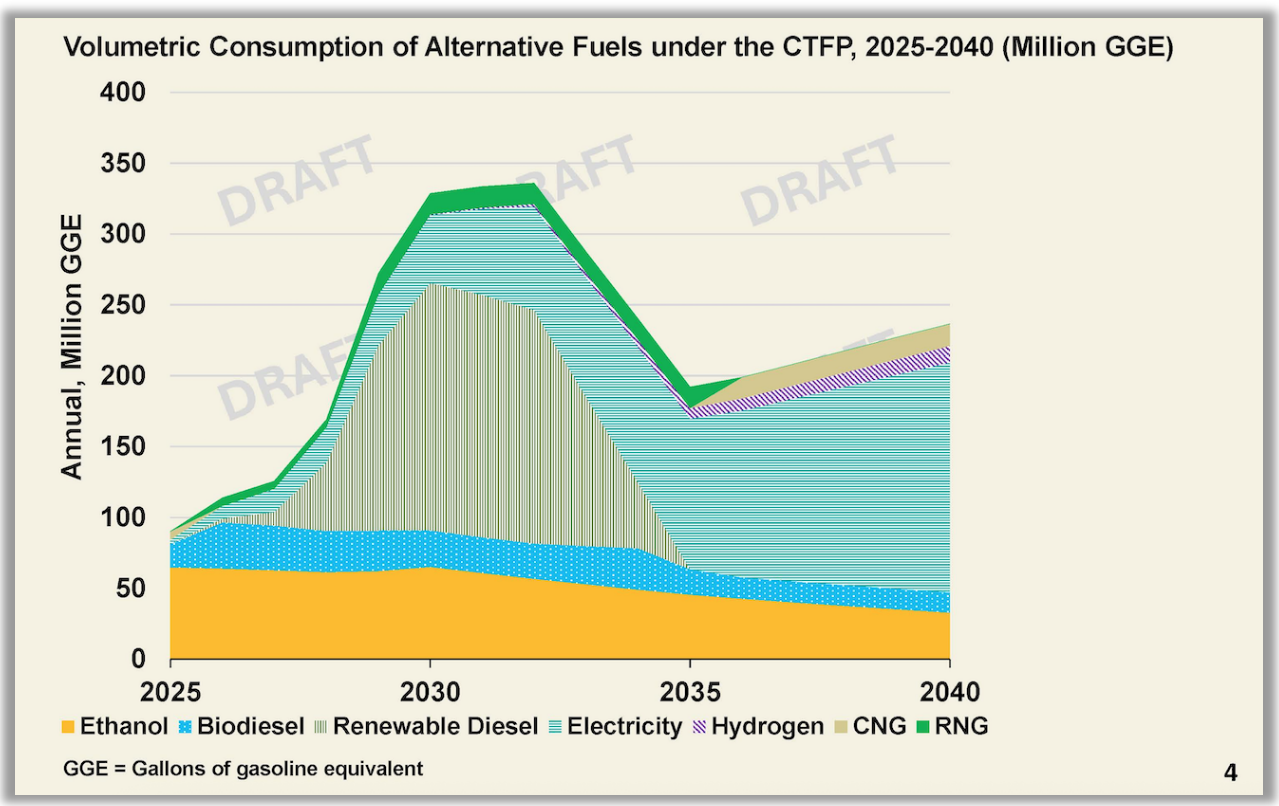
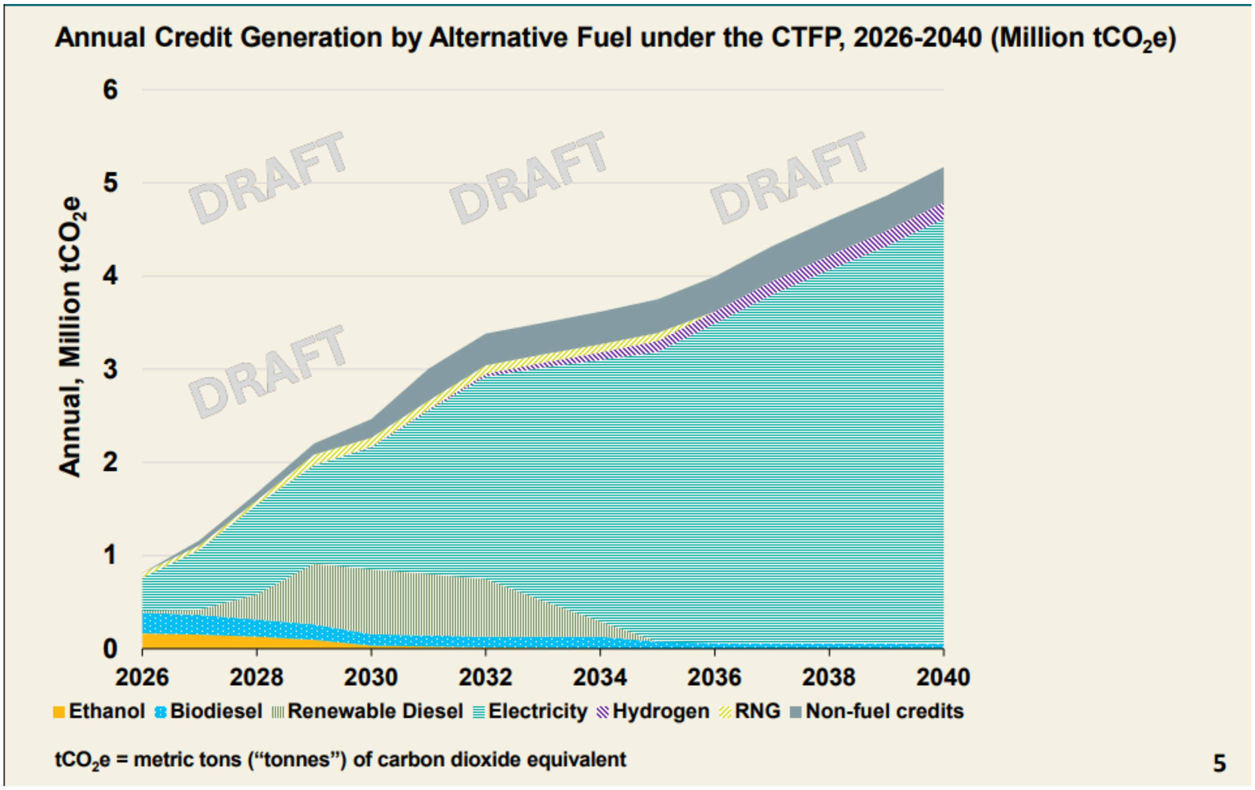
[2] H.B. 41, § 4(C)(2).
[3] *Id.* at § 4(A).
[4] California Air Resources Board, *Low Carbon Fuel Standard*, slide 3 https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf.

achieved a 12.6% reduction in the CI of transportation fuel after nearly 15 years.[5] Oregon first implemented its clean fuel program in 2016 with a goal of reducing the CI of transportation fuel by at least 10% below 2015 levels by 2025,[6] and in 2022 added the goal of reducing the CI of transportation fuel by at least 20% below 2015 levels by 2030.[7] When Washington implemented its clean fuel program in 2023 it originally required a CI reduction of 20% below 2017 levels by 2038, and recent legislation moved target date up to 2034.[8] In other words, each state gave itself at least 10 years to reach the 20% CI-reduction target. New Mexico requires the 20% CI-reduction to be met in less than 4 years.

To meet New Mexico's CI-reduction target, significant and consistent volumes of all low-CI fuels will be needed in New Mexico. Despite this, NMED released fuel volume and credit market projections earlier this year showing it expects most credit generation to come from speculatively high volumes of two types of alternative fuels: electricity and renewable diesel.[9]



[5] California Air Resources Board, *California Low Carbon Fuel Standard Workshop*, 2024, slide 12, https://ww2.arb.ca.gov/sites/default/files/2024-04/LCFS%20April%20Workshop%20Slides.pdf.
[6] Cory-Ann Wind, et al. *Oregon Clean Fuels Program*, at 6 (Feb. 2022), https://www.oregon.gov/deq/ghgp/Documents/CFPProgramReview.pdf.
[7] Oregon Dep't of Environmental Quality, *Clean Fuels Program Expansion 2022,* at 80 (Sep. 23, 2022), https://www.oregon.gov/deq/rulemaking/Documents/DEQ17-2022.pdf.
[8] Washington H.B. 1409, § 1(5).
[9] New Mexico Environment Department, *Fuel Volume and Credit Market Projections for the Clean Transportation Fuel Program (CTFP),* at slides 4 and 5 (Jan. 31, 2025), CTFO Fuel Volume and Credit Market Projections.



NMED's projections anticipate a significant influx of renewable diesel, along with a steadily increasing stream of electricity as a fuel, to meet the 2030 and 2040 goals. Both forms of alternative fuel carry risk. Renewable diesel volumes fluctuate significantly depending on which state (or foreign jurisdiction) program offers the highest credits prices, and electricity as a fuel depends on a consistent and significant increase in the uptake of electric vehicles. In view of the current federal administration's actions related to electric vehicles and the credit-price sensitivity of renewable diesel distribution, New Mexico's CTFP will struggle to meet its 20% CI-reduction goal by 2030 if one or both of these fuel types do not enter the New Mexico market as expected.

NMED's projections show ethanol remaining the most consistent volume of alternative fuel between 2026 and 2040. This is unsurprising given federal ethanol blending requirements and the value of bioethanol as a source of octane in gasoline. NMED's projections nonetheless show ethanol generating relatively few credits through 2030 and essentially no credits afterwards. NMED provides two reasons for these projections: (1) the bioethanol blend wall will remain at E10; and (2) the carbon intensity of bioethanol is constrained by the current average CI of corn production.[10] This reasoning, in POET's view, is misguided. With the continued expansion of E15 nationwide,[11] there is no reason to believe the blend wall will remain at E10. Moreover, NMED incorrectly portrays corn ethanol as not being able to achieve the low CI needed to meet the program's goals. Contrary to NMED's assumptions, the carbon intensity of bioethanol produced from corn is variable, and decarbonization of bioethanol production is now explicitly

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[10] *See id.* at p. 5.

[11] On Oct. 2, 2025, California became the final state to officially approve the use of E15. *See* http://gov.ca.gov/2025/10/02/governor-newsom-signs-bill-expanding-fuel-options-to-cut-gas-prices/.

incentivized by federal policy through the Clean Fuel Production tax credit.[12] Given current investments in existing technology and practices, including renewable process energy, carbon capture and sequestration, and climate-smart agriculture, bioethanol production is on a path to becoming a zero-CI liquid fuel type in the near short term. .[13]

Bioethanol is and will almost certainly remain the most consistent low-carbon fuel alternative available in New Mexico for the foreseeable future. Rather than relying on speculative volumes of other renewable fuels, New Mexico should take advantage of the consistent volumes of bioethanol certain to be sold into the state help meet its CI-reduction goals. New Mexico can do this by recognizing and relying on accurate and up-to-date science and by incentivizing farmers and producers to invest in available decarbonization methods.

III. The EIB Should Amend the Petition to Adopt the Argonne National Laboratory's GREET Model's ILUC Penalty for Corn Ethanol.

In the Petition, NMED proposes an outdated ILUC penalty of 19.8 gCO_2e/MJ for corn ethanol, mirroring the value established more than 15 years ago by California under its LCFS. This penalty significantly overstates the actual land-use impacts associated with corn ethanol and reflects a modeling approach that no longer aligns with current scientific understanding. Moreover, the unnecessarily punitive ILUC penalty proposed in the Petition arbitrarily punishes bioethanol producers and limits their ability to effectively contribute to the CTFP's CI-reduction goals. POET thus urges the EIB to revise the proposed ILUC penalty for corn ethanol in the Petition to align with the most accurate and up-to-date science as reflected by the ANL's GREET model's 6.10 gCO2e/MJ value.

