July 16, 2020

James Duffy
Branch Chief, Transportation
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

RE: Recommended LCFS Workshop Issue- Recognizing Soil Carbon Sequestration within CA-GREET

(Comment submitted electronically to LCFSWorkshop@arb.ca.gov)

Dear Mr. Duffy,

I am writing to recommend that the California Air Resources Board ("CARB") integrate the issue of how best to recognize soil carbon sequestration ("SCS") that results from enhanced farming practices in the upcoming Low Carbon Fuel Standard ("LCFS") Public Workshop to Discuss Potential Regulation Revisions for 2022 (the "LCFS Revisions Workshop"). Specifically, I am recommending that CARB recognize SCS within the next iteration of the CA-GREET model that underlies the LCFS program.

By quantifying SCS in CA-GREET and in LCFS pathways, CARB would take a leading role in incentivizing carbon smart farming practices in all locations that grow feedstock for LCFS fuel pathways, build knowledge regarding the short and long-term effectiveness of various SCS strategies, and speed fulfillment of California's aggressive decarbonization goals. According to the Intergovernmental Panel on Climate Change, soil carbon sequestration provides 89% of the global technical GHG emission mitigation potential from agriculture.[1] This topic therefore warrants consideration in the LCFS Revisions Workshop.

Gevo's Leading Role in the Advanced Bioeconomy

Gevo is a leading renewable chemicals and advanced biofuels company dedicated to delivering low carbon, advanced, sustainable fuels and chemicals. Gevo is committed to replacing the non-sustainable, greenhouse gas generating fossil carbon-based chemicals

[1] Smith, P., D. Martino, Z. Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, B. Scholes, O. Sirotenko, 2007: Agriculture. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, at p. 499 (emphasis in original), available at https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg3-chapter8-1.pdf (last viewed July 16, 2020) (hereafter, 2018 IPCC Agriculture Chapter).

and fuels that dominate the world today with advanced, renewable carbon alternatives. Gevo's production technologies and fuels address multiple transportation sectors and are carbohydrate based. Gevo is a world leader in developing facilities and producing isobutanol, , renewable gasoline, renewable jet fuel, and other biochemicals.

Gevo is also pioneering and supporting farming practices to enhance soil health and sequester carbon in order to enable regenerative farming practices. In connection with Gevo's sales of advanced biofuels to Europe, Gevo is already rewarding farmers for innovating, developing solutions to the dynamic global farming system, and implementing better farming practices.

California Policy Requires Decarbonization of the Transportation Sector

Pursuant to SB 32 and AB 197, California must reduce its GHG emissions 40% below 1990 levels by 2030 necessitating dramatic GHG reductions compared to current policies. Transportation emissions are the dominant GHG emissions source, constituting 41% of California's total GHG emissions of 424.1 $MMTCO_2e$.[2] Transportation GHG emissions have clearly emerged as the most difficult sector to decarbonize with transportation's rising from 35% of California's GHG emissions in 2015 to 41% in 2017.[3]

Pursuant to Governor Brown's Executive Order B-55-18, California has a statewide goal to achieve carbon neutrality as soon as possible, and no later than 2045, and to achieve and maintain net negative emissions thereafter in addition to statewide targets of reducing GHG emissions including SB 32 and AB 197.[4] In addition, the Executive Order provides that, "The California Air Resources Board shall work with relevant state agencies to ensure future Scoping Plans identify and recommend measures to achieve the carbon neutrality goal."

To identify negative emissions pathways that physically remove CO_2 from the atmosphere and strategies that can enable California to meet its goal of achieving carbon neutrality by 2045, the Lawrence Livermore National Laboratory developed a recently published report entited, Getting to Neutral, Options for Negative Carbon Emissions in California ("Getting to Neutral Report" or "Report").[5] The Getting to Neutral Report

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[2] Air Resources Board, Public Workshop on the Transportation Sector to Inform Development of the 2030 Target Scoping Plan Update, September 14, 2016, https://www.arb.ca.gov/cc/scopingplan/meetings/091316/FINAL%20Scoping%20Plan%20Transport%20Workshop.pdf (last viewed September 19, 2016), at slide 11 and 14.

