Supporting Climate-Smart Farming Practices through Midwestern Clean Fuels Policies

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Clean fuels policies are technology-neutral, performance-based policies that increase the use of low-carbon fuels and reduce greenhouse gas emissions from transportation fuels over time. These policies establish mechanisms that evaluate fuel producers based on a well-to-wheels lifecycle greenhouse gas assessment. This creates incentives for fuels with carbon intensity scores below the annual standard.

Farm-level emissions from biofuel feedstock production, like corn and soybeans, make up a significant portion of overall biofuel emissions. Clean fuels policies should provide incentives to reduce these farm-level emissions.

Existing programs like the California Low Carbon Fuel Standard and Oregon Clean Fuels Program assign an average value for biofuel feedstock emissions rather than assigning a unique carbon intensity score for farm-level practices which influence the overall carbon intensity of biofuels. This blocks opportunities to recognize and compensate farmers for climate-smart farming practices.

However, major advances in science and technology, private sector innovation, and in-field demonstration and learning by growers will make farm-level carbon accounting feasible in the near term.

For example, the United States Department of Agriculture (USDA) recently funded the Expanding Soil Health Through Carbon Markets Regional Conservation Partnership Program in South Dakota.[1] This project will leverage USDA funds to compensate farmers supplying corn to an ethanol facility for climate-smart practices and pay for on-farm soil sampling and quantification of the resulting greenhouse gas benefits.

Data collected through this project will increase confidence in current models used to quantify soil carbon sequestration and nitrous oxide emissions and the impacts of crop yield, tillage intensity, and nutrient management on biofuel greenhouse gas emissions. It will also help farmers and biofuel producers become more familiar with the specific practices that can impact greenhouse gases, as well as record-keeping that will be needed to verify the practices. It should be noted that clean fuels policies already rely on similar models to assign an emissions penalty against biofuels for indirect land use change and to determine nitrous oxide emissions.

In another example, technology provider FBN Gradable is operating a direct procurement initiative with POET Ethanol. Key results from the initiative—which scored 68 farms around POET's Chancellor, South Dakota biorefinery—showed a variance in carbon intensity scores, or the CO^2 equivalent emissions for a bushel of production.

1 In September 2021 USDA's Natural Resource Conservation Service awarded $7.5 million to a project developed by the American Coalition for Ethanol, South Dakota Corn, Dakota Ethanol, South Dakota State University, and Cultivating Conservation to pay farmers who install conservation practices that benefit soil health, improve crop productivity, and sequester carbon and other greenhouse gases.

Producers in this program scored between 13 and 45 grams of CO^2 equivalent per megajoule against a national average of 29.5 grams, demonstrating meaningful greenhouse gas emissions reductions. Eighty-four percent of farms in the initiative performed better than the national average. The weighted average score (adjusted for bushels) was 23.69, or just under 20% lower than the national average. An analysis of practices on each farm revealed opportunities for every operation to reduce carbon intensity through conservation practices, with the potential to reduce emissions by an additional 50 percent.

Midwestern clean fuel programs should build on what's in place to develop a framework for farm-level carbon accounting, leading to greater overall impacts. By addressing this issue as Midwest states develop and consider new clean fuel policies, there is the potential to inform existing state programs and a potential federal program.

Benefits

Quantifying greenhouse gas emissions for biofuel feedstocks at the field or acre level and assigning them unique carbon intensity scores has major benefits:

- It compensates and continuously incentivizes farmers, on a purely voluntary basis, for climate-smart farming practices.
- It improves water quality and soil health.
- It will help to achieve scale more quickly and offer significant near-term greenhouse gas emission reductions.