The ANL developed the GREET model to accurately score lifecycle GHG emissions for renewable fuels, such as corn ethanol, and establish CI values for the full range of factors that impact the production and use of biofuels. One such factor is the ILUC penalty, which is designed to account for GHG emissions, if any, attributable to land use changes driven by different types of crop-based biofuel demand. This feature of the GREET model has been continuously revised *downward* for corn ethanol. ANL regularly updates the GREET model with the most recent information reflecting the best available science.[14] In the latest version of the R&D GREET model, published on January 10, 2025, ANL assigns corn ethanol an ILUC penalty of 6.1 gCO_2e/MJ.[15] This modeling adjustment reflects a downward adjustment of 2.5 gCO2e/MJ from the 8.6 gCO2e/MJ ILUC penalty incorporated into the 2023 R&D GREET Model.[16]

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[12] *See* 26 U.S.C. 45Z.
[13] *See* Moniz, Ernst et al., *A Strategic Roadmap for Decarbonizing the U.S. Ethanol Industry,* EFI FOUNDATION at 7 (Sept. 2024*)* https://efifoundation.org/foundation-reports/a-strategic-roadmap-for-decarbonizing-ethanol-in-the-united-states/.
[14] *See* H. Kwon, X. Liu, S. Kar, H. Cai, M. Wang, *Expansion of Carbon Calculator for Land Use and Land Management Change from Biofuels Production (CCLUB) to Address Induced Land Use Changes and Other Indirect Effects of Clean Fuel Production for R&D GREET 2024,* https://greet.anl.gov/publication-cclub_update_2024.
[15] *Id.* at 8-9 (Table 4).
[16] *See* X. Liu, H. Cai, M. Wang, H. Kwon, *Updates to Carbon Calculator for Land Use and Land Management Change from Biofuels Production (CCLUB) for the GREET Model*, at 3 (Table 1) (Dec. 2023), https://greet.anl.gov/publication-cclub_update_2023.

Other biofuels programs have adopted ILUC penalties more closely aligned with ANL GREET. For example, Oregon's version of the GREET model used to established CIs for its Clean Fuel Program assigns corn ethanol an ILUC penalty of 7.6 gCO_2e/MJ.[17] Other programs, such as Canada's Clean Fuel Regulations, do not assess an ILUC penalty at all.[18] These programs reflect a growing understanding supported by peer-reviewed research that ILUC penalties for corn ethanol have decreased significantly over the past 15 years. In fact, a 2021 study analyzed 26 published estimates of ILUC values for corn ethanol since 2008 and found that ILUC estimates had declined from values exceeding 100 gCO_2e/MJ in 2008, to generally below 10 gCO_2e/MJ in more recent modeling. The authors concluded that the best estimate of ILUC for corn ethanol is 3.9 gCO_2e/MJ.[19] Notably, the authors analyzed ILUC penalties published by CARB and the EPA, and they determined those higher ILUC values were based upon "modeling approaches that do not represent best practices" and, for CARB's model, relied on emissions assumptions not based on solid scientific reasoning.[20]

Most recently, on January 15, 2025, the U.S. Treasury Department adopted a model (45ZCF-GREET) intended for use in the implementation of the federal 45Z Clean Fuel Production Credit, §45Z(B)(1)(B)(ii) and §45Z(B)(1)(B)(iii)(II) of the Inflation Reduction Act.[21] The 45ZCF-GREET model assigned to corn ethanol an ILUC penalty of 5.8 gCO2e/MJ.[22] The U.S. Treasury Department's 45Z guidelines provided an even more detailed analysis by demonstrating and accounting for indirect effects from various sources in addition to land use change, such as GHG emissions due to livestock and other crops.[23] The following table summarizes the analysis:[24]

[17] Or. Admin. R. 253-8010 (2025), (Table 10), https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=321685.
[18] *See* Canada's Fuel Lifecycle Assessment Model, https://www.canada.ca/en/environment-climate-change/services/managing-pollution/fuel-life-cycle-assessment-model.html.
[19] *See* Scully, Melissa et al., *Carbon Intensity of Corn Ethanol in the United States: State of the Science*, ENVIRONMENTAL RESEARCH LETTERS, at 7 (Mar. 10, 2021) https://iopscience.iop.org/article/10.1088/1748-9326/abde08.
[20] *Id.* ("Estimates from CARB (19.8 $gCO_2e\ MJ^{-1}$) and EPA (26.3 $gCO_2e\ MJ^{-1}$ predicted for 2022) fall outside our range, resembling LUC values from LCAs prior to 2011 (figure 1), and are based on modeling approaches that do not represent current best practices.")
[21] *See* Guidelines to Determine Life Cycle Greenhouse Gas Emissions of Clean Transportation Fuel Production Pathways Using 45ZCF-GREET, https://www.energy.gov/sites/default/files/2025-01/45zcf-greet_user-manual.pdf.
[22] *Id.* at 26, Table 9b.
[23] *Id.* at 23-26.
[24] *Id.* at 26, Table 9b.

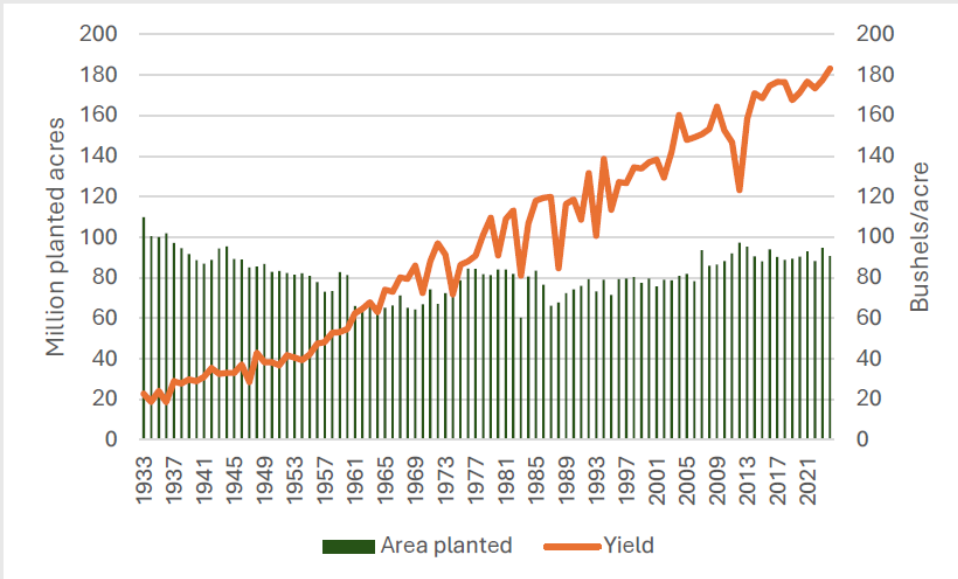
Results are estimated in grams CO_2e per megajoule of SAF using sample yields for each pathway.

45Z Clean Fuel(s) – Pathway	Feedstock	Total	ILUC	Livestock	Other Crops
Ethanol - Fermentation	U.S. Corn Starch	4.58	5.75	-1.58	0.41
Ethanol - Fermentation	Brazilian Sugarcane	3.70	13.10	-6.09	-3.31
Ethanol - Fermentation	U.S. Sorghum Grain	4.61	7.42	-2.00	-0.81
Biodiesel - Transesterification	U.S. Soybean Oil	12.35	12.58	-0.54	0.31
Renewable Diesel, SAF - HEFA	U.S. Soybean Oil	13.62	13.84	-0.54	0.32
Biodiesel - Transesterification	U.S./Canadian Canola/Rapeseed Oil	16.48	15.02	-0.88	2.33
Renewable Diesel, SAF - HEFA	U.S./Canadian Canola/Rapeseed Oil	18.18	16.53	-0.90	2.55

Recent research on the ethanol industry and ILUC also rebuts the common concern that farmers are incentivized to increase their overall land use to grow more corn for ethanol production, showing instead that farmers have become more efficient on the land already in use for growing crops. For example, recent research published by the former Department of Energy Secretary, Dr. Ernest Moniz, found that since 2001 overall land use for food crops has stayed relatively even while yields have increased dramatically.[25] In fact, the Moniz Study found that "land used for planting U.S. food crops has *decreased by 2.1%* from 2001 to 2024, while the yield has *increased by 25.1%*," indicating "that increased corn ethanol production has not affected other food crops' production and land use."[26] The graph below from the Moniz Study further demonstrates that increases in corn ethanol production have been primarily driven by yield improvements:[27]

[25] *See, e.g.,* Moniz, Ernest, et al., *A Strategic Roadmap for Decarbonizing the U.S. Ethanol Industry,* EFI FOUNDATION at 2, 20-22 (Sept. 2024) https://efifoundation.org/foundation-reports/a-strategic-roadmap-for-decarbonizing-ethanol-in-the-united-states/.
[26] *Id.* at 20 (emphasis added).
[27] *Id.* at 21.

Figure 3. Corn productivity increase – U.S. corn acreage and average yield



Corn yields have steadily increased over the years, despite consistent planted acres, indicating significant productivity gains in corn production. Data from: U.S. Department of Agriculture National Agricultural Service "Quick Stats": corn acreage and corn planted.

Not only does corn used for ethanol production already coexist with other staple grains without affecting their production or land use, but ethanol production actually complements the overall U.S. food supply. Indeed, dried distillers grains ("DDGs"), a main byproduct of ethanol production, are used as a high-protein animal feed for livestock, displacing other feeds and thus minimizing the land needed to grow additional food for livestock.[28]

The best available science, the most recent research, and the consensus across modern models, such as the 2024 R&D GREET and 45ZCF-GREET models, establishes an ILUC penalty of around 6.1 gCO_2e/MJ or less for corn ethanol. Likewise, the same information establishes that California's and Washington's ILUC penalties of 19.8 gCO_2e/MJ for corn ethanol is not supported and is widely considered an outlier, appearing instead to reflect policy choices to minimize biofuel crediting in their programs and prioritize crediting associated with electric vehicles, a priority likely to face significant headwinds in view of the current federal administration's approach to climate policy. If New Mexico is to succeed in the ambitious CI-reduction goals set for the CTFP, it will need low-CI ethanol to play a major role. And for low-CI ethanol to help achieve New Mexico's goals, the EIB should align the ILUC penalty for corn ethanol with the R&D GREET model and move away from California's values that no longer stand up to scientific scrutiny. In this respect, POET supports and endorses fully the technical testimony of Dr. Tristan Brown, JD, PhD, submitted to EIB on September 2, 2025.[29]

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[28] *Id.* at 20-21.
[29] *See* Attachment A.

IV. The EIB Should Amend the Petition's Book-and-Claim Accounting Rules to Avoid Unnecessary Restrictions on the Use of RECs.[30]

Although POET is supportive of including book-and-claim accounting in the CTFP, POET has several concerns with the current language in the Petition that appears to severely restrict the ability of low-carbon fuel producers to rely on renewable energy certificates ("RECs") to lower the CI of their biofuels. The EIB should take the opportunity to address these issues before the regulation goes into effect.

There are two essential problems with the Petition's proposal. First, the definition of "book-and-claim" requires that renewable electricity used for crediting under the CTFP be generated in or near New Mexico.[31] Second, biofuel producers are prohibited from claiming the GHG reductions associated with RECs under New Mexico's CTFP if those producers also claim benefits from the same RECs under the Inflation Reduction Act's ("IRA") federal tax credit program.[32] POET recommends the EIB reconsider these restrictions and adopt a book-and-claim accounting rule that will genuinely drive investment in renewable electricity and promote New Mexico's CI-reduction goals.

