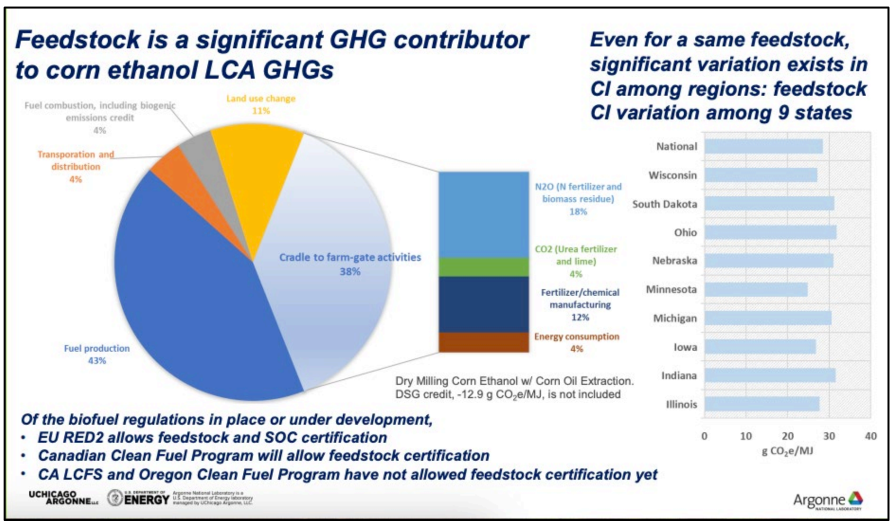
The IRC §45Z Carbon Intensity (CI) Opportunity

Introduction

Recognizing that agriculture is a significant contributor to climate related impacts, the AgWise platform is on a mission to help farmers digitize and quantify agriculture practices and impacts to drive better production practices and profitability. The Income Reduction Act (IRA), signed into law in 2022, offers a monumental financial incentive to drive innovation and supply chain collaboration in the adoption of clean energy solutions. As part of the IRA, several new clean energy business tax credits were instituted, supercharged by offering open market transferability of these tax credits to unrelated parties, driving further potential value to these tax credits.



Inflation Reduction Act (IRA)

August of 2022, the Inflation Reduction Act was a bill passed by US Congress and signed into law, making historic commitments towards clean energy with financial incentives to drive innovation and adoption of clean energy solutions. In addition to grants and other investment programs, the US government incentivized American businesses through tax credits codified in the Internal Revenue Code (IRC) to offset business tax liability. The IRA also introduced an open market tax credit transferability – driving significant additional value to these tax credits. While the IRS only issued provisional guidance on transferability of these tax credits in June of 2023, the total transfer activity for 2023 is estimated at $7-$9 Billion and is projected to grow to $100 Billion by 2030.

Our focus is on the IRC §45Z, Clean Fuel Production Credit, covering both aviation and non-aviation fuel, going into effect 1/1/2025. IRC §40B, Sustainable Aviation Fuel (expiring 12/31/2024), is also relevant because there's been more regulatory guidance and it's anticipated that at least some of that will get carried over to IRC §45Z.

A Background on Agriculture & Ethanol

<u>Opportunities</u>

1. Economic Benefits for Farmers: Increased Demand for Crops: Growing demand for biofuels like ethanol can lead to higher prices for crops such as corn and sugarcane, benefiting farmers economically.

2. Environmental Benefits: Reduction in Greenhouse Gas Emissions: Ethanol burns cleaner than fossil fuels, contributing to lower greenhouse gas emissions when used as a fuel additive.

Nuances

1. Food vs. Fuel Debate: Using crops like corn for ethanol production can lead to competition with food supply, potentially driving up food prices and impacting food security.
2. Environmental Concerns
   - Land Use Changes: Expansion of biofuel feedstock production can lead to deforestation and loss of biodiversity if not managed sustainably.
   - Water Usage: Ethanol production is water-intensive, raising concerns about water resource management, especially in areas prone to drought.
3. Economic Viability: Market Fluctuations: The profitability of ethanol production can be affected by fluctuations in oil prices, government policies, and subsidies.
4. Regulatory and Policy Challenges: Government Policies**: The success of the ethanol industry heavily depends on supportive government policies, including subsidies, tax incentives, and renewable fuel standards.

