SDI Biocarbon Solutions™

661 Manufacturers Drive
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February 26, 2024

SUBMITTED ELECTRONICALLY

Internal Revenue Service
CC:PA:LPD:PR (REG-117631-23)
Room 5203
P.O. Box 7604, Ben Franklin Station
Washington, DC 20044

The Honorable Lily Batchelder
Assistant Secretary (Tax Policy)
Department of the Treasury
1500 Pennsylvania Avenue, NW
Washington, DC 20220

The Honorable Daniel I. Werfel
Commissioner
Internal Revenue Service
1111 Constitution Avenue, NW
Washington, DC 20224

The Honorable William M. Paul
Principal Deputy Chief Counsel
and Deputy Chief Counsel
(Technical)
Internal Revenue Service
1111 Constitution Avenue, NW
Washington, DC 20224

RE: Comments on proposed regulations in REG-117631-23

Dear Ms. Batchelder, Mr. Werfel, and Mr. Paul:

SDI Biocarbon Solutions LLC, a joint venture between Steel Dynamics, Inc. and Aymium, appreciates the opportunity to submit the following comments to the U.S. Department of Treasury (Treasury) and the Internal Revenue Service (IRS) on REG-117631-23, regarding the proposed regulations (Proposed

Regulations) under Sections 45V and 48(a)(15)[1] for credits attributable to clean hydrogen production facilities (collectively, the Hydrogen Credits) published in the Federal Register on December 26, 2023.[2]

SDI Biocarbon Solutions LLC and its members appreciate the thoughtful and pragmatic Proposed Regulations issued by Treasury and the IRS. We believe the Proposed Regulations set forth a strong framework that can be further built upon to achieve the Congressional policy goals of the Inflation Reduction Act of 2022 (IRA) and the Hydrogen Credits.

Our comments focus on requests by Treasury and the IRS for comments by taxpayers included in the preamble to the Proposed Regulations, primarily related to the application of the "most recent GREET model" as defined in Proposed Section 1.45V-1(a)(8)(ii) and the Section 45V anti-abuse rule set forth in Proposed Section 1.45V-2(b). We respectfully offer suggestions to further accelerate the domestic clean hydrogen proliferation priorities associated with the IRA and the Hydrogen Credits. We have provided a statement below of our recommendations related to the Proposed Regulations. Background on SDI Biocarbon Solutions LLC, its low-carbon hydrogen and biocarbon production facility, and its members, as well as a description on the importance of biomass pyrolysis to the domestic production of low-carbon hydrogen and overall decarbonization, follows. Finally, we provide a comprehensive explanation of our recommendations following these summaries.

I. Statement of Recommendations

SDI Biocarbon Solutions LLC respectfully makes the following recommendations with respect to the Proposed Regulations and the Hydrogen Credits:

1. The biomass-specific hydrogen production pathway in current 45VH2-GREET should be expanded to (1) include a broader definition of wood-based feedstocks and include non-wood feedstocks such as agricultural residues, and (2) expressly include pyrolysis in addition to gasification as a hydrogen production technology.

2. The Proposed Regulations and/or current 45VH2-GREET should be clarified to take into account that carbon that leaves a facility in a solid or liquid product and is not emitted to the atmosphere during clean hydrogen production using pyrolysis should be calculated to reduce lifecycle "well-to-gate" GHG emissions.

3. The Section 45V anti-abuse rule set forth in Proposed Section 1.45V-2(b) should be revised to promote on-site hydrogen generation for beneficial use in processes that produce hydrogen and other products of value by clarifying that this provision applies only where hydrogen is wasted and used "solely" for the production or hydrogen for the primary purpose of obtaining tax credits.

[1] All references to "Section" or "Sections" in this letter are to the Internal Revenue Code of 1986, as amended, or the Treasury regulations promulgated thereunder, unless specifically provided otherwise.

[2] 88 Fed. Reg. 246.