A. <u>The EIB Should Amend the Petition's "Book-and-Claim" Definition to Remove the Final Sentence.</u>

Book-and-claim accounting is designed to decouple geographic proximity from the environmental benefits associated with renewable electricity generation. Because renewable electricity providers typically supply their electricity to the grid where it is combined with non-renewable electricity, there is no way to accurately track the renewable electricity reaching a specific purchaser. Book-and-claim accounting addresses this issue by allowing purchasers to claim the amount of electricity purchased from a renewable energy provider without showing they physically received the renewable electricity, ultimately supporting renewable electricity development and the gradual decarbonization of the electric grid. Without book-and-claim accounting, however, biofuel producers can only claim the lower CI associated with the use of renewable electricity if there is a direct connection between the renewable electricity generator and the biorefinery.

The current definition of "book-and-claim" in the Petition effectively limits the availability of RECs to those generated from renewable electricity source in or connected to New Mexico. POET understands New Mexico's goals to increase its in-state renewable electricity generation; however, such a restrictive definition severely limits the number of RECs available for purchase. Moreover, under the proposed definition, there would be no incentive to purchase RECs from outside of New Mexico because the CI reductions associated with those RECs would not be recognized. In other

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[30] POET agrees with and incorporates the amendments proposed by the "SAF Producer Group" to NMAC 20.2.92.7(B)(12) and NMAC 20.2.92.206(E)(1)(f) as shown in Exhibit 2 of the "Notice of Intent to Present Technical Testimony on Behalf of Gevo, Next Renewable Fuels, Inc., and World Energy LLC," (the "SAFPG" filings) the relevant text of which is reproduced in this filing.

[31] *See* NMAC 20.2.92.7(B)(12).

[32] *See, e.g.,* NMAC 20.2.92.206(E)(1)(f).

words, the Petition's book-and-claim language does not incentivize biofuel producers to sell the lowest-CI fuel into New Mexico and is thus inconsistent with the goals of the CTFP.

The stated objective of the proposed regulation is to "reduce the carbon intensity of transportation fuel… by a minimum of twenty percent below 2018 carbon intensity levels by 2030 and by a minimum of thirty percent below 2018 levels by 2040."[33] Purchasing renewable electricity and investing in renewable electricity development, regardless of where it is generated, represents decarbonization and is one way for biofuel producers to help New Mexico achieve its goal.[34] To that end, POET proposes adopting the following amendment to the definition of "book-and-claim" as proposed by the "SAF Producer Group":[35]

> **20.2.92.7 DEFINITIONS:** The definitions in the Environmental Improvement Act, Section 74-1-3 NMSA 1978 shall apply in 20.2.92 NMAC. The definitions in 20.2.2.7 NMAC shall not apply in 20.2.92 NMAC.
>
> A. Definitions beginning with the letter "A."
>
> (…)
>
> *B. Definitions beginning with the letter "B."*
>
> *(…)*
>
> *(12) **"Book-and-Claim"** means the accounting methodology where the environmental attributes of an energy source are detached from the physical molecules or electrons when they are commingled into a common transportation and distribution system for that form of energy. The detached attributes are then assigned by the owner to the same form and amount of energy when it is used.* ~~***For the purposes of 20.2.92 NMAC, the common transportation and distribution system shall be connected to New Mexico.***~~

POET respectfully urges the EIB to adopt this proposed amendment in the final rule.

B. <u>Restrictions on Applicability of RECs</u>

POET is also concerned about language in the CTFP that appears to constrain producers from claiming the CI benefits associated with RECs for both CTFP credit and IRA tax credit purposes. As currently drafted, NMAC 20.2.92.206(E)(1)(f) prohibits a producer from using RECs in "any other programs," which could be interpreted to bar a bioethanol producer from selling a gallon of low-CI ethanol into New Mexico for CTFP credit if the producer also claimed tax credits under

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[33] NMAC 20.2.92.5.

[34] POET is supportive of New Mexico's desire to promote clean energy development and deployment in New Mexico, but the CTFP is not the place for such a policy. NMED should pursue that objective through separate renewable energy policies or initiatives.

[35] *See* SAFPG-GEVO-Exhibits-1-11 at Exhibit 2.

Section 45Z of the IRA for that same gallon of fuel relying on the same REC. This language creates confusion and could frustrate New Mexico's CTFP goals.

Federal tax credits under 45Z attach to any gallon of biofuel produced in the United States having a CI below a certain threshold.[36] The current language of the CTFP may force producers to choose whether to obtain credits through the CTFP or federal tax credits through 45Z and, in view of the incentives offered under 45Z, will likely result in producers choosing not to participate in New Mexico's CTFP. As a result, a bioethanol producer's lowest-CI biofuel will find markets outside New Mexico and will not contribute to the 20% CI-reduction goal in the state by 2030, an outcome that would actively undermine the goals of the CTFP and this rulemaking.

POET believes this restriction is unintended. Unlike double counting, the use of RECs to demonstrate emissions reductions under both the CTFP and 45Z reflects the same environmental benefit and does not constitute a duplication of credit for separate state programs. To avoid discouraging low-CI fuel producers from participating in New Mexico's nascent program, POET urges the EIB to revise the proposed language to clarify that low-CI fuel sold in New Mexico may rely upon RECs to earn both CFS and 45Z tax credit. POET proposes adopting the following amendment to NMAC 20.2.92.206(E)(1)(f) as proposed by the "SAF Producer Group":[37]

> ***20.2.92.206 CARBON INTENSITIES FOR ELECTRICITY:***
>
> (…)
>
> *E. Offsite renewable electricity. Offsite renewable electricity may be used through book-and-claim accounting to report zero carbon intensity electricity used as a transportation fuel in the CTFP-DMS or may be used to lower the average carbon intensity of electricity used to produce transportation fuel as a part of an alternative fuel pathway.*
>
> *(1) All RECs retired pursuant to 20.2.92 NMAC shall meet the following qualifications:*
>
> (…)
>
> *(f)* ***~~RECs may not be utilized for any other programs.~~ Any RECs or other environmental attributes associated with the energy are not issued credits or claimed produced, or are retired and not claimed under any other voluntary or mandatory program with the exception of the federal Renewable Fuel Standard, incentives under the Infrastructure Investments and Jobs Act or the Inflation Reduction Act, other federal or state fuel credit programs, sustainability certification schemes, and Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The fuel reporting entity may also apportion***

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36 *See* Internal Revenue Service, *Clean Fuel Production Credit,* https://www.irs.gov/credits-deductions/clean-fuel-production-credit.

37 *See* SAFPG-GEVO-Exhibits-1-11 at Exhibit 2.

environmental attributes between transportation fuel and co-products subject to approval by the department in the fuel pathway application process.

POET believes the proposed amendment captures NMED's intended goal of ensuring no double-counting of credits across different state programs for the same gallon of fuel. POET further notes that the same amendment would need to be made to sections 20.2.92.201(C)(4) and 20.2.92.506(E)(11)(c).

POET urges the EIB to revise the Petition to clarify that low-CI fuel sold in New Mexico may rely upon RECs to earn both CTFP and 45Z tax credit.

V. CONCLUSION

POET appreciates the opportunity to comment and looks forward to working with NMED to establish a Clean Transportation Fuels Program in New Mexico. If you have any questions, please contact me at Paul.Townsend@POET.com or (605) 756-5612.

Sincerely,

Paul W. Townsend
Regulatory Counsel

Attachment A

RECEIVED Pamela Jones
By Environmental Improvement Board at 4:30 pm, Sep 02, 2025

STATE OF NEW MEXICO
ENVIRONMENTAL IMPROVEMENT BOARD

IN THE MATTER OF PROPOSED
ADOPTION of 20.2.92 NMAC
Clean Transportation Fuel Program **No. EIB 25-23(R)**

GROWTH ENERGY'S NOTICE OF INTENT TO PRESENT TECHNICAL EVIDENCE

Growth Energy, by and through its counsel of record, Hinkle Shanor LLP (Thomas M. Hnasko), pursuant to 20.1.1.302 NMAC and the Pre-Hearing Order of July 15, 2025, hereby submits this Notice of Intent to Present Technical Evidence at the public hearing regarding the captioned proceeding.

1. Name of Person for Whom the Witness will Testify.

Growth Energy.

2. Identification of Technical Witness(es).

Tristan R. Brown, J.D., Ph.D.

3. Qualifications, Education and Work Background.

Dr. Brown's qualifications, education and work experience are set forth in his curriculum vitae, attached as Exhibit A to his direct testimony, and are further described in Part I of his direct testimony.

4. Text of Recommended Rule Modification.

Growth Energy recommends that the EIB replace Table 9 in NMED's proposed Rule with Table 1 set forth in Dr. Brown's direct testimony at page 7.

5. **Statement of Reasons.**

NMED's proposed regulation assigns carbon intensity values to indirect land use change (ILUC) that are calculated using a decade-old model adopted by the California Air Resources Board (CARB). Over the last ten years, advancements in research and scientific modeling have rendered CARB's model obsolete. More up-to-date models have become the standard in federal climate policy, including through incorporation in various climate incentives in the Inflation Reduction Act passed under President Biden. By adopting the CARB figures, NMED is proposing values that contradict the latest federal policy and science developed by the United States National Laboratories. Dr. Brown will offer technical testimony regarding the evolution in ILUC research and modeling since 2014 and will explain the advantages of using the U.S. Department of Energy's Research and Development GREET Model (R&D GREET) and its GTAP-BIO + CCLUB method for quantifying ILUC. Dr. Brown will recommend that the Board replace Table 9 in NMED's proposed regulation with a Table that reflects the ILUC values calculated by the R&D GREET model, which better capture observed data regarding ILUC, align New Mexico with more recently developed state and federal biofuels programs, and position New Mexico for greater success in the implementation of the CFTP.

6. **Identification of Exhibits**.

The following Exhibits have been reproduced in Dr. Brown's direct testimony as Figure 1, Table 1, and Figure 2 at pages 6, 7, and 8.

1. Figure 1: Comparison of U.S. corn acres harvested and corn yields since 2000, as set forth in U.S. Department of Agriculture. 2025. "Corn and Other Feed Grains – Feed Grains Sector at a Glance," USDA Economic Research Service, April 17. Available on the Web at: https://www.ers.usda.gov/topics/crops/corn-and-other-feed-grains/feed-grains-sector-at-a-glance (accessed September 1, 2025).

2. Table 1: Comparison of New Mexico's estimated ILUC values for crop-based biofuels with most recent estimated values, as set forth in Kwon, H., X. Liu, S. Kar, H. Cai, and

M. Wang. 2025. "Expansion of Carbon Calculator for Land Use and Land Management Change from Biofuels Production (CCLUB) to Address Induced Land Use Changes and Other Indirect Effects of Clean Fuel Production for R&D GREET 2024," Argonne National Laboratory, ANL/ESIA-24/22, January. Available on the Web at: https://publications.anl.gov/anlpubs/2025/05/193639.pdf (accessed August 31, 2025).

3. Figure 2: Comparison of corn ethanol ILUC values from selected studies, adapted from Lee, U., H. Kwon, M. Wu, and M. Wang. 2021. "Retrospective analysis of the U.S. corn ethanol industry for 2005-2019: implications for greenhouse gas emission reductions," *Biofuels, Bioproducts and Biorefining* 15: 1318-1331. Available on the Web at: https://scijournals.onlinelibrary.wiley.com/doi/abs/10.1002/bbb.2225 (accessed September 1, 2025), and updated to include Kwon, H., X. Liu, S. Kar, H. Cai, and M. Wang. 2025. "Expansion of Carbon Calculator for Land Use and Land Management Change from Biofuels Production (CCLUB) to Address Induced Land Use Changes and Other Indirect Effects of Clean Fuel Production for R&D GREET 2024," Argonne National Laboratory, ANL/ESIA-24/22, January. Available on the Web at: https://publications.anl.gov/anlpubs/2025/05/193639.pdf (accessed August 31, 2025).