Principles

Existing and future clean fuels policies provide an opportunity to design a framework that achieves the benefits stated above by following the guiding principles below:

- On-farm conservation measures should be voluntary and not required. Greater participation will happen if structured as an incentive.
- Participation in on-farm conservation measures is determined by the farm operator.
- Continuous improvements in farm sustainability should be incentivized.
- Credit revenue should benefit farmers, feedstock processors, and biofuel producers.
- Protocol design should strike a balance between precision and cost for producers, seeking strategies to verify practices that minimize cost where possible while still ensuring outcomes.
- Protocol design should be updated over time to reflect the massive investment and progress in technology.
- Greenhouse gas lifecycle assessment should be transparent, verifiable, and repeatable.
- Just as immediate and full crediting to low carbon ethanol production facilities early adopters has occurred in the California Low Carbon Fuel Standard and Oregon Clean Fuels Program markets, full crediting to low carbon biofuel feedstock producer early adopters should also occur.

Framework Design Recommendations

Clean fuels policies should immediately incorporate quantification of per-acre or per-unit emissions factors from fuel use and upstream emissions from fertilizer and chemical[2] manufacturing. Emissions factors derived from on-farm fuel use, and upstream emissions from fertilizer and chemical manufacturing, are relatively simple to quantify and verify. Many of these emissions factors have been quantified and are available to the public.[3]

The main challenge involves collecting farm-level data including fuel use and fertilizer management practices and making it available for auditors, tracing feedstocks through the supply chain, and tracking and tracing upstream emissions from chemical production. However, these same challenges have existed for biofuel processors for several years, and accounting, auditing, and verification procedures have been successfully implemented.

Biofuel feedstock carbon intensities can be lowered through less use of fuel, fertilizer, and chemicals per unit of biofuel feedstock production, leading to lower emissions per unit of energy production. Actual data instead of modeling data can be used to determine these emissions factors.

Farm-level quantification of in-field nitrous oxide emissions should also begin immediately. Additionally, regionally specific nitrous oxide emissions factors should be developed and updated as science and technology improve. This quantification should take into account emissions from both biomass nitrogen and fertilizer nitrogen application.

Quantifying nitrous oxide emissions is more complex than emissions factors related to on-farm fuel use and upstream emissions from fertilizer and chemical manufacturing. There are accepted modeling tools that estimate nitrous oxide emissions based on the following:

- A mass balance calculation requiring data input on fertilizer application rates
- Crop yields that determine nitrogen fertilizer utilization efficiency
- Form, time, and placement of nitrogen applied

If crops utilize a high portion of applied nitrogen fertilizer, direct and indirect nitrous oxide emissions are significantly reduced. Nitrous oxide emission reduction credits should also be generated with the adoption of certain farm practices (e.g., adoption of "4R" nitrogen fertilizer management practices—right time, right rate, right form, and right placement—and other conservation practices).

Metadata analyses suggest that certain farm practices can significantly reduce on-farm nitrous oxide emissions.[4] Other models estimate nitrous oxide emissions based on satellite data. They are another emerging option for quantifying farm-level nitrous oxide emissions combined with some farmer data collection (e.g., fertilizer application rates). The design of

2 The term "chemical" means pesticidal product for only insect, disease and weed management.

3 Examples of publicly available modeling tools include the US Department of Energy's Argonne National Laboratory's Greenhouse gases, Regulated Emissions, and Energy use in Technologies (GREET) Model and the United States Department of Agriculture's CarbOn Management Evaluation (COMET) Tool.

4 Tai M. Maaz, Tek B. Sapkota, Alison J. Eagle, Michael B. Kantar, Tom W. Bruulsema, and Kaushik Majumdar, "Meta-Analysis of Yield and Nitrous Oxide Outcomes for Nitrogen Management in Agriculture," *Global Change Biology 27*, no. 11 (April 2021): 2343-2360; Alison Eagle, Lydia Olander, Katie Locklier, James Heffernan, and Emily Bernhardt, "Fertilizer Management and Environmental Factors Drive N2O and NO3 Losses in Corn: A Meta-Analysis," *Soil Science Society of America Journal 81*, no. 5 (October, 2017): 1191-1202; Marc Ribaudo, Jorge Delgado, LeRoy Hansen, Michael Livingston, Roberto Mosheim, and James Williamson, *Nitrogen In Agricultural Systems: Implications For Conservation Policy*, EER-127 (U.S. Deptartment of Agriculture, Economic Research Service, September 2011).

a quantification framework needs to be mindful of the fact that the best management practices may not overcome an unresponsive fertilizer market (e.g., geopolitical and supply chain disruptions) which limits the types and locations of fertilizer available for sale to farmers.