II. Background on SDI Biocarbon Solutions LLC, its Members, and the Facility

SDI Biocarbon Solutions LLC and the Facility

SDI Biocarbon Solutions LLC (Biocarbon LLC) is a joint venture between Steel Dynamics, Inc. (SDI) and Aymium. Biocarbon LLC has been established to construct, own, and operate a currently-in-development 90-acre facility located in Columbus, Mississippi, producing industrial-scale amounts of both low-carbon hydrogen and biocarbon (the Facility). Specifically, the Facility, when completed, will produce low-carbon hydrogen as a source of energy for the Facility, as well as biocarbon to be used as a direct substitute for anthracite coal in SDI's steel production. SDI's substitution of biocarbon for anthracite coal in its steel production mills is expected to reduce its annual greenhouse gas emissions by over 500,000 metric tons annually, contributing significantly to decarbonization goals by potentially reducing SDI's direct steelmaking greenhouse gas emissions by up to 35%.

The main feedstock input to the Facility initially will be woody biomass, including sawdust, chips, shavings, pre-commercial thinnings, pulpwood, and timber harvest residuals, which will be 100% sustainably and domestically sourced from the robust Mississippi and Alabama forest industry, supporting a circular economy. These biomass sources would otherwise either be left to decay, burned in place, or deposited to landfills, potentially further contributing to greenhouse gas emissions. The sourcing of this biomass links two industries – steel and timber/lumber – that have most often not been in collaboration, creating a dual-industry benefit and shifting SDI's inputs from foreign or domestic anthracite coal to domestic biomass.

In addition to more traditional forms of woody biomass, the Facility will have the capability to use other sources of biomass including agricultural residues such as peanut shells and other organic byproducts as an input to the biocarbon production process. Biocarbon LLC also plans to explore additional biomass feedstocks as an input to maintain a wide portfolio of supplier options.

To make low-carbon hydrogen and biocarbon, the Facility starts by drying the biomass feedstock and then heating it without oxygen, a process called pyrolysis. This process breaks down the biomass, creating a gas rich in hydrogen and turning the solid material into a product than may be used as a substitute for anthracite coal. Because the Facility will use sustainably sourced biomass and capture the carbon in the form of the biocarbon product, this method significantly reduces the overall carbon footprint of the hydrogen production, making it effectively a carbon-negative solution.

SDI Biocarbon Solutions LLC Members

SDI, with facilities located throughout the U.S. and Mexico, is one of the largest domestic steel producers and metal recyclers in the United States. Headquartered in Fort Wayne, Indiana, SDI's diverse steel product portfolio includes hot roll, cold roll, coated sheet steel, structural steel beams and shapes, rail, engineered special-bar-quality steel, cold finished steel, merchant bar products, and specialty steel sections. SDI's metals recycling operations collect and process ferrous and nonferrous scrap from manufacturing and end-of-life items, such as automobiles, appliances, and machinery. This processed scrap is then sold to end-users for reuse, including in SDI's own electric arc furnace (EAF) steel mills, which produce new steel from the scrap material. SDI sells a meaningful amount of the recycled steel to its own steel fabrication operations that in turn produce and sell structural steel joist and deck building systems to consumers.

Headquartered in Minnesota, Aymium is the leading domestic producer of biocarbon and biohydrogen. Aymium operates the largest advanced biocarbon production facility in the United States, located in Michigan, and its products are engineered to immediately replace fossil inputs to metals production, reducing lifecycle environmental impacts.

III. Importance of Biomass Pyrolysis in Domestic Production of Low-Carbon Hydrogen and Overall Decarbonization.

The Hydrogen Credits reflect Congressional efforts to increase the domestic production of clean hydrogen as a critical fuel source to replace more carbon intensive energy sources in mostly in hard-to-abate industrial and other commercial sectors and as part of a comprehensive decarbonization strategy embodied by the IRA and other federal legislation. As such, the Hydrogen Credits embody Congressional intent to support and incentivize the creation of a resilient, secure, and trusted supply chain for verifiable clean hydrogen; support the transition from fossil fuels to low-carbon energy production (the energy transition); and create domestic jobs. The following details how the domestic production of low-carbon hydrogen through pyrolysis furthers these Congressional objectives.