Dr. Brown's direct testimony also cites and relies upon the following Exhibits, all of which are available through the hyperlinks provided in Section VI of Dr. Brown's direct testimony.

4. Searchinger, T., R. Heimlich, R. Houghton, F. Dong, A. Elobeid, et al. 2008. "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change," *Science* 319(5867): 1238-1240. Available on the Web at: https://www.science.org/doi/abs/10.1126/science.1151861 (accessed September 1, 2025).

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7. California Air Resources Board. 2014. "Detailed analysis for indirect land use change," LCFS Land Use Change Analysis, December. Available on the Web at: https://ww2.arb.ca.gov/resources/documents/lcfs-land-use-change-assessment (accessed August 30, 2025).

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7. Direct Testimony.

Dr. Brown's direct testimony is attached to this Notice of Intent.

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DIRECT TECHNICAL TESTIMONY OF TRISTAN R. BROWN, J.D., Ph.D.

Introduction

My name is Tristan R. Brown, J.D., Ph.D. I am an energy economist and lawyer specializing in the assessment of the climate and financial impacts of low-carbon fuels under life cycle assessment (LCA) and techno-economic analysis frameworks.

I have been retained by Growth Energy, the world's largest ethanol trade organization, to advise on New Mexico's Clean Transportation Fuel Standard. My engagement by Growth Energy is strictly in my individual capacity as an independent consultant, and my comments are not made on behalf of any other institution with which I am affiliated.

My testimony supports Growth Energy's proposal that the New Mexico Environmental Improvement Board ("EIB") adopt revised emissions factors for indirect land use change (ILUC) that align with the most recent version of Argonne National Laboratory's Research and Development GREET Model (R&D GREET).

Executive Summary

Part I provides an overview of my expert qualifications and work experience on the subject of low-carbon fuels life cycle assessment (LCA).

Part II provides a brief narrative description of how early modeling on the indirect land-use change (ILUC) of crop-based biofuels was conducted by the U.S. Environmental Protection Agency (EPA) and California Air Resources Board (CARB). It specifically focuses on modeling that was conducted up through the release of CARB's 2014 ILUC estimates since these are the values on which New Mexico's proposed ILUC values are based. Part II discusses the primary components of the GTAP-BIO + AEZ-EF model that CARB used to calculate its 2014 estimates and how this was combined with a variation of the Argonne National Laboratory Greenhouse gases, Regulated Emissions, and Energy use in Technologies (GREET) model to calculate life cycle carbon intensity (CI) scores for crop-based biofuels based on the land use change modeling capabilities that were available to CARB at the time.

Part III details the iterative process of ILUC modeling critiques and improvements that occurred in the ILUC modeling community between 2015 and 2025 and how this led to the development of the Carbon Calculator for Land Use Change from Biofuels Production (CCLUB) land use change emissions factor model as a replacement for the now-obsolete AEZ-EF model that was used by CARB in 2014. The section also discusses how the GTAP-BIO + CCLUB modeling framework has been employed to produce land use change estimates for crop-based biofuels in jurisdictions other than California. Finally, Part III provides details on the continuous federally-funded improvements that have been made to

GTAP-BIO + CCLUB in recent years in direct response to critical feedback that has been published in the refereed literature.

Part IV compares New Mexico's proposed ILUC values for crop-based biofuels with estimates from the most recent version of GTAP-BIO + CCLUB. It also compares New Mexico's proposed ILUC values for corn ethanol with estimates that have been made since 2008. Part IV shows that New Mexico's proposed ILUC values for both crop-based biofuels and corn ethanol specifically are much higher than those found in modeling estimates from the last decade.

Part V presents a recommendation that New Mexico align itself with the U.S. government by utilizing the latest version of the GTAP-BIO + CCLUB modeling framework to calculate ILUC estimates under the Clean Transportation Fuel Program. It explains how such an alignment would (1) minimize distortions between the Program and similar programs in other programs that utilize (or can be expected to utilize) the most recent modeling to produce ILUC estimates, and (2) reduce compliance costs under the Program by enabling crop-based biofuels to receive full credit for the emissions reductions that are calculated by modern LCA models based on up-to-date modeling methodologies and data sources.

Part VI lists all references cited in this testimony along with hyperlinks.

I. Qualifications

My full background and qualifications are set forth in my resume, which is attached to this direct testimony as Exhibit A.

I am currently a (Full) Professor of Energy Resource Economics and Director of the Bioeconomy Development Institute at the SUNY College of Environmental Science & Forestry (SUNY-ESF), where I was named Exemplary Researcher in 2024. I hold a J.D. from the University of Missouri, a Ph.D. in Biorenewable Resources & Technology from Iowa State University, and I am a member of the Missouri Bar.

I have 16 years of direct experience analyzing low-carbon fuels policies and their greenhouse gas (GHG) accounting systems, including ILUC assessment methodologies. From 2009-2010 I was employed as a research associate in Iowa State University's (ISU) Center for Agricultural and Rural Development (CARD), where I conducted research using the Global Trade Analysis Project (GTAP) global equilibrium model. From 2010-11 I was employed as a research associate in ISU's Department of Economics, where I conducted research on the U.S. Renewable Fuel Standard (RFS) and California's Low Carbon Fuel Standard (LCFS). From 2012-2014 I was employed as a research associate in ISU's Bioeconomy Institute, where I conducted research on systems analyses of low-carbon fuels, including life cycle assessment (LCA). Since 2014 I have been employed in my current faculty position at the ranks of Assistant Professor (2014-2019) and Associate Professor (2019-2025).

In my 16 years of researching low carbon fuels policies, I have provided testimony, comments, and information to numerous government agencies, boards, and commissions. I have provided written testimony to the Virginia State Corporation Commission and written comments to the California Air Resources Board, the New York Climate Action Council, the Vermont Public Utility Commission, and the U.S. Environmental Protection Agency. From 2015-2017 I served as an expert witness on behalf of the State of Mississippi. From 2020-21 I served on the Energy-Intensive and Trade-Exposed Industries advisory panel of the New York State Climate Action Council.

I have specific and longstanding experience regarding systems analyses, including LCA, of low-carbon fuels. I have published 44 papers on low-carbon fuels in the refereed literature in addition to several books, book chapters, and non-refereed papers. I have also been credited with 86 presentations on the subject at conferences, workshops, and other professional gatherings as either lead or co-author. I have taught eight different courses on renewable energy topics and served as major or co-major professor for 16 graduate students, including six Ph.D. students. Finally, I have been principal or co-principal investigator on 24 different research grants covering low carbon fuel topics, including LCA of low carbon fuel pathways.

II. How ILUC Modeling Was Conducted Under the U.S. Renewable Fuel Standard (RFS) and California Air Resources Board (CARB) Low Carbon Fuel Standard (LCFS)

Prior to 2007, the modeling of GHG emissions from low-carbon fuels such as corn ethanol was primarily conducted on the basis of direct supply chain emissions on a life cycle basis. These emissions would be summed across the full chain and then compared to those of the corresponding fossil fuel (e.g., gasoline in the case of corn ethanol). A smaller emissions total for the low-carbon fuel would lead to a finding that its use resulted in a net reduction to GHG emissions relative to the business-as-usual case involving the corresponding fossil fuel's use.

Beginning in 2008 it became common for GHG emissions from land-use change induced by the consumption of low-carbon fuels to be included in LCAs of low-carbon fuels. An initial analysis by Searchinger et al.[1] estimated that the lifecycle GHG emissions for corn ethanol were higher than for gasoline after accounting for ILUC emissions of 104 gCO_2e/MJ. The analysis was based on the logic that higher demand for low-carbon fuels from crop feedstocks leads to higher global prices, resulting in the conversion of non-cropland (forests, pasture, and grazing land) to cropland, especially in developing countries. The Searchinger et al. finding corresponded with a requirement in the authorizing legislation for the U.S. RFS and California LCFS that ILUC emissions be included in the calculation of lifecycle GHG emissions of participating biofuels (RFS) and low-carbon fuels (LCFS). The original Searchinger et al. estimate was highly sensitive to its use of an unrealistic set of default assumptions, however,[2] leading to large downward revisions to estimated ILUC emissions from U.S. corn ethanol as ILUC modeling improved in rigor and complexity between 2009 and 2014,[3] at which point CARB adopted an ILUC emissions value for that fuel of 19.8 gCO_2e/MJ.[4] This is the ILUC emissions value that is being proposed for use in New Mexico.[5]

CARB's 2014 estimate was the result of an analysis conducted with the general equilibrium model GTAP-BIO in conjunction with the land emissions factor model AEZ-EF. Put simply, GTAP-BIO was employed to identify the area of non-cropland in different "agro-ecological zones" (AEZ) that would be converted to cropland in response to low-carbon fuel supply chain shocks at volumes generally corresponding to U.S. policy requirements. AEZ-EF, which was based on the then-current (circa 2006) IPCC GHG inventory methods and default values, was then used to determine the emissions released by the conversion of each type of land in each AEZ. Taken together, GTAP-BIO and the AEZ-EF calculated ILUC emissions factors for corn ethanol (among other low-carbon fuels). In early 2015 CARB described AEZ-EF as the "current state-of-the-art for emissions factors for various types of land conversions across the globe" and the combination of GTAP-BIO and AEZ-EF as "the best tools currently available to estimate ILUC emissions from biofuels."[6]

CARB's lifecycle carbon intensity (CI) calculations in 2014 were therefore based on an ad hoc combination of models that had been developed for different modeling objectives by different modeling teams. The Argonne National Laboratory's (ANL) Greenhouse gases, Regulated Emissions, and Energy use in Technologies (GREET) model, as modified by CARB (CA-GREET), was used to calculate emissions across the low-carbon fuel supply chain. GTAP-BIO and AEZ-EF were used to calculate ILUC emissions for each crop-based low-carbon fuel pathway based on their specific feedstock. These were then combined to produce a lifecycle CI score for each corresponding low-carbon fuel pathway participating in California's LCFS.

III. ILUC Modeling Has Significantly Improved Since the California Air Resources Board's Latest Estimates Were Released in 2014

The subsequent decade has seen steady improvements made to both the GTAP-BIO model and the overall CI score calculation methodology through funding from the U.S. government. The GREET model continues to be the primary means of calculating lifecycle GHG emissions across the low-carbon fuel supply chain, and it has been further adopted in support of the Washington Clean Fuel Standard (WA-GREET),[7] the Oregon Clean Fuels Program (OR-GREET),[8] the U.S. Department of Treasury (45ZCF-GREET),[9] and the International Civil Aviation Organization (ICAO-GREET).[10]

Given the widespread adoption of GREET to analyze a suite of low-carbon fuels pathways that includes several that utilize crop-based feedstocks, Argonne National Laboratory has taken the additional step of developing a GREET-integrated land use emissions factor model called the Carbon Calculator for Land Use Change from Biofuels Production (CCLUB). CCLUB, as detailed below, replaces the obsolete AEZ-EF model with a much more detailed model that incorporates the subsequent decades' worth of new research on land use change and land use emissions. CCLUB has started to replace AEZ-EF in newer LCA-based programs such as Oregon's Clean Fuels Program,[11] which estimates ILUC emissions for U.S. corn ethanol of 7.6 gCO_2e/MJ.[12] Like the AEZ-EF model that preceded it, CCLUB is compatible with the GTAP-BIO model (GTAP-BIO + CCLUB), which has also undergone major evidence-based modifications from the version that CARB used to calculate its corn ethanol ILUC value of 19.8 gCO_2e/MJ in 2014.