Clean Fuel Production – The Regulatory Framework

The Internal Revenue Code and Guidance

The Internal Revenue Code (IRC) codifies federal tax law and is the primary source of authority. The Treasury Regulations (Regs) interpret the IRC, providing more extensive explanations and examples. However, with any new tax law, there's a lag in the publication of proposed, temporary, and final Regs. While lawmakers work through the interpretation and practical application of the new law, taxpayers and stakeholders are left chasing a moving target. To somewhat address these uncertainties, the IRS offers interim guidance (see IRS Positions below).

For IRC §§ 40B & 45Z, the IRS has published several Notices that offer safe harbors for some of the ambiguities (this is where Notice 2024-37, etc. come into play).

This document outlines the law, authorities, publications, and unknowns around the §45Z Clean Transportation Fuel tax credit opportunity. With that said, this is my interpretation and insight to help our team collectively strategize around this opportunity, while navigating the uncertainties.

U.S. Internal Revenue Code (IRC) (Statutes)
(Foundation for all federal tax authority)

⬇

U.S. Treasury Regulations

- Overview of general types:
  - **Final** (highest authority issued by the Treasury and binding on the IRS; subject to a change in the IRC)
  - **Temporary** (provides guidance until final regulations are issued and have the same authority as final regulations)
  - **Proposed** (generally not binding unless the IRS states otherwise)

IRS Positions

- **Revenue Rulings** (official IRS interpretation of IRC and can be relied upon and cited as authority)
- **Revenue Procedures** (official IRS interpretation on how to comply with the tax law and can be relied upon and cited as authority)
- **Private Letter Rulings, Determination Letters, Technical Advice Memoranda, and Chief Counsel Advice** (provide guidance on a specific taxpayer's situation and cannot be relied upon by other taxpayers, however, can provide insight on the IRS's position on certain issues and may lead to a primary source that may not have been previously considered)
- **IRS Forms, Publications, and FAQs** (provide guidance only and should not be solely relied upon)

IRC §§ 40B & 45Z

<u>IRC §40B – Sustainable Aviation Fuel (SAF) Credit</u>

Relevant Time Period: SAF sold/used between 1/1/2023-12/31/2024

<u>Synopsis:</u> The Sustainable Aviation Fuel (SAF) Credit, with respect to any sale or use of a "qualified mixture" during the taxable year, is equal to the product of: gallons of SAF in mixture (x) sum of $1.25 (+) supplementary amount. The credit shall be reduced by any benefit/application under IRC §6426 or §6427(e).

<u>Calculation of credit</u>: the SAF in the qualified mixture must be certified as having a life cycle GHG emissions reduction percentage of at least 50 percent as compared to petroleum-based jet fuel, for a base credit of $1.25. A supplemental credit amount increases the $1.25 base tax credit by 1 cent for each percentage point by which the life cycle GHG emissions reduction percentage exceeds 50 percent. The maximum increase is 50 cents, capping the total credit at $1.75 per gallon.

<u>Methods to determine lifecycle GHG emissions reduction percentage</u>: such determination is made in accordance to: (1) the most recent CORSIA model adopted by the ICAO <u>or</u> (2) any similar methodology which satisfies the criteria under section 211(o)(1)(H) of the Clean Air Act.

<u>IRC §40B Developments & Explanations</u>

The primary source of confusion for §40B was around the method to determine lifecycle GHG emission reduction percentage and whether the DOE's ANL-Greet would qualify as an "other" method to quantify the emissions reduction percentage.