The potential role of hydrogen and biocarbon in steelmaking decarbonization. The adoption of hydrogen produced from biomass pyrolysis, alongside biocarbon, significantly enhances the potential for decarbonization within the steel industry. Hydrogen from biomass pyrolysis represents a dual advantage: it leverages renewable resources for hydrogen production and utilizes sustainably sourced biomass, thereby reducing reliance on fossil fuels. When used as a reducing agent in ironmaking, this hydrogen offers a cleaner alternative to conventional coke or coal, substantially cutting down greenhouse gas emissions. Biocarbon, similarly derived from biomass, provides a renewable and carbon-neutral substitute for coke in the reduction process. The combination of these technologies not only aids in slashing the carbon footprint of steel manufacturing but also aligns with a circular economy by valorizing biomass waste. Their integration into the steel production process is a pivotal move towards achieving a greener, more sustainable industry, underscoring the critical role of innovative, biomass-based solutions in the global endeavor to combat climate change.

SDI Biocarbon Solutions represents a critical step towards decarbonizing the steel industry. The initiative embodied by the Facility and other similar projects produces clean hydrogen and a biocarbon product from sustainably sourced biomass, reducing energy consumption and providing an alternative to anthracite coal. This approach not only offers a viable pathway to incorporate hydrogen and biocarbon into ironmaking but also positions these projects as significant potential sources of clean hydrogen. We believe that the Hydrogen Credits' incentivization of this initiative will play a crucial role in advancing this innovative technology, further reducing reliance on fossil fuels and promoting sustainable practices within the steel production industry. Demonstration and expanded use of this technology will allow rapid decarbonization of the steel industry.

Water neutral technology. Biomass pyrolysis offers a compelling advantage over electrolysis for clean hydrogen production, primarily due to its minimal water usage. Unlike electrolysis, which consumes significant amounts of water, biomass pyrolysis leverages the inherent hydrogen, oxygen, and water in biomass materials. This not only conserves precious water resources but also utilizes renewable biomass effectively. Pyrolysis, therefore, stands out as a more sustainable and efficient method for generating clean hydrogen, aligning with environmental goals and resource conservation.

Biomass availability in the USA. The National Renewable Energy Laboratory (NREL) published Technical Report NREL/TP-560-39181, *A Geographic Perspective on the Current Biomass Resource Availability in the United States*. The document speaks to the value of the biomass resource to the United States. It states that an estimated 423 million tons of biomass are technically available in the country. Additionally, it mentions that crop, forest, and primary mill residues provide about 70% of the total biomass resources. This reflects that the United States' biomass resource is substantial and can play a critical role in the decarbonization of the steel industry and beyond.

Benefits to domestic supply chains and onshoring jobs. Biomass pyrolysis could significantly boost domestic supply chains and job creation. Utilizing the 423 million tons of available U.S. biomass involves labor-intensive steps like harvesting, extraction, and transportation. This not only creates jobs but also reduces reliance on imported fossil fuels and coal, further supporting U.S. manufacturing. For instance, Biocarbon LLC's biocarbon, a direct substitute for anthracite coal, highlights a move towards using domestic, often local resources over imports from politically unstable areas like Russia and Ukraine (which are the largest global producers of anthracite), enhancing energy security and economic stability. The U.S. Department of Agriculture applies a job creation factor of 4:1 for biomass-based facilities using pyrolysis, meaning, for each direct job at the biohydrogen and biocarbon production facility, four additional jobs are created or supported in the domestic feedstock supply value chain.

Why is this important? The focus on electrolysis for producing clean hydrogen overshadows the critical advantages of biomass pyrolysis, a method that utilizes the photosynthesis process that occurs in nature and extracts CO2 from the atmosphere. Sustainably-sourced biomass pyrolysis, which creates hydrogen from organic material without depleting water resources, represents a sustainable and underutilized path to replace fossil fuels. It offers a pragmatic solution that is not dependent on the uncertain future of increased renewable electricity generation and associated infrastructure. Recognizing and investing in biomass and pyrolysis technologies, as supported through policies and legislation including the IRA and the Hydrogen Credits, could yield significant environmental benefits today, leveraging nature's own mechanism for carbon sequestration, photosynthesis.