Development of both GTAP-BIO and CCLUB has benefited over the last several years from multiple rounds of theoretical critiques followed by evidence-based updates, resulting in major improvements to their modeling rigor and accuracy compared to the combined version of GTAP-BIO and AEZ-EF that was employed by CARB in 2014. GTAP-BIO and CCLUB have also benefited from database and other source material updates that were not available to CARB back in 2014. Taken together, these improvements fall into two broad categories: (1) data upgrades and (2) modeling improvements.

GTAP-BIO + CCLUB has superior modeling complexity than was available to GTAP-BIO + AEZ-EF due to its use of different land use change and land use emissions factor databases for domestic and international regions. CCLUB makes use of an updated version of AEZ-EF that incorporates the latest IPCC 2019 emission inventory guidelines (GTAP-BIO + AEZ-EF made use of IPCC 2006 guidelines), but this time as one input for calculating land use change emissions factors rather than as the sole input. In addition to the updated AEZ-EF, CCLUB also is able to utilize either Winrock or Woods Hole datasets for the calculation of international carbon emissions factors, reducing output sensitivity to the model's assumed factors.[13] Domestic land use change estimates in CCLUB originally used the parameterized CENTURY model but, since 2023, CCLUB has further utilized the DayCent model (a daily time-step version of CENTURY) for this purpose.[14]

These modeling improvements enable GTAP-BIO + CCLUB to incorporate datasets that were unavailable when GTAP-BIO + AEZ-EF was utilized by CARB in 2014, providing the former with improved analytical rigor relative to the latter. Its use of IPCC 2019 emission inventory guidelines is a substantial upgrade to the AEZ-EF model,[15] for example, while the use of CENTURY (and now also DayCent) incorporates regularly updated research on county-level soil carbon emissions factors from Colorado State University in a manner that is compatible with the U.S. Environmental Protection Agency's national GHG inventory guidelines for domestic lands.[14] Specifically, the use of CENTURY and DayCent enable GTAP-BIO + CCLUB to calculate soil carbon emissions factors as a function of climatological, physical, and input factors at a time when low- and no-till agricultural practices have become so widespread as to be reflected in agricultural land values.[16]

Perhaps most importantly, GTAP-BIO + CCLUB incorporates observational data on the soil content of domestic lands in order to "ground truth" a rough assumption made by GTAP-BIO + AEZ-EF regarding a parameter that past ILUC estimates have been especially sensitive to. An important finding of GTAP-BIO + AEZ-EF was that land use change primarily occurred on "cropland-pasture", a domestic land type in which cropland and pasture transition from the one to the other over time (e.g., cropland rotating to pasture and then back to cropland).[17] In 2014 the definition of this land type was not well understood, and AEZ-EF accounted for this uncertainty by assuming that the emission factor for cropland-pasture converted to cropland was 50% that of the emission factor from converting pasture to cropland for the first time.[18]

GTAP-BIO + CCLUB also uses inputs that reflect observational data on domestic land use that is different from what was assumed a decade ago. In 2014 the U.S. had experienced steady growth in corn acreages as measured by acres harvested (see Figure 1). This led to expectations of increased domestic land use change in order to meet rising corn ethanol demand that was reflected in the ILUC modeling at the time. Corn acres harvested peaked in 2016 before trending lower, however, as corn yields increased. More recent ILUC modeling reflects this important change in corn harvest trends.

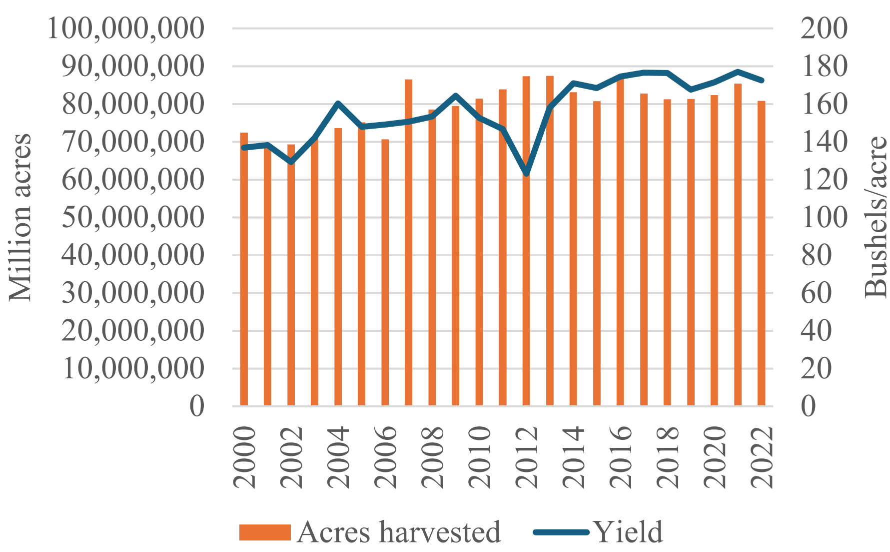

Figure 1. Comparison of U.S. corn acres harvested and corn yields since 2000.[19]

A critique of earlier versions of CCLUB was that the model assumed the existence of a negative emission factor (i.e., net carbon sequestration) on average from the conversion of cropland-pasture to cropland, which was a major difference from the AEZ-EF model's net carbon loss assumption.[3] The CCLUB model's incorporation of bespoke emission factor datasets for domestic land use change that were not accessible in 2014's GTAP-BIO + AEZ-EF models proved to be an important upgrade in this regard, however. Recent real-world data published in the refereed scientific literature has supported the CCLUB model's assumption by finding that negative emission factors exist on average at surveyed domestic cropland-pasture parcels when converted to cropland, for example.[20] Regenerative agricultural practices in corn production such as no-till,[21] cover-cropping,[22]can lead to negative emission factors. Observational data on the international peatland, which contains especially high carbon stocks, also suggests that CCLUB's land use change emission factors are more accurate than those of 2014's GTA-BIO + AEZ-EF.[23]

IV. New Mexico's proposed ILUC values are much higher than commonly used ILUC values that are based on recent modeling.

New Mexico's proposed ILUC values are, with the exception of canola-based biofuels, much higher than the most recent values that have been calculated by GTAP-BIO + CCLUB for the same biofuels (see Table 1). This is a consequence of New Mexico's proposed use of the values that were estimated by CARB in 2014. CARB's 2014 values were outliers even at that time (see Figure 2), and the improvements to ILUC modeling and model databases described above have caused ILUC estimate values to fall substantially further over the subsequent decade.

Table 1. Comparison of New Mexico's estimated ILUC values for crop-based biofuels with most recent estimated values.

	ILUC (gCO_2e/MJ)	
Low-carbon fuel pathway	*New Mexico proposal*	*GTAP-BIO+CCLUB (2024)[14]*
Corn ethanol	19.8	6.10
Sugarcane ethanol	11.8	13.10
Sorghum ethanol	19.4	7.52
Soy biodiesel	29.1	10.32
Soy renewable diesel	29.1	11.69
Canola biodiesel	14.5	15.15
Canola renewable diesel	14.5	16.68

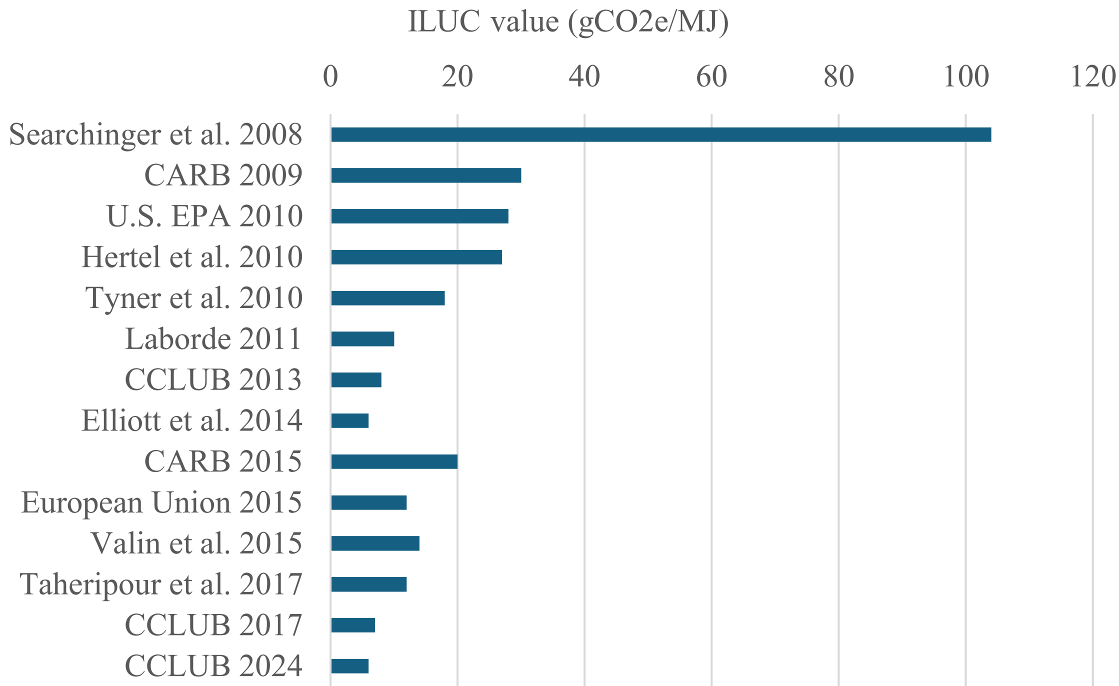

Figure 2. Comparison of corn ethanol ILUC values from selected studies. Adapted from Lee et al.[24] *and updated to include Kwon et al.*[14]

New Mexico's proposed ILUC value for corn ethanol is higher than any of the values that GTAP-BIO + CCLUB is capable of calculating regardless of the database that is employed. A 2023 model comparison exercise (MCE) was conducted by the U.S. Environmental Protection Agency (EPA) using GTAP-BIO + CCLUB, as well as other ILUC models.[25] The exercise ran the 2017 version of GTAP-BIO + CCLUB through an extensive sensitivity analysis in order to determine how sensitive its ILUC estimates were to user assumptions. The MCE found that the estimates using CENTURY for domestic land use change emission factors ranged from 6.5 to 9.7 gCO_2e/MJ, with a midpoint value of 7.4 gCO_2e/MJ. Even applying international land use change emission factors to domestic lands, which is an extremely conservative assumption due to large differences in soil carbon content between the two, produced a high ILUC estimate of only 16.2 gCO_2e/MJ.

V. New Mexico Should Utilize ILUC Values as Calculated by GTAP-BIO + CCLUB in Order to Maintain Alignment with the U.S. Government Through Use of the Latest Data and Modeling Capabilities

ILUC emission value estimates have trended steadily lower since CARB calculated values for the LCFS in 2014 due to the development of more rigorous ILUC models that utilize updated databases supported by empirical data. The period from 2015 to 2025 saw major improvements to ILUC modeling that were driven by U.S. government investment into the GTAP-BIO + CCLUB modeling framework. This framework now serves as the basis for multiple low-carbon fuel policies at the state and federal levels. Most notably, on January 10, 2025, the Biden Administration issued Treasury Notices 2025-10 and 2025-11, which implement the clean fuel production tax credit (26 U.S.C. § 45Z) and adopt the 45ZCF-GREET model for purposes of calculating the lifecycle emissions of biofuels eligible for the tax credit. Like Argonne National Laboratories' R&D GREET Model, the 45ZCF-GREET Model uses the GTAP-BIO + CCLUB modeling framework to measure ILUC. New Mexico should align with the United States Treasury Department, Department of Energy and the State of Oregon which have all adopted GTAP-BIO + CCLUB to calculate updated ILUC values instead of adopting the obsolete values from CARB's 2014 use of GTAP-BIO + AEZ-EF.