[3] Presentation of Executive Officer Richard Corey, slide entitled "Transportation Remains a Key Focus," presented at Argus Biofuels & Carbon Markets Summit, October 22, 2019, at slide 11.

[4] Executive Order B-55-18, available at https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf

[5] Sarah E. Baker, Joshuah K. Stolaroff, George Peridas, Simon H. Pang, Hannah M. Goldstein, Felicia R. Lucci, Wenqin Li, Eric W. Slessarev, Jennifer Pett-Ridge, Frederick

analyzed California's carbon neutrality goal and determined that it is necessary for the State to remove 125 million metric tons ("MMT") of carbon from the atmosphere each year by 2045 in order to achieve carbon neutrality. The Report then determined the lowest cost and most productive pathways to create a negative emissions strategy and identified the three central pillars of the strategy:

1. *Capture and store as much carbon as possible through better management of natural and working lands.*
2. *Convert waste biomass to fuels and store the CO_2.*
3. *Remove CO2 directly from the air using purpose-built machines and store the CO_2.*[6]

The Importance of Natural Solutions Including Soil Carbon

The natural solutions encompassed by the Report include farming practices that increase the amount of carbon stored in soils. The Report found that, "These approaches are among the least expensive we examined, averaging $11 per ton of CO_2 removed from the atmosphere." The Report also recognized that these strategies have important co-benefits including improved soil health.[7] The Report went on to state:

> *Natural systems are always the first option for negative emissions, both due to their concomitant advantages (soil health, ecosystem services) and to their generally lower cost… Natural systems have the advantage that their system issues are perhaps the most simple, with the source of the CO_2 being the atmosphere and the ultimate sink being the natural system itself.*[8]

The Getting to Neutral Report specifically referenced the following Soil Carbon strategies: cover cropping, mulching, no-till farming, reduced-till farming, and compost application. Regarding scale of the opportunity, the Report found that:

> *Soils have lost approximately 130 billion metric tons of organic carbon (477 billion metric tons of CO_2 equivalent) to the atmosphere globally since the advent of modern agriculture. Reversing soil organic carbon losses by altering land management would sequester atmospheric CO_2 while also potentially delivering*

J. Ryerson, Jeff L. Wagoner, Whitney Kirkendall, Roger D. Aines, Daniel L. Sanchez, Bodie Cabiyo, Joffre Baker, Sean McCoy, Sam Uden, Ron Runnebaum, Jennifer Wilcox, Peter C. Psarras, Hélène Pilorgé, Noah McQueen, Daniel Maynard, Colin McCormick, Getting to Neutral: Options for Negative Carbon Emissions in California, January, 2020, Lawrence Livermore National Laboratory, LLNL-TR-796100, at p. 29, available at https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf (hereafter "Getting to Neutral Report," footnotes omitted).

[6] Getting to Neutral Report at p. 3.

[7] Id. at p. 4.

[8] Id. at p. 15.

gains in soil fertility. Estimates of the near-term carbon storage potential of agricultural soils are in the range of approximately 0.08-1.85 metric tons of carbon per hectare per year, or 0.3-6.8 tons of CO_2 equivalent per hectare per year. In theory, increasing soil carbon stocks globally at these rates could sequester 1-4 billion tons of carbon (3.7-14.7 billion tons of CO_2) per year, with the potential to offset global temperature increase.[9]

The Value of Regenerative Agriculture as a Natural Solutions

Consistent with the Getting to Neutral Report, regenerative agriculture has tremendous momentum, is actionable today, and has great atmospheric carbon reduction potential. According to the IPCC 2018 report, the global technical GHG emission mitigation potential from all agriculture exceeds 5 gigatons of CO2e per year. Per the Agriculture chapter's Executive Summary, "Soil carbon sequestration (enhanced sinks) is the mechanism responsible for most of the mitigation potential (*high agreement, much evidence*), with an estimated 89% contribution to the technical potential."[10]

In order to achieve these substantial reductions, market signals must be provided to farmers that there are economic rewards for better practices. In order to accurately access the level of SCS that individual farms are achieving, CARB must establish a robust, individualized methodology to determine and provide an economic incentive for the actual SCS achieved on individual farms for specific crops.