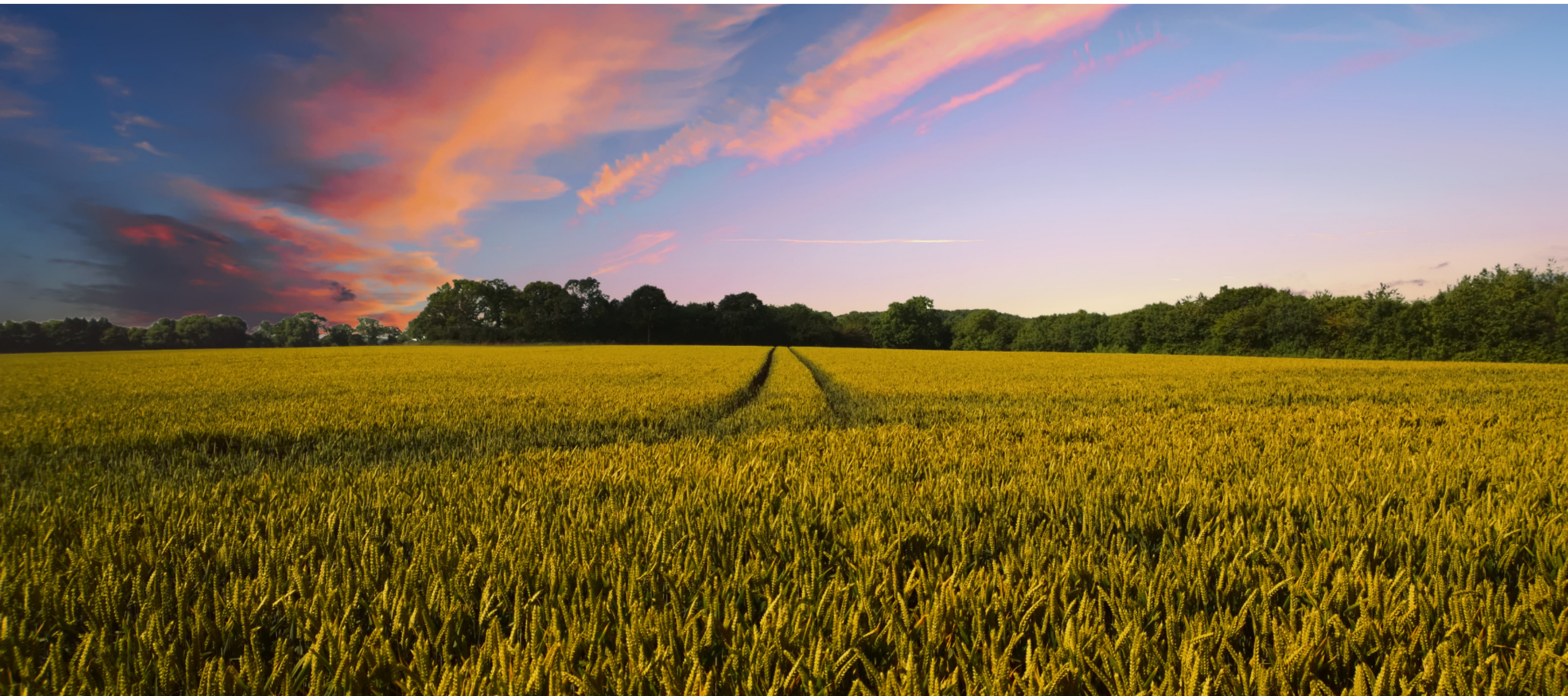
Soil organic carbon storage can occur when biofuel feedstock crops and cover crops are produced and when marginal quality cropland is set aside and planted to native prairie grasses/species. This practice should be recognized as a **crucial opportunity for near-term reductions of atmospheric carbon dioxide as well as soil health and other benefits. Immediate steps should be taken to incorporate this practice into biofuel lifecycle assessment.**