Alignment would have two major advantages. First, alignment would minimize future distortions between New Mexico and other jurisdictions, particularly given that future policies (both existing and new) can be expected to utilize the latest modeling techniques and datasets. Second, alignment would minimize costs of the Clean Transportation Fuel Program while increasing the competitiveness of New Mexico's low-carbon fuel feedstock producers (e.g., sorghum farmers) by ensuring that participating low-carbon fuels with ILUC emissions receive the appropriate number of credits. The proposed use of the GTAP-BIO + AEZ-EF's 2014 ILUC values, by contrast, would unnecessarily reduce the credits received by low-carbon fuels with ILUC emissions, increasing the credit price necessary to achieve the required GHG emissions reduction threshold under the Clean Fuel Transportation Program.

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Professional Preparation

Member of the Missouri Bar	2009 – Present
Iowa State University, Ph. D., Biorenewable Resources & Technology	2014
University of Missouri, J.D.	2008
University of Iowa, Political Science, B.A.	2005

Professional Employment

Director of the Bioeconomy Development Institute, SUNY College of Environmental Science & Forestry, 2021 – Present
Professor of Energy Resource Economics, Dept. of Sustainable Resources Management, SUNY College of Environmental Science & Forestry, 2025 – Present
Associate Professor of Energy Resource Economics, Dept. of Sustainable Resources Management, SUNY College of Environmental Science & Forestry, 2019-2025
Assistant Professor of Energy Resource Economics, Dept. of Forest and Natural Resources Management, SUNY College of Environmental Science & Forestry, 2014–2019
SyracuseCoE Faculty Fellow, Syracuse Center of Excellence, Syracuse University, 2017–2018
Graduate Lecturer, Department of Political Science, Iowa State University, 2013–2014
Research Associate, Bioeconomy Institute, Iowa State University, 2011–2014
Research Associate, Department of Economics, Iowa State University, 2009–2011

Honors and Awards

2024 2024 Exemplary Researcher Award, SUNY ESF.
2014 Teaching Excellence Award, Iowa State University.
2012 Biofuels Digest 2012 Book of the Year Award, for Why are We Producing Biofuels?
2009 Winner, Farm Foundation 30-Year Policy Competition, Climate Change category, for "The Embedded Carbon Valuation System: A Policy Concept to Address Climate Change."

Advisory Appointments

Energy Vision Board of Directors (2021-Present)
NYSERDA Anaerobic Digestion Project Steering Group (2021-2023)
NYS Climate Action Council, Agriculture and Forestry Advisory Panel, Bioeconomy Subgroup (2021-2022)
NYS Climate Action Council, Energy-Intensive and Trade-Exposed Industries Advisory Panel (2020-2022)

Synergistic Activities

- Led and coordinated research teams across four disciplines and with collaborators from outside institutions for two USDA grants totaling $1,906,622.
- PI for externally-funded projects on the policy and economics of renewable energy and biobased products with combined budgets of $2,287,409.
- Developed and taught five different classes on renewable energy policy and economics, and taught another three existing courses on renewable energy pathways.

- Author or co-author on 32 refereed articles, three book chapters, and two textbooks on techno-economic analysis, life cycle assessment, and policy analysis of renewable energy pathways with collaborators from the fields of Agronomy, Economics, Engineering, Law, and Management.
- Advised government officials in policymaking and law enforcement at the international, federal and state levels on U.S. climate policy, and developed state policies in support of statutory decarbonization targets.

Grants Funded

2024 Co-PI: "Advancing Commercialization through the Monitoring, Measurement, and Verification of Large, Established Willow Biomass Crops," U.S. DOE ($8,012,587).

2023 PI: "Development of Stochastic Techno-economic Feedstock Risk Model," EcoStrat ($58,000).
Co-PI: "Upstate 2.0," National Science Foundation ($1,000,000, $220,000 ESF share).
Co-PI: "Tool for Assessing Carbon Storing Materials – TACSMA," NYSERDA ($686,483).
Co-PI: "Sustainable Manufacturing via Upconversion of Waste to Stored Energy Systems. USDA NSRC ($270,110).

2022 PI: "A review of the scientific literature on particulate matter emissions from wood-burning appliances," Empire State Forest Products Association ($37,022).
PI: "Carbon-Negative Renewable Distillate Fuels: Conversion of Willow Feedstocks into Liquid Fuels and Biochar," USDA AFRI ($999,900).
Co-PI: "New York Connects," USDA Climate-Smart Commodities Partnership ($60,000,000, $11,0000,000 ESF share).
Co-PI: "Indicators of the U.S. bioeconomy," USDA Office of the Chief Economist ($70,498 ESF share).
Co-PI: Sustainable sugar production from shrub willow and forest residues for bioproducts, biochemicals, and biofuels. CUSE Grant ($44,000).

2021 PI: "A Review of the Scientific Literature on Greenhouse Gas and Co-Pollutant Emissions from Waste-Derived Bioenergy Resources," New York League of Conservation Voters ($34,858).
PI: "Quantifying the Comparative Value of Carbon Abatement Pathways Over Different Investment Timing Scenarios," National Biodiesel Board ($119,381).
PI: "Quantifying the Comparative Value of Carbon Abatement Pathways in Residential Space Heating Over Different Investment Timing Scenarios," National Grid ($89,213).

2020 Co-PI: "Developing New York's Wood-Based Economy," New York Ag & Markets ($1,000,000).
Co-PI: "Mid-Atlantic Sustainable Biomass for Value-Added Products Consortium (MASBio)," USDA NIFA AFRI Competitive Grants Program ($629,000 SUNY ESF share).

2019 PI: "Quantifying the Comparative Value of Carbon Abatement Pathways Over Different Investment Timing Scenarios," National Biodiesel Board ($58,585).
Co-PI: "Mass Timber Construction," SUNY Discovery Challenge ($600,000)
Co-PI: "Pathways to a Net-Zero Carbon Future: Landscape Design for Sustainable Energy and Climate Change Mitigation," SUNY Discovery Challenge ($600,000)

2017 PI: "Evaluating the Ability of Land to Replicate Indian Point's Electricity Supply Profile," Syracuse Center of Excellence ($15,000).

2016 PI: "Development Of Stochastic Techno-Economic And Life Cycle Models For Quantifying The Economic And Environmental Costs Of Cellulosic Bioenergy," USDA BRDI ($906,722).

2015 PI: "Development of Stochastic Techno-economic Model for Short-Rotation Woody Crop Production," NEWBio ($10,000).

2011 PI: "Energy Education Grant," Iowa Office of Energy Independence ($13,750).
Co-PI: "Techno-economic Analysis Initiative," Bioeconomy Institute ($150,000).

2010 PI: "The Embedded Carbon Valuation System as an Alternative to Cap-and-Trade," Biobased Industry Center ($40,000).

Refereed Publications (* denotes invited paper)

2025 Asamoah, S., **T.R. Brown**, S. Mousavi, R. Malmsheimer, T. Volk. “Technoeconomic Evaluation of Landowner Participation in Willow Biomass Production for a Biorefinery.” *Biomass and Bioenergy* 200: 108060.

Mousavi, S., **T.R. Brown**, R. Malmsheimer, D. Kumar, J. Frank. "End-of-Life Climate Impacts of Polyhydroxyalkanoates in the United States: The Role of Feedstock Variability and Temporal Dynamics - A Systematic Review." *Polymer Degradation and Stability* 240: 111500.

Mousavi, S., **T.R. Brown**, R.W. Malmsheimer. “Sustainable bioplastics products for building applications: recent trends and future opportunities – A systematic review.” *Biofuels, Bioproducts, and Biorefining* https://doi.org/10.1002/bbb.70005.

2024 *Dill, A., **T.R. Brown**, R.W. Malmsheimer, H. Ha, J.R. Frank, P.K. Kileti, B. Barkwill. “Quantifying the Financial and Climate Impacts of Greenhouse Gas Abatement Pathways in Residential Space Heating.” *Sustainability* 16(5): 2135.

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Hermanns, R., N. Sousavi, **T.R. Brown**, B. Buma, A. Alpert, M. Renner, R. Meys. “Cross-Sector Thinking Could Improve GHG Mitigation Outcomes from US Biomass Use.” *Science* (under review).

2022 Frank, J.R., **T.R. Brown**, H. Ha, D. Slade, M. Haverly, and R. Malmsheimer. “Quantifying and comparing the cumulative greenhouse gas emissions and financial viability of heavy-duty transportation pathways for the Northeastern United States.” *Fuel* 323: 124243.

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Ali, A., T.W. Koch, T.A. Volk, R.W. Malmsheimer, M.H. Eisenbies, D. Kloster, **T.R. Brown**, N. Naim, O. Therasme. “The environmental life cycle assessment of electricity production in New York State from distributed solar photovoltaic systems.” *Energies* 15(19): 7278.

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2017 ***Brown, T.R.**, R.C. Brown. "What role for the bioeconomy in an electrified transportation sector?" *Biofuels, Bioproducts, and Biorefining*, 11:363-372 (2017).

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Zhang, Y., **T.R. Brown**, G. Hu, R.C. Brown. "Techno-economic analysis of two bio-oil upgrading pathways." *Chemical Engineering Journal*, 225:895-904 (2013).

Zhang, Y., **T.R. Brown**, G. Hu, R.C. Brown. "Comparative techno-economic analysis of biohydrogen production via bio-oil gasification and bio-oil reforming." *Biomass and Bioenergy*, 51:99-108 (2013).

2012 **Brown, T.R.**, R. Thilakaratne, R.C. Brown, and G. Hu. "Techno-economic analysis of biomass to transportation fuels and electricity via fast pyrolysis and hydroprocessing." *Fuel*, 106:463-469 (2012).

Brown, T.R., Y. Zhang, G. Hu, R.C. Brown. "Techno-economic analysis of biobased chemicals production via Integrated Catalytic Processing." *Biofuels, Bioproducts, and Biorefining*, 6:73-87 (2012).

Brown, T.R., G. Hu. "Technoeconomic sensitivity of biobased hydrocarbon production via fast pyrolysis to government incentive programs." *Journal of Energy Engineering*, 138:54-62 (2012).

Zhang, Y., **T.R. Brown**, G. Hu, R.C. Brown. "Techno-economic analysis of monosaccharide production via fast pyrolysis of lignocellulose." *Bioresource Technology*, 127:358-365 (2012).

2011 **Brown, T.R.**, M. Wright, R.C. Brown. "Estimating profitability of two biochar production scenarios: Slow pyrolysis vs. fast pyrolysis." *Biofuels, Bioproducts, and Biorefining* 5:65-68 (2011).

Du, X., F. Dong, D.J. Hayes, **T.R. Brown.** "Assessment of environmental impacts embodied in U.S.-China trade and related climate change policies." *American Journal of Agricultural Economics* 93:1 (2011).

Industry Publications

2021 Carr, M., **T.R. Brown**, C. Murphy. "Biotech solutions for climate report: Examining biotechnology's contributions to addressing the climate crisis." *Industrial Biotechnology* 17(3): 151-165 (2021).

2020 **Brown, T.R.** "Biomass-based diesel: A market and performance analysis." Fuels Institute, March 2020.

Working Papers and Essays

2022 Ha, H. and **T.R. Brown**. "A review of the scientific literature on greenhouse gas and co-pollutant emissions from waste- and coproduct-derived biomass-based diesel and renewable natural gas." Bioeconomy Development Institute, January 2022. Available on the Web at: https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/61f9865afb2b77058f2f4515/1643742811198/BBD_RNGwhitepaper.pdf.