IV. Description of Recommendations

A. Recommendation 1 – The biomass-specific hydrogen production pathway in current 45VH2-GREET should be expanded to (1) include a broader definition of wood-based feedstocks and include non-wood feedstocks such as agricultural residues, and (2) expressly include pyrolysis in addition to gasification as a hydrogen production technology.

Background

The Proposed Regulations would establish that a hydrogen production facility's lifecycle greenhouse gas (GHG) emissions rate on which Hydrogen Credit eligibility and tier amount depend is based on the application of the "most recent GREET model" if the facility's feedstock and hydrogen production technology are included in such model. The current most recent GREET model, 45VH2-GREET, includes eight hydrogen production pathways. Under the Proposed Regulations, if a facility does not fit entirely within a 45VH2-GREET production pathway, it must request an emissions value from the U.S. Department of Energy (DOE) that will serve as the basis for the facility's petition to the IRS for a provisional emissions rate (PER) that it uses to determine its lifecycle GHG emissions rate until the most recent GREET model is updated to include the facility's feedstock and hydrogen production technology.

The only biomass-specific hydrogen production pathway included in the current 45VH2-GREET is "[b]iomass gasification with corn stover and logging residue with no significant market value with potential CCS." The current, December 2023 DOE published Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways Using 45VH2-GREET 2023 (GREET User Manual) describes the feedstock encompassed by this production pathway as follows:

> 45VH2-GREET 2023 currently allows for biomass gasification to be modeled using two feedstocks- corn stover and forest logging residue with no significant market value, such as bark, branches, cutter shavings, leaves, needles, and pre-commercial thinnings (i.e., not milling residues from industrial processing or whole trees).

The GREET User Manual also describes the hydrogen production technology of "gasification" as follows:

> This technology converts coal or biomass feedstocks into synthetic gas, using elevated temperatures and with controlled amounts of oxygen and/or steam. The resulting synthetic gas (syngas) contains hydrogen, and potentially CO, CO2, and other trace gases and impurities. Gasification facilities can also be supplemented with CCS.

Recommendation

We respectfully request that the Proposed Regulations and the current 45VH2-GREET model reflect the current state of the domestic production of clean hydrogen, as well as the complexities and rapid technological advancements that continue to be made within the industry. Treasury and the IRS acknowledged those technological advancements in the preamble to the Proposed Regulations, noting that the "initial version of 45VH2-GREET does not model every possible biomass fuel as a feedstock nor does it represent all hydrogen production technologies that are currently of commercial interest." To address this, the Proposed Regulations direct a taxpayer to the PER process. As discussed more fully below, the potential disconnect between the current state of the production of clean hydrogen in the industry and the technologies that are not represented in the 45VH2-GREET model, coupled with the proposed process for addressing this disconnect, negatively impact the implementation of the Hydrogen Credits and creates inefficiencies for both taxpayers and the federal government.

We observe that Treasury and the IRS in the preamble to the Proposed Regulations have requested comments to the current 45VH2-GREET model as well as the Proposed Regulations. We accordingly request that implementation of the current 45VH2-GREET model be expanded as set forth below to expressly include hydrogen created through pyrolysis of a variety of biomass feedstocks. If any of the requests set forth in this recommendation may not be implemented in the manner requested, we request that additional guidance be issued reaching the results sought through the requests below.

1. The current 45VH2-GREET model should expressly include a broader range of renewable biomass feedstocks.

There are hundreds of millions of tons of sustainable renewable feedstocks available in the U.S. each year, including forest trimmings, sawmill residues, and a broad range of agricultural co-products such as trimmings, shells, hulls, and pits. The Secretary, through the current 45VH2-GREET model, should

provide for use of these biogenic feedstocks to encourage use of materials to create low-carbon clean hydrogen that otherwise may be burned or sent to landfills where they have the potential to create GHG emissions through biological degradation.