<u>Internal Revenue Bulletin Notice 2024-6</u>, specifically excluded the use of the ANL-Greet (or any other existing Greet) and said the DOE would work with other agencies to develop a new Greet. The government promised an updated GREET model by March 1, 2024.

<u>Internal Revenue Bulletin Notice 2024-37</u> (Pub. 4/30/24) – provided further guidance and safe harbors for calculating the emissions reduction percentage, certification, and registration for claiming the credits, including the following:

1. <u>40BSAF-GREET model (</u>modified version of the R&D Greet) was introduced as an acceptable method that satisfied the requirement under 211 (o)(1)(H) of the Clean Air Act. The new model, calculates life cycle GHG emissions associated with SAF from two production routes, HEFA and ATJ-Ethanol. The most relevant feedstocks offering distinct SAF pathways:
   - HEFA – U.S. soybean
   - HEFA – U.S. and Canadian canola/rapeseed
   - HEFA – tallow
   - HEFA – used cooking oil (UCO)
   - HEFA – U.S. distillers corn oil
   - ATJ-Ethanol – U.S. corn
   - ATJ-Ethanol – Brazilian sugarcane
2. <u>Indirect Land Use Change</u>. DOE utilized GTAP-BIO modeling for land use change that impacts pathways. This number didn't go up as projected (see 40BSAF-GREET technical guidance from ANL), but it's a static calculation that does not reflect actual user data.
3. <u>USDA CSA Pilot introduction</u>. While the prior Greet versions calculated the impacts on the CI score at a farm level for corn and soybean feedstock, the CSA pilot takes a simplified, all or nothing approach (subject to extensive recordkeeping and certification requirements):
   - For <u>corn</u> feedstock, producers can get a <u>10-point</u> CI score reduction if they use: 1) cover crops, 2) no-till (or reduced till), and 3) enhanced efficiency fertilizer.

- For soybean feedstock, producers can get a 5-point CI score reduction if they use: 1) cover crops, and 2) no-till (or reduced till).

4. Additional Requirements: Recordkeeping, Certification, and Registration.
   - CSA Program – The Notice outlines specific recordkeeping and certification requirements. ISO 14065 certified third-party verification is required + USDA Technical Service Provider or Certified Crop Advisor to validate adoption of conservation practices and standards.
   - 40BSAF-GREET & LCFS - Establishes safe harbors for recordkeeping, certification, and registration by producers – see appendix for model certificates.
   - Direct Relationship – requires SAF producers to have a direct relationship/contract with the producer of the CSA feedstock.

Sarah's Commentary/Insights

SAF & International Standards. IRC §40B is essentially evaluated on an international standard, thus lawmakers were struggling to articulate how to quantify a CI or emissions reduction when calculating the tax credit. I personally believe that there will be a more streamlined approach using a GREET model for §45Z non-aviation fuel. I suspect the §45Z SAF will follow something similar to §40B.

SAF Credits are Worth More. SAF tax credits are substantially greater that §45Z non-aviation fuel credits which has made this a very hot top in politics and among farmers. However, there's only ONE SAF plant operating in the US. While there's number of plants under construction, it's awhile before they will be able to process SAF. Because §40B expires at the end of this year, it will likely not impact many to any farmers.

Lack of Quantification of Farm Practices Hurts Regenerative Farmers. It was expected that there would be an update to the GREET feedstock calculator FD-CIC that would be the method of calculating on-farm CI reductions. The FD-CIC would have provided a much greater benefit to farmers that have actually adopted regenerative and climate smart practices, allowing them to quantify their actual practices – opposed to the all or nothing approach that caps out at a 10 point reduction.