2019 Malmsheimer, R.W., T.A. Volk, H. Ha, J. Frank, **T.R. Brown**. "Why the IPCC believes that Bioenergy Carbon Capture and Storage (BECCS) is Critical to Limiting Global Warming to 1.5°C." *World Biomass*.

2017 **Brown, T.R.** "A perspective on proposed changes to the revised Renewable Fuel Standard's blending obligation." Available on the Web at: https://www.researchgate.net/publication/315812529_A_Perspective_on_Proposed_Changes_to_the_Revised_Renewable_Fuel_Standard%27s_Blending_Obligation.

2010 **Brown, T.R.**, A. Elobeid, D. Hayes, J. Dumortier. "Market impact of domestic offset programs." Working Paper 10-WP 502, Center for Agricultural and Rural Development, Iowa State University, January 2010.

2009 **Brown, T.R.**, D. Hayes, R.C. Brown. "The Embedded Carbon Valuation System: A Policy Concept to Address Climate Change." Farm Foundation 30-Year Challenge Policy Competition, June 2010.

Books and Book Chapters

2024 **Brown, T.R.** and J. Frank. "Policy and Biochar." In: Lehmann, Johannes and S. Joseph, editors. Biochar for Environmental Management. Routledge; 2024.

2019 Wright, M.M. and **T.R. Brown**. "Costs of Thermochemical Conversion of Biomass to Power and Liquid Fuels." In: Brown, R.C., editor. Thermochemical Processing of Biomass. Wiley; 2019.

2017 **Brown, T.R.** "Economic Comparison of Various Pathways to Pyrolysis-Based Fuels." In: Brown, R.C. and K. Wang, editors. Fast Pyrolysis of Biomass: Advances in Science and Technology. Royal Society of Chemistry; 2017.

2014 **Brown, T.R.**, M.M. Wright, Y. Roman-Leshkov, R.C. Brown. "Techno-economic assessment of biorefineries." In: Waldron, K.W., editor. Advances in Biorefineries: Biomass and waste supply chain exploitation. Woodhead Publishing; 2014.

2013 Brown, R.C., **T.R. Brown.** Biorenewable Resources, 2nd ed., 2013.

2012 Brown, R.C., **T.R. Brown.** Why are We Producing Biofuels? Ames: Brownia; 2012.

Technical Presentations

2025 Hossain, M.S., C.G. Yoo, S. Adhikari, O. Therasme, T.A. Volk, T.R. Brown, and D. Kumar. "Techno-economic analysis of bioplastic and bio-oil co-production from forest residue biomass using hybrid conversion process." ASABE Annual International Meeting 2025, Toronto, Canada, July 13 – 16, 2025.

Mousavi, S., **T.R. Brown**, R.W. Malmsheimer. "Decarbonization through Bioplastic Wall Systems: Life Cycle and Energy Analysis in Residential Buildings in New York State." 23rd Annual New York State Green Building Conference, Syracuse, NY, March 27, 2025.

2024 **Brown, T.R.** "The climate- and environmentally-beneficial valorization of woody biomass in New York State." Key Technologies of the Bioeconomy 2024, Ubatuba, Brazil, October 4, 2024.

2023 **Brown, T.R.**, T. Volk, R.W. Malmsheimer, D. Kumar, and O. Therasme. "Renewable carbon-negative distillate fuels: Conversion of willow feedstocks into liquid fuels and biochar." U.S. Department of Agriculture 2023 Principal Investigator Meeting, Kansas City, MO, July 14, 2023.

Dill, A., **T.R. Brown**, H. Ha, R.W. Malmsheimer. "Integration of Biomass Feedstock and Conversion Models." ISSST 2023, Ft. Collins, CO, June 13, 2023.

2022 H. Ha, **T.R. Brown**, R.J. Quinn, T.A. Volk, R.W. Malmsheimer, M.-O. Fortier, J.R. Frank, S. Bick. "A stochastic techno-economic analysis of forest biomass feedstock supply chains: clean and dirty chips for bioenergy applications." 2022 North American Biochar and Bioenergy Conference, Morgantown, WV. August 9, 2022.

Brown, T.R., T. Volk, R. Malmsheimer, D. Kumar, O. Therasme, R.C. Brown, R. Smith, T. Daugaard, and M. Haverly. "Carbon-negative renewable distillate fuel in New York State." tcbiomass2021, Denver, CO. April 21, 2022.

Dill, A., **T.R. Brown**¸ R. Malmsheimer, H. Ha, J. Frank, P. Kileti, B. Barkwill, and M. Mauro. "Determining the comparative value of carbon abatement pathways in residential space heating." AIChE Spring Meeting, San Antonio, TX. April 13, 2022.

H. Ha, **T.R. Brown**, J. Frank, and A. Dill. Carbon intensities and criteria air pollutant emissions of waste- and coproduct-derived bioenergy resources resulting from on-road transportation applications. AIChE Spring Meeting, San Antonio, TX. April 12, 2022.

H. Ha, **T.R. Brown**, R. J. Quinn, T. A. Volk, R. W. Malmsheimer, M. O. Fortier, J. R. Frank, S. Bick. "A Stochastic Techno-Economic Analysis of Forest Biomass Feedstock Supply Chains: Clean and Dirty Chips for Bioenergy Applications." 3rd International Conference on Environment and Forest Conservation (ICEFC), Kastamonu, Turkey. February 21, 2022.

2021 Frank, J., **T.R. Brown**, H. Ha, M. Haverly, D. Slade, and R.W. Malmsheimer. "Quantifying the Cumulative Greenhouse Gas Emissions and Financial Viability of Heavy-Duty Transportation and Residential Heating Pathways for the Northeastern United States." Energy Policy Conference. October 15, 2021.

2020 Frank, J., **T.R. Brown**, M. Haverly, D. Slade, and R.W. Malmsheimer. "Quantifying the Comparative Value of Carbon Abatement Scenarios over Different Investment Timing Scenarios." Next Generation Scientists for Biodiesel, Virtual Science Live Event. September 10, 2020.

Ha, H., Y. Kim, **T.R. Brown**, M.-O. Fortier, T.A. Volk, R.W. Malmsheimer, J. Frank, and O. Therasme. "Integrated Life Cycle Assessment and Techno-Economic Analysis of a Forest Biomass Feedstock Supply in the Northeast United States." AIChE Virtual Spring Meeting. August 21, 2020.

Brown, T.R. "Biofuels and Transportation Decarbonization Under the CLCPA." New York Society of American Foresters Annual Meeting, Syracuse, NY. January 24, 2020.

Frank, J., **T.R. Brown**, M. Haverly, D. Slade, and R.W. Malmsheimer. "Quantifying the comparative value of carbon abatement scenarios over different investment timing scenarios." National Biodiesel Conference and Expo, Tampa, FL. January 22, 2020.

2019 Frank, J., **T.R. Brown**, R. Bhonagiri, R. Quinn, K. McGiver, M.-O. Fortier, R. Malmsheimer, T. Volk, and T. Dapp. "Assessing Indian Point's electricity generation through renewable energy pathways: A technical and economic analysis." Energy Policy Research Conference, Boise, ID. September 30, 2019.

2018 Frank, J., **T.R. Brown**, R. Bhonagiri, R.J. Quinn, K. McGiver, M.-O. Fortier, R.W. Malmsheimer, T.A. Volk. "Assessing Indian Point's energy generation through renewable electricity pathways: A technical and economic analysis." AIChE Annual Meeting, Pittsburgh, PA. November 1, 2018.

Ha, H., **T.R. Brown**, Quinn, Ryan J., T.A. Volk, R.W. Malmsheimer, M.O. Fortier and J.R. Frank, "Techno-economic analysis of supplying forest biomass feedstock for biopower applications." AIChE Annual Meeting, Pittsburgh, PA. October 25, 2018.

Quinn, R.J., H. Ha, R. Bhonagiri, T.A. Volk, **T.R. Brown**, D. Kiernan, R. Malmsheimer, and M.-O. Fortier. "Life cycle assessment of forest biomass pathways in the Northeast U.S." AIChE Annual Meeting, Pittsburgh, PA. October 27, 2018.

Sullivan, B.M., M.-O. Fortier, **T.R. Brown**, R. Malmsheimer. "Geographic life cycle assessment of electricity from tidal turbines in the United States." SETAC Europe 24th LCA Case Study Symposium, Vienna, Austria. September 25, 2018.

Frank, J., **T.R. Brown**, R. Malmsheimer. “A techno-economic evaluation of the financial trade-off between the production of biochar, biofuel, and methanol via pyrolysis under uncertainty.” USBI Biochar Conference, Wilmington, DE. August 22, 2018.

Brown, T.R., J. Frank, H. Ha, R. Quinn, J. Heavey, M.-O. Fortier, T. Volk, R. Malmsheimer. “Stochastic analysis of lignocellulosic feedstock systems for bioenergy applications.” AIChE Spring Meeting, Orlando, FL. April 25, 2018.

2017 Frank, J., **T.R. Brown**, T. Volk, R. Malmsheimer, J. Heavey. “A Stochastic Techno-Economic Model for Quantifying the Economic Cost of Cellulosic Bioenergy Pathways in the Northeast U.S.” AIChE Annual Meeting, Minneapolis, MN. November 2, 2017.

2015 **Brown, T.R.** “A Critical Analysis of Thermochemical Cellulosic Biorefinery Capital Cost Estimates.” Tcbiomass2015, Chicago, IL. November 5, 2015.

Zhao, X., **T.R. Brown**, W. Tyner. “Stochastic techno-economic evaluation of cellulosic biofuel pathways.” 33rd USAEE/IAEE North American Conference, Pittsburgh, PA. October 26, 2015.

2014 **Brown, T.R.** “A Framework for Defining the Economic Feasibility of Cellulosic Biofuel Pathways.” 4th Annual Energy Policy Research Conference, San Francisco, CA. September 4-5, 2014.

2013 **Brown, T.R.** and M.M. Wright. “Techno-economic impacts of shale gas on cellulosic biofuel pathways.” AIChE 2013 Meeting, San Francisco, CA. November 4-7, 2013.

2012 Brown, R.C. and **T.R. Brown**. “Commercial Prospects for Advanced Biofuels.” Coastal Bend Energy Forum of the ACS South Texas Chapter, Chicago, IL. October 26-28, 2012.

2010 **Brown, T.R.**, M. Wright, R.C. Brown. “Estimating the Profitability of Two Biochar Production Scenarios.” 2010 U.S. Biochar Initiative Conference, Ames, IA. June 26-30, 2010.

Invited Talks

2025 **Brown, T.R.** “Overcoming Barriers to Carbon Accounting for Bio-Based Chemicals.” Molecule Forum EU, Brussels, Belgium. June 13, 2025.

Brown, T.R. “New York State’s Climate-Focused Biochar Policies: Opportunities, Obstacles, and Lessons for other Jurisdictions.” Biochar IV, Santa Marta, Colombia. May 21, 2025 (keynote).

Brown, T.R. “Overcoming Barriers to Carbon Accounting for Bio-based Products.” Molecule Forum North America, Washington, D.C. May 13, 2025.

Brown, T.R. “State-level Legislative Leadership on Clean Fuel Programs.” RNG Summit 2025, Houston, TX. April 24, 2025.

Brown, T.R. “Cutting Through the Noise: Obtaining Foundational Data for Advocacy & Education.” RNG Summit 2025, Houston, TX. April 23, 2025.

Brown, T.R. “The New York State Bioeconomy: Opportunities and Hurdles Under the New York State CLCPA.” SUNY ESF Exemplary Researcher Seminar, Syracuse, NY. March 27, 2025.

2024 **Brown, T.R.** “Global Water Industry: Supplies and Infrastructure.” GLG Virtual Climate Change Event, London, UK. June 12, 2024.