There are significant opportunities to reduce greenhouse gas emissions by enhancing soil organic carbon. Soil organic carbon storage introduces questions regarding modeling and measurement that can be resolved. For example, there are rapid scientific and technological improvements taking place to model and measure soil organic carbon storage at the field level and through real-world demonstration projects. Furthermore, soil organic carbon modeling is already included in existing clean fuel policies as part of the indirect land use penalty.

Estimating soil organic carbon should generally rely on a combination of in-field measurements and modeled values (or an ensemble of models). Continued efforts should work to improve modeling tools that reduce the cost of in-field measurements. In addition, efforts should validate modeling tools with ongoing data collection and metadata analysis of existing data, including data from soil testing and eddy covariance analysis.

Two main options for the generation and sale of farm-level greenhouse gas credits should be considered. In the first option, farmers would generate on-farm credits directly and sell directly into a credit market. In the second option, biofuel producers (or a third party) would aggregate credits on behalf of farmers and sell them into the credit market as part of a lower biofuel carbon intensity. Both models are viable and should be considered.

Biofuel producers and the farmers that supply feedstock to their facilities should have the option to use a carbon intensity score that includes either (1) voluntarily quantified farm-level emissions associated with feedstock production or (2) default farm-level emissions derived from lifecycle models.



Additional Considerations

In designing the framework, the following items should also be considered:

- Specific roles for the following entities: There is a need to identify specific roles for farmers, biofuel producers, regulators, carbon market operators, obligated parties, credit tracking and retirement, third-party aggregators, regional program operators, third-party verifiers, and certified crop consultants. Additionally, a science committee should be established to identify and validate proven GHG reduction strategies and practices.
- Data collection, privacy, and auditing: Data management systems should protect the confidentiality of farmer data while still allowing auditing and verification. It is important to determine who has liability for greenhouse gas claims made under the program and have that entity share data with auditors.
- Chain of custody: Demonstrating lower carbon intensity biofuel feedstock requires documenting the chain of custody of the feedstock (e.g., corn or soybeans) from grower to biofuel producer. Generally, this is simpler for ethanol because corn growers tend to provide corn directly to an ethanol plant and more complex for biodiesel and renewable diesel because there is less likely to be direct relationships with soybean growers. However, the chain of custody has been demonstrated for both corn and soybeans.
- Recognizing the impact on compliance: Incorporating farm-level greenhouse gas credit generation will result in an additional supply of credits. It will also offer an increased opportunity for more rapid greenhouse gas emission reductions. Negative impacts on the program can be avoided by how the regulator sets the schedule of reductions and can be addressed if needed by increasing the standard's stringency.
- Pricing transparency: Successful recruitment of farmers will require transparency on pricing.

Background

This document was developed by the Farm Greenhouse Gas Accounting Committee as a part of the Midwestern Clean Fuels Policy Initiative, which is facilitated by the Great Plains Institute. Members of the committee that helped shape this guide and support the principles presented include:

- American Coalition for Ethanol
- Christianson PLLP
- Farmers Business Network
- Gevo
- Guardian Energy
- HabiTerre, Inc.
- National Sorghum Producers
- Oberon Fuels
- POET, LLC
- Renewable Fuels Association
- South Dakota Corn Growers Association

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Learn more about the Midwestern Clean Fuels Policy Initiative and associated work products at BetterEnergy.org