- The initial rule making highlighted that for SAF producers to use farm-based feedstock, such as corn and soybeans, regenerative practices must be adopted for there to be significant reduction on the CI score.
- Notice 2024-37 places a lot of limitations on this. The TD's press release accompanying 2024-37 seemed to suggest that, by virtue of the CSA pilot, this is something that could pull over to IRC §45Z in 2025 (why would multiple government agencies implement a pilot that practically nobody would be able to execute/receive any benefit from?).
- Bundling the CSA practices into a rigid, all or nothing approach fails to consider climate and soil-type variances that limit certain farmers from adopting certain practices while still being able to maintain their yield.
- Quantifying practices according to the FD-CIC provides farmers more flexibility in adopting better practices according to what makes sense based on their situation.

Extent of Impact on §45Z. At the end of this year, §40B SAF credits moves over to §45Z, which encompasses both SAF and non-aviation fuel. It's expected that some of the determinations under §40B will be carried over to §45Z, which goes into effect on 1/1/2025 – this is why the transitory §40B rule and rulemaking matters.

Opportunity. Under Notice 2024-37, we need to figure out how to integrate the recordkeeping, certification, and registration protocols introduced into our protocol (see model certificates in the appendix).

IRC §45Z – Clean Fuel Production Credit

Relevant Timing: For clean fuel produced after 12/31/2024 and sold before 1/1/2028

Synopsis: A general business tax credit is available for the production of: 1) Clean transportation fuel, or 2) Sustainable aviation fuel. This credit is eligible for transferability under §6418.

Qualification:

Transportation fuel must satisfy the following:
- Is suitable for use as fuel in a highway vehicle or aircraft
- Has an emissions rate of 50 kgs of CO_2e per mmBTU (Carbon Intensity)
- Not derived from co-processing monoglycerides, diglycerides, triglycerides, fatty acids, free fatty acids, or with feedstock other than biomass.

Sustainable aviation fuel must meet the following:
- Portion of the liquid fuel that is not kerosene
- Sold for aircraft use
- Meets the requirements of ASTM International Standard D7566 or Fischer Tropsch provisions of ASTM D1655

Calculation of credit

RC §45Z(a)(1): Credit (=) applicable amount per gallon of transportation fuel (x) emission factor (§45Z(b))

IRC §45Z(a)(2). Applicable amount:
- (A): Base for transportation fuel is $.20
- (B): Bonus. Base shall be increased to $1 when the requirements of §45Z(f)(6) & (7) are satisfied (wage and apprenticeship factors)

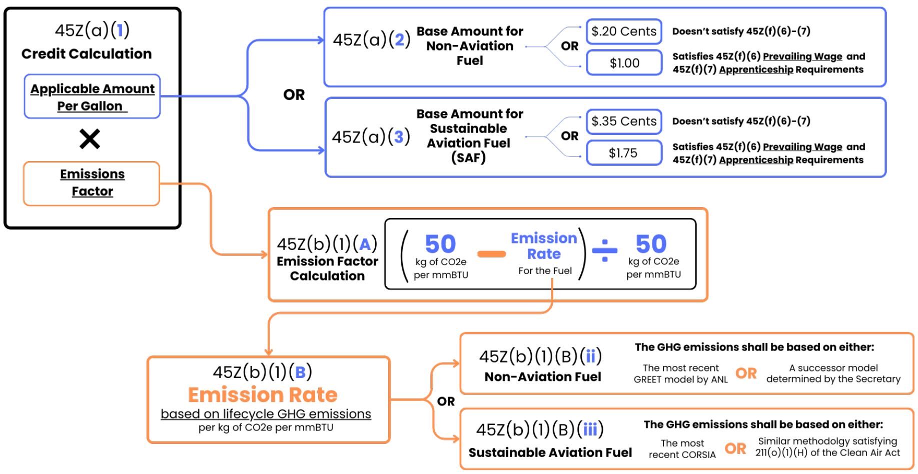
IRC §45Z(a)(3). Special rate for sustainable aviation fuel:
- (A): Base for SAF is $.35
- (B): Bonus. Base shall be increased to $1.75 when the requirements of §45Z(f)(6) & (7) are satisfied (wage and apprenticeship factors)