Brown, T.R. “Plastic Waste Crisis: Environmental Impact and Industry Challenges.” GLG Virtual Climate Change Event, London, UK. February 13, 2024.

2023 **Brown, T.R.** “New York Cap-and-Invest: Lessons Learned Elsewhere.” New York Association of Public Power Fall Conference, Cooperstown, NY, October 3, 2023.

Brown, T.R. “Low-Carbon Fuels and the New York State CLCPA.” NECA Fuels Conference, Boston, MA, September 18, 2023.

Brown, T.R. “Affordability and Equity.” City & State NY Electrification Summit, Albany, NY, May 31, 2023.

Brown, T.R. “The Role of Forestry during New York’s Energy Transition.” New York Society of American Foresters Annual Meeting 2023, Syracuse, NY, January 26, 2023.

2022 **Brown, T.R.** “Seed Industry and Sustainability Demands: Opportunities and Challenges.” CSS & Seed Expo 2022, Chicago, IL, December 7, 2022 (keynote).

Brown, T.R. “Plastics Pollution and the Oceans.” GLG Virtual Climate Change Event, London, UK. November 16, 2022.

Brown, T.R. “The Future of Energy on Long Island.” Long Island Energy Conference, Molloy University, Rockville Centre, NY, October 26, 2022.

Brown, T.R. “The Financial Sector and Droughts.” GLG Virtual Climate Change Event, London, UK, October 25, 2022.

Brown, T.R. “The Financial Sector and Climate Change.” GLG Virtual Climate Change Event, London, UK. October 19, 2022.

Brown, T.R. “An Update on the Climate-Focused Bioeconomy in New York State.” All-Island Bioeconomy Summit, Tullamore, Ireland. October 12, 2022.

Brown, T.R. “Insurance and the Climate-Focused Bioeconomy.” InnSure Climate Forum, Boston, MA. October 6, 2022.

Brown, T.R. “Achieving State Climate Change Goals with Bio-Energy” (panel). Pathways to a Clean Future Forum, Albany, NY. September 15, 2022.

Brown, T.R. “The Insurance Sector and the Climate Protection Gap.” Joh. Berenberg, Gossler & Co. KG Virtual Climate Change Event, Hamburg, Germany. July 7, 2022.

Brown, T.R. “The Climate-Focused Bioeconomy in New York State.” NewLab Bioeconomy Initiative Workshop, Brooklyn, NY. June 29, 2022.

Brown, T.R. “The Climate-Focused Bioeconomy in New York State.” 2022 Climate-Focused Bioeconomy Workshop, Syracuse, NY. May 12, 2022.

Brown, T.R. “The Role of New York Agriculture Under the CLCPA.” 2021 New York State Agricultural Society Annual Meeting and Forum. Syracuse, NY, January 6, 2022.

2021 **Brown, T.R.** and H. Ha. “Methane at the Interface of Science and Policy: A New York State Perspective.” 3rd Renewable Natural Gas Summit. Virtual, December 14, 2021.

Brown, T.R. “The Next Generation of State Clean Energy Initiatives.” Council of State Governments National Conference. Santa Fe, NM, December 3, 2021.

Frank, J., **T.R. Brown**, H. Ha, D. Slade, M. Haverly, and R. Malmsheimer. “Quantifying the Cumulative Greenhouse Gas Emissions and Financial Viability of Heavy-Duty Transportation Pathways for the Northeastern United States.” Biodiesel Technical Workshop. Kansas City, MO, November 12, 2021.

Brown, T.R. "Why Hydrogen Must be a Part of New York's Decarbonization Strategy." New York Business Council 2021 Annual Environment Conference, Saratoga Springs, NY. November 10, 2021.

Brown, T.R. "Biofuels and Transportation Decarbonization under the CLCPA." Empire State Forest Products Association Regional Meeting, Rensselaer, NY. September 27, 2021.

Brown, T.R., J. Frank, O. Therasme, T. Volk, H. Ha, M.-O. Fortier, R. Malmsheimer. "Negative carbon abatement costs from shrub willow production in the Northeastern U.S.: An integrated stochastic analysis." Iowa State University, Bioeconomy Institute, Ames, IA. May 3, 2021.

Brown, T.R. "Overview of Advanced Biobased Processing." New York Climate Leadership and Community Protection Act Bioeconomy Subgroup, Albany, NY. March 1, 2021.

2020 **Brown, T.R.** "Thermochemical Processing and the New York Climate Leadership and Community Protection Act." 2020 Thermochemical Conversion & Biochar Workshop, Rochester, NY. October 29, 2020.

Brown, T.R. "Why are we producing sustainable energy?" Union College Earth Day Lecture, Schenectady, NY. April 22, 2020.

Brown, T.R. "Global Biofuel Growth and Developments." UBS Global Investment Research Conference, London, UK. April 1, 2020.

2019 Malmsheimer, R.W., C. Beier, **T.R. Brown**, P. Crovella, J. Heavey, and T. Volk. "SUNY ESF's Forest-Based Climate Change Research." Mackenzie Hughes LLP Attorney Retreat, Oneida, NY. September 26, 2019.

Brown, T.R. "Biochar and Sustainability in NYS: A Brief Overview." Helping NYS Address Its Climate Goals through Thermochemical Conversion Workshop, Cornell University. July 16, 2019.

Brown, T.R. "Biomass-based diesel in the U.S. and world markets: An overview." Fuels2019, Dallas, TX. May 21, 2019.

Brown, T.R.., Frank, J., Ha, HakSoo, Quinn, R., McGiver, K., et al. "Assessing Indian Point's Energy Generation Through Renewable Electricity Pathways: A Technical and Economic Analysis." University of Idaho Natural Resources and Society Seminar, Moscow, ID. March 26, 2019.

2018 **Brown, T.R.**, H. Ha, R. Quinn, T. Volk, R. Malmsheimer, et al. "Integrated TEA/LCA of Lignocellulosic Feedstock Systems for Bioenergy Applications." MABEX 2018, Philadelphia, PA. September 12, 2018.

Brown, T.R. "An Interdisciplinary Approach to Analyzing International Energy Development Feasibility Under Uncertainty." Pennsylvania State University, School of International Affairs, State College, PA. January 22, 2018.

2017 **Brown, T.R.** "America's Missing Cellulosic Gallons." Pennsylvania State University, MABEX 2017, State College, PA. September 13, 2017.

2016 **Brown, T.R.** "Biochar, Dedicated Energy Crops, and Sustainable Energy Policy." Cornell University, 2016 Biochar Conference, Ithaca, NY. April 15, 2016.

2015 **Brown, T.R.** "Soil Carbon and Sustainable Energy Policy." Cornell University, Atkinson Center for a Sustainable Future Seminar, Ithaca, NY. September 25, 2015.

Brown, T.R. "Motivations for Energy Policy." Alfred State Renewable Energy Seminar, Alfred, NY. March 26, 2015.

2014 **Brown, T.R.** "A Landmark Test of ILUC." ExCo 74 Workshop: Land-use and Mitigating ILUC, IEA Bioenergy, Brussels, Belgium. October 23, 2014.

2013 **Brown, T.R.** "Middle East Energy: Crisis or Plenty?" Osher Lifelong Learning Institute at ISU Lecture, Ames, IA. October 7, 2013.

Brown, T.R. "Biofuels and Globalization." 2013 Technology, Globalization, and Culture Lecture, Ames, IA. September 17, 2013.

Brown, T.R. "RIN Policy and Regulatory Headline Risk in 2013." Iowa Biodiesel Board 2013 Annual Meeting, Ankeny, IA. September 13, 2013.

Brown, T.R. "RIN Policy and Regulatory Headline Risk in 2013." 2013 EcoEngineers RIN Academy, Des Moines, IA. August 26, 2013.

Brown, T.R. "The Challenges to Biodiesel." 2013 Renewable Energy Group Leadership Meeting, Ames, IA. August 1, 2013.

Brown, T.R. "The Economics of Hybrid Processing." 2nd Annual Hybrid Processing Symposium, Ames, IA. May 16, 2013.

Brown, T.R. "Are Biofuels a Crime against Humanity?" 2013 Agricultural Forum: Science, Education & Research, Ames Chamber of Commerce, Ames, IA. April 18, 2013.

Brown, T.R. "Fast Pyrolysis and the RFS2: The Effects of Uncertainty." Iowa NSF EPSCoR Energy Policy Workshop Series, Ames, IA. February 7, 2013.

2012 **Brown, T.R.** "Biofuels and Globalization." 2012 Technology, Globalization, and Culture Lecture, Ames, IA. October 17, 2012.

Brown, T.R., R.C. Brown. "Why Are We Producing Biofuels?" Osher Lifelong Learning Institute at ISU Lecture, Ames, IA. April 24, 2012.

2011 **Brown, T.R.** "Biofuels and Globalization." 2011 Technology, Globalization, and Culture Lecture, Ames, IA. November 28, 2011.

2010 **Brown, T.R.**, M. Wright, R.C. Brown. "The Embedded Carbon Valuation System: Impacts on Bio-energy Systems." Alternative Policies on Climate Change and their Implications for U.S. Agricultural Economy Conference, Fargo, ND. May 24, 2010.

Teaching Experience

SRE 419/619 Energy Policy Assessment Methodologies, SUNY-ESF (Spring 2017 – Spring 2020)
SRE 337/537 Energy Resource Assessment, SUNY-ESF (Spring 2017 – Spring 2019)
SRE 335/535 Renewable Energy, SUNY-ESF (co-taught Spring 2016)
FOR 208 Intro to Sustainable Energy Resources, SUNY-ESF (Fall 2015)
SRE 416 Sustainable Energy Policy, SUNY-ESF (Spring 2015 - present)
BRT 516X International Biorenewables Law & Policy, Iowa State University (Spring 2014)
BRT 501 Fundamentals of Biorenewable Resources (Spring 2013)
BRT 515 Biorenewables Law & Policy, Iowa State University (Spring 2012 - Fall 2013)

Graduate Students

Andry Razanokoto (M.S., 2017)
Jenny Frank (M.S., 2018)

Wayne Wang (M.P.S., 2018)
Mark Finley (M.P.S., 2019)
Ryan Quinn (M.S., 2019)
Kirsten McGiver (M.P.S., 2020)
Phoebe O'Conner (M.P.S., 2020)
HakSoo Ha (Ph.D., 2021)
Patrick Wickersham (M.P.S., 2021)
Jenny Frank (Ph.D., 2021)
Michael Goodman (M.P.S., 2022)
Leila Nayar (M.P.S., 2022)
Alexandra Dill (Ph.D., 2025)
Niloufar Mousavi (Ph.D., expected 2026)
Samuel Asamoah (Ph.D., expected 2027)
Chen, Xiaowei (Ph.D., expected 2027)

Peer Reviewer

Biomass & Bioenergy	2018 – present
Energy Policy	2017 – present
Green Chemistry	2016 – present
GCB Bioenergy	2015 – present
Bioresource Technology	2013 – present
BioFPR	2013 – present
BioResources	2013 – present
Fuel	2012 – present
Journal of Waste Management	2012 – present

Academic Committee Work

SUNY-ESF General Education Assessment Committee (2024-Present)
SRM Departmental Review Committee (2022-Present)
SRM Graduate Education Committee (2018-Present)
Sustainable Energy Management Faculty Search Committee (2019-2020)
Sustainable Energy Management Faculty Search Committee (2018-2019)
Sustainable Energy Management Faculty Search Committee, Chair (2017–2018)
Construction Management Faculty Search Committee (2017-2018)
SUNY-ESF Campus Sustainability Committee (2016–Present)
Sustainable Energy Management Ad Hoc Committee (2015–2017)
Sustainable Energy Management Faculty Search Committee (2015–2016)