Overview of Recommended Approach

SCS calculations should rely on qualified biogeochemical models and include on field sampling of individual farms. Individualized on farm calculations are necessary for creating an accurate description of the emissions and sequestration specific to the cultivation of each crop. Utilizing default values or other estimate-based assumptions will overall reduce the integrity of the GHG modeling being done. Such an approach will lead to large discrepancies in actual GHG emissions compared to calculated GHG emissions and eliminate any LCFS-based incentive to utilize better farm practices in growing the feedstocks used to produce transportation fuels. As a result, methods that use default values or evade individual farm calculations harm the overall integrity of the LCFS program and undermine its objective of utilizing a market signal to reward genuine GHG reductions in the transportation fuel sector.

Today California utilizes models such as the ones recommended here for N_2O emissions on croplands within the state. One such example is the geochemical model for process-based modeling for DeNitrification-DeComposition that is used today in the CARB's GHG Inventory.[11] As with any model there is a risk of uncertainty, this risk is why soil

[9] Id. at 22 (footnotes omitted).
[10] 2018 IPCC Agriculture Chapter (full cite at footnote 1), at p. 499.
[11] CARB GHG Inventory Updates Documentation, 2018 Edition

sampling is vital. On field soil sampling is the most robust method to mitigate the risk of over estimating soil carbon accumulation while still allowing for the farmers to reap the carbon value benefits of implementing the better farming practices.

Incentivizing SCS based on individualized farming practices creates a risk of double counting and double incentivizing the same carbon in different carbon markets (e.g., NORI, CAR). The ability to track the specific farm from which particular feedstocks are sourced from is needed to enable truly accurate calculations of greenhouse gas emissions for that feedstock, and ultimately for the finished fuel. This proposed approach guarantees that all transportation is accurately characterized from a carbon intensity standpoint and creates a verifiable system that shows whether and to what degree specific farms have claimed any type of carbon credit.

This granular level of feedstock tracing can be done by utilizing blockchain technology, like "Verity," the blockchain system Gevo has already chosen to implement and build. Individual batches of corn can be traced through from the farm where the batch was grown to the final fuels produced. Conversely, individual batches of corn delivered as feedstock to an advanced biofuel production facility can be traced back to individual farms. The source, status, and destination of the feedstock can be seen on the blockchain platform in real time.

To enable effective verification, any changes to the emissions or inputs calculated for each individual farm are immutable on the blockchain, meaning that any changes made will be revealed during a verification or other audit. In addition, cradle to grave documentation, including soil carbon sampling of the individualized farms can be seen on the blockchain. This approach leads to transparency for both the farmers in the system and for CARB. This level of documentation and monitoring is rigorous, but necessary in order to accurately calculate farm-specific feedstock emissions. Utilization of the blockchain system here allows for simple auditing of any and all values claimed on the blockchain.

Conclusion

The Getting to Neutral Report emphasizes that the first two necessary actions for California to take in order to achieve carbon neutrality by 2045 are:

1. *Scale up and accelerate implementation of natural solutions.*
2. *Ensure eligibility and economic viability of negative emission pathways under the State's climate programs.*[12]

The Getting to Neutral Report represents the most comprehensive and credible strategy document developed to date that charts a viable course for California to achieve carbon neutrality. Consistent with the Reports' recommendations, it is essential that CARB

[12] Getting to Neutral Report, at p. 7.

integrate the recognition of soil carbon sequestration into the state's most effective GHG reducing program for transporation fuels, the Low Carbon Fuel Standard.

Thank you for your consideration of our input. We would welcome the opportunity to provide any further information that would be value to ARB on this subject.

Respectfully,

Patrick Gruber
CEO