IRC §45Z(b)(1): Emissions Factors:
- (A) Calculation: Emission factor of transportation fuel (=) quotient of 50 Kg of CO_2 per mmBTU – emission rate / 50 Kg of CO_2 per mmBTU
- (B) Emission Rate:
  - (i). In General. Subject to (ii) and (iii) below, the Secretary (IRS) shall annually *publish a table for emissions rate* for types of transportation fuel based on the lifecycle greenhouse gas emission (as described in §211(o)(1)(H) of the Clean Air Act).
  - (ii). Non-Aviation Transportation Fuel. The lifecycle greenhouse gas emissions shall be based on:
  - The most recent GREET model developed by Argonne National Laboratory (ANL) OR
  - A successor model determined by the Secretary.
  - (iii). Sustainable Aviation Fuel (SAF). The lifecycle greenhouse gas emissions shall be based on:
    - The most recent Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) adopted by the International Civil Aviation Org (ICAO), OR
    - Any similar methodology that satisfies §211(o)(1)(H) of the Clean Air Act

Further Guidance. The Secretary has **until 1/1/2025** to issue guidance on implementation of §45Z, including the:
- Calculation of the emission factors for transportation fuel
- The table described in (b)(1)(B) above, and
- The determination of the credits under §45Z

Provisional Guidance. 45Z(b)(1)(D). In the case of any transportation fuel for which an emissions rate has not been established under subparagraph (B), a taxpayer producing such fuel may file a petition with the Secretary for determination of the emissions rate with respect to such fuel.

§45Z Calculation Flow



Sarah's Commentary/Insights

The IRC calculates the credit per gallon. Since the farmer is dealing with bushels, we need to convert the credit pertaining to the production of corn, to per bushels. Since it takes one bushel to produce 2.8 (some sources say 2.7) gallons of ethanol, the credit amount per gallon will be multiplied by 2.8. For a per acre credit amount, we use 177, the average bushels per acre.

§45Z Credit Calculation Examples

With a modest emissions rate of 40 kg of CO2e per mmBTU (10 point CI reduction)

(50 - 40) / 50 = 0.2 Emissions factor

§45Z Non-Aviation Fuel		§45Z(a)(3) Sustainable Aviation Fuel	
Without W&A Bonus ($.20)	**With W&A Bonus ($1)**	**Without W&A Bonus ($.35)**	**With W&A Bonus ($1.75)**
Per Gallon .20 x 0.2 = $.04	**Per Gallon** 1 x 0.2 = $.20	**Per Gallon** .35 x 0. x = $.07	**Per Gallon** 1.75 x 0.2 = $.35
Per Bushel .04 x 2.8 = $.112	**Per Bushel** .20 x 2.8 = $.56	**Per Bushel** .07 x 2.8 = $.196	**Per Bushel** .35 x 2.8 = $.98
Per Acre .112 x 177 = $19.82	**Per Acre** .56 x 177 = $99.12	**Per Acre** .196 x 177 = $34.69	**Per Acre** .98x 177 = $173.48

To convert the credit from a per gallon to a per bushel or acre, we use the following averages:

177 bushels of corn = 1 acre | **1 bushel = 2.8 gallons of ethanol**

IRC §6418 - Transferable Clean Energy Tax Credits

Relevant Timing: Went into effect 1/1/2023 but final Treas. Regs. interpreting the new Code provision was not published until May of 2024, going into effect July 2024.

Synopsis – Introduces the transferability vehicle for the transfer of certain clean energy tax credits to unrelated parties. Relevant details:

- Tax credit buyer must be an unrelated party

- Payment for the tax credit must be in cash
- Payments are not taxable to the transferor of the credit.
- Procedure for registration and qualification must be followed.

IRS FAQs: https://www.irs.gov/credits-deductions/elective-pay-and-transferability-frequently-asked-questions-transferability

Registration Requirement

Notice 2024-49 provided guidance around the registration requirement for producers of clean fuel to be able become eligible for the §45Z tax credits, per the registration requirement under §4101. Taxpayers (ethanol producers) must have a signed registration letter from the IRS, dated on or before January 1, 2025. Per the IRS, delays in the registration process will likely affect the company's eligibility to claim the 45Z credit. For instance, if a business receives a letter of registration dated June 30, 2025, it won't be able to claim the 45Z credit for any fuel produced and sold prior to this date.

Sarah's Commentary/Insights

§6418 is really important, in my opinion, for the following reasons:

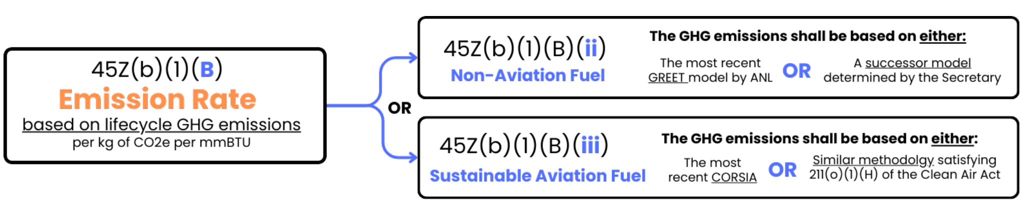
- Transferability should drive up the value of the §45Z tax credits to the ethanol producer, increasing the value of each CI score point reduction done by farmer growing corn feedstock for ethanol.
- The transferability of §45Z tax credits to an unrelated party will necessitate a traceable audit trail of all items that impact the CI score. Without this audit trail, the marketability of these tax credits to an unrelated party is significantly impaired. I believe those credits without a true audit trail will only be sold at a decent discount because of the potential liability.

This is the first time the Tax Code has offered a true open market transferability vehicle for tax credits. Previously, companies generating the tax credits only benefited from the credits to the extent of their tax liability. Alternatively, clean/renewable energy companies without sufficient income to absorb the credits would enter complex "tax equity partnerships" with another company that had significant tax liability. These arrangements were complicated, expensive, and offered very little marketability of the tax credits.

Policy makers project that the open-market transferability will provide a significant economic incentive to companies investing in clean energy projects. It's speculated that these transferable tax credits could be worth as much as $.90 for each $1 of tax credits.

I believe there's going to be a lot of variables around the ultimate market value of the credits. Furthermore, the first tax filing season after this went into law is still underway (business taxpayers with extensions have until Sept. 15 to file their 2023 taxes) and the buyers of the tax credits will not use the credits until the file their 2024 taxes (either in March or September of 2025), we probably won't know for a bit how much the tax credits are going for on an open market.

Quantifying Emissions for the Production of Clean Fuel



GREET

The Argonne National Laboratory's (ANL) GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) model is a comprehensive tool used to evaluate the environmental impacts of various transportation fuels and vehicle technologies. Specifically, it calculates the reduction in Carbon Intensity (CI) scores by assessing the entire lifecycle of a fuel or technology.

1. Lifecycle Assessment (LCA) Approach. The GREET model uses a lifecycle assessment approach to calculate the CI scores. This involves evaluating all stages of a fuel or technology's lifecycle, including:
- Feedstock Production: The extraction or cultivation of raw materials
- Feedstock Transportation: The transportation of raw materials to processing facilities.
- Fuel Production: The conversion of raw materials into usable fuel.
- Fuel Transportation and Distribution: The transportation of the fuel to distribution centers and end-users.
- Vehicle Operation: The use of the fuel in vehicles.
- End-of-Life: The disposal or recycling of materials.

2. Data Input and Modeling. The GREET model requires detailed input data for each stage of the lifecycle. This includes:
- Energy Use: The amount and type of energy consumed at each stage.
- Emissions: The greenhouse gases and other pollutants emitted during each stage.
- Efficiency: The efficiency of processes and technologies used.
- Feedstock and Fuel Characteristics: The properties and yields of raw materials and fuels.

3. Emission Factors. The model uses emission factors to quantify the greenhouse gases emitted per unit of energy or material used.

4. Calculation of Carbon Intensity. Carbon Intensity is calculated as the total greenhouse gas emissions (measured in CO_2-equivalent) per unit of energy produced or consumed (e.g., grams of CO_2-equivalent per megajoule of fuel). The model sums up the emissions from all lifecycle stages to determine the overall CI score.

5. Comparative Analysis. To calculate the reduction in CI scores, the GREET model compares the CI of alternative fuels or technologies with that of conventional fuels or baseline technologies. The reduction is expressed as a percentage decrease in CI.

Relevant GREET Models

FD-CIC. The FD-CIC is designed to calculate the carbon intensity, at a farm level, of agriculture feedstocks used in biofuel production. It integrates with the GREET model to read life-cycle inventory data for key farming inputs, providing detailed assessments of greenhouse gas emissions from the cultivation of biofuel feedstocks. This model is particularly useful for evaluating the environmental impacts of agricultural practices and their contributions to the carbon footprint of biofuels

R&D. The R&D GREET model is used to evaluate the energy use and emissions output of emerging technologies in the transportation and energy sectors. This model helps in assessing the potential benefits of new technologies and innovations under development, providing insights into their environmental impacts. It supports research initiatives by offering a framework for analyzing the life-cycle impacts of new technologies before they are commercialized.

CCLUB. CCLUB is a specialized GREET model focusing on the carbon emissions associated with land use changes due to biofuel production. It evaluates the greenhouse gas emissions resulting from direct and indirect land use changes when agricultural land is repurposed for biofuel feedstock production. This model is crucial for understanding the broader environmental impacts of biofuel policies and ensuring sustainable land use practices.

40BSAF. 40BSAF aims to analyze the feasibility and environmental benefits of producing large-scale sustainable aviation fuel, aiding the aviation industry's sustainability goals.

GTAP-BIO. The GTAP-BIO model, developed by Purdue University, is an extension of the Global Trade Analysis Project (GTAP) model tailored to assess the economic and environmental impacts of biofuel production and policies. It incorporates modifications to the standard GTAP framework to better capture the dynamics of biofuels, including detailed representations of land use changes and greenhouse gas emissions associated with biofuel feedstock cultivation. GTAP-BIO evaluates global trade effects, sectoral interactions, and the lifecycle emissions of biofuels, providing a comprehensive tool for policymakers and researchers to analyze the trade-offs and synergies between biofuel production and environmental sustainability.

CORSIA

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a global market-based measure developed by the International Civil Aviation Organization (ICAO) to address CO_2 emissions from international aviation. The most current CORSIA model aims to stabilize CO_2 emissions from international aviation at 85% of 2019 levels from 2024 onwards. It involves a broad participation of states, stringent offsetting requirements, and the promotion of sustainable aviation fuels. The updated model emphasizes transparency through a rigorous MRV system and phased implementation, ensuring that the aviation industry can effectively contribute to global climate goals.

Climate Smart Agriculture Pilot Program

IRS Notice 2024-37 introduced the USDA Climate Smart Agriculture Pilot Program (CSA Pilot Program) incorporates greenhouse gas and carbon sequestration benefits of climate-smart feedstock production into the carbon intensity calculation for the purpose of the IRC 40B SAF tax credit. It is specific to the calculation of GHG emissions using the safe harbor for the 40BSAF-GREET 2024 model for purposes of the 40B credit and should not be used for the calculation of GHG emissions for any other purpose.

The program is limited to two feedstocks: domestic corn and domestic soybeans. It requires specific practices for each feedstock, such as no-till farming, planting cover crops, and applying enhanced efficiency nitrogen fertilizer for corn-based alcohol-to-jet using ethanol (ATJ-Ethanol), and no-till farming and planting cover crops for soybean HEFA (hydro-processed esters and fatty acids).

The program also outlines requirements for certification, recordkeeping, and traceability to ensure compliance.
For further details, you can refer to Appendix A of the notice

Sarah’s Commentary/Insights

Limitations & Opportunities Around Quantifying Farm-Level CI Scores

While the GREET is a valuable and widely accepted tool for lifecycle analysis of emissions for transportation fuel, there are several limitations when it comes to quantifying carbon intensity of feedstock production at the farm level, especially concerning climate-smart practices. Here are some of the key downfalls:

1. Limited granularity for farm-level practices: GREET models often use aggregated data and averages, which may not accurately reflect the specific practices implemented on individual farms. This lack of granularity can lead to oversimplification of the complex interactions between farming practices and greenhouse gas emissions.
2. Difficulty in capturing the impact of climate-smart practices: Many climate-smart practices, such as conservation tillage, cover cropping, or precision agriculture, have nuanced effects on carbon sequestration and emissions. GREET models may not fully capture these effects due to their complexity and variability across different agricultural systems.
3. Temporal limitations:
4. GREET models typically provide a snapshot of emissions at a given point in time. However, the benefits of many climate-smart practices accrue over extended periods. The models may not adequately account for long-term carbon sequestration or emissions reductions.

5. Lack of regionalization: Agricultural practices and their impacts can vary significantly based on local climate, soil types, and other environmental factors. GREET models may not always account for these regional differences, potentially leading to inaccurate estimations of carbon intensity.
6. Incomplete accounting of soil carbon dynamics: Soil carbon sequestration is a crucial aspect of many climate-smart practices. However, GREET models may not fully capture the complexities of soil carbon dynamics, including the potential for carbon saturation and the reversibility of sequestration.
7. Limited consideration of indirect land-use change: While GREET does include some factors related to land-use change, it may not fully account for the indirect effects of agricultural practices on land use in other areas, which can have significant impacts on overall carbon intensity.
8. Challenges in quantifying nitrous oxide emissions: Nitrous oxide emissions from agricultural soils are a significant contributor to greenhouse gas emissions, but they are highly variable and difficult to measure accurately. GREET models may struggle to capture this variability effectively.
9. Lack of comprehensive data on innovative practices: As new climate-smart practices emerge, there may be a lag in incorporating reliable data into GREET models, potentially underestimating the benefits of these innovative approaches.
10. Difficulty in accounting for co-products and by-products: In many agricultural systems, there are multiple products and by-products. GREET models may face challenges in accurately allocating emissions and energy use among these various outputs.
11. Limitations in capturing the effects of crop rotations and diversification: Complex crop rotations and diversification strategies, which are often part of climate-smart agriculture, may not be fully represented in GREET models due to their focus on individual crops or products.
12. Challenges in quantifying the impact of precision agriculture: The benefits of precision agriculture techniques, such as variable rate applications of inputs, can be difficult to quantify accurately in broad-scale models like GREET.
13. Lack of integration with other environmental impacts: While GREET focuses on greenhouse gas emissions and energy use, it fails to fully account for other environmental impacts of agricultural practices, such as water use, biodiversity, or soil health, which are often interrelated with carbon intensity.

Despite the limitations within the GREET model, it is our best-case scenario for quantifying the emissions rate. The model delivers credit (CI score reduction) to farmers, particularly around the implementation of regenerative practices. The Climate Smart Program introduced in Notice 2024-37 hurts farmers – in my opinion. It places a static number on their practices. They would have a much better CI score running through the GREET if they were doing the practices introduced there in most cases.

With that said, I think we need to provide farmers with multiple options on calculating their CI score, under the guidance available, while providing the tools and resources for them to quantify these measures.

IRC §45Z - Nuances and the Unknowns

1. **Value to the Farmer**
2. **Implications of Transferability**
3. **The Emission Rate**
4. **Traceability and Verification**
5. **A Potential Differentiating Standard: Non-Aviation Fuel vs Sustainable Aviation Fuel**