Biomass to hydrogen provides the potential for low-carbon hydrogen production in furtherance of Congressional purpose of enacting the Hydrogen Credits as described above. The current 45VH2-GREET, however, provides only a single and particularly narrow biomass to hydrogen pathway through "gasification" using only "corn stover" and "logging residue." Such pathway is unnecessarily and overly restrictive in a way that is contrary to the Congressional policy goals of the IRA and the Hydrogen Credits. Based on our knowledge of the industry, we do not expect that such narrow biomass-specific production pathway will be widely adopted in the United States.

Trees and plants are the most efficient technology today for large-scale removal of CO2 from the atmosphere. Use of sustainably sourced biomass to produce clean hydrogen is critical to achieve GHG reductions because it both removes CO2 from the atmosphere and prevents CO2 from burning or degradation in landfills. As noted in Princeton University's *Net Zero America: Potential Pathways, Infrastructure and Impacts* (2020), "biomass plays an especially important role because it *removes CO2 from the atmosphere* as it grows." While the DOE has identified that there are more than one billion tons of biomass available on an annual basis in the United States,[3] the current 45VH2-GREET model provides for production of clean hydrogen using only "corn stover" and "logging residue." This is unnecessarily restrictive and undermines the massive potential to use biomass to produce low carbon intensity clean hydrogen.

Accordingly, the biomass-specific production pathway in the current 45VH2-GREET should be expanded to include forest materials (including thinnings, harvest residues and mill residues), agricultural residues (including orchard trimmings, shells, pits and husks), and energy crops. At a minimum, we request confirmation that "logging residue" includes managed softwoods including forest thinnings. Thinning forests is essential for forest health and promotes forest growth and carbon sequestration. As noted by Argonne National Laboratory, "remaining trees have less competition for water and soil resources, and growth rate increases after thinning."[4] Notably, the amount of carbon stored in U.S. forests has increased over 10% since 1990 due in part to the millions of tons of thinnings each year that support forest health and increase carbon sequestration. It is important that the Secretary, through the 45VH2-GREET model, not unnecessarily limit the sources of biomass and clearly provide for use of a broad range of sustainably sourced biomass, including forest thinnings, for the scalable production of low carbon intensity clean hydrogen.

2. "Pyrolysis" should be expressly included in the current 45VH2-GREET model as a clean hydrogen production technology.

Thermal conversion pathways for the production of clean hydrogen, such as pyrolysis of sustainably sourced feedstock, should be expressly included in addition to "gasification." Pyrolysis can convert biogenic feedstock into hydrogen and other products through non-combustion thermal conversion in a near-zero oxygen environment. Pyrolysis has the advantage over gasification in that, in addition to

[3] See DOE report, entitled *2016 Billion-Ton Report Advancing Domestic Resources for a Thriving Bioeconomy*, which can be found at https://www.energy.gov/eere/bioenergy/2016-billion-ton-report.

[4] Jeongwoo Han et al., *Carbon Dynamics for Biofuels Produced from Woody Feedstocks* (May 2018).

production of clean hydrogen, it can co-produce other valuable renewable products such as biocarbon and biofuels. This allows production of multiple decarbonizing products at a single site and allows feedstocks to be taken to their highest and best use. The potential for biomass pyrolysis to create clean hydrogen is well recognized.[5]

We can discern no reason why the biomass-specific hydrogen production pathway should be limited to only gasification technologies and not also include pyrolysis. These methods for producing low-carbon hydrogen from biomass feedstock are exceedingly similar and pyrolysis includes the "gasification" of biomass feedstock.[6] Whereas gasification uses heat and oxygen to combust feedstock to produce hydrogen, and the majority of the feedstock is consumed through combustion, pyrolysis uses heat but is completed in an oxygen-free environment and converts biogenic feedstock into hydrogen in a non-combustion process while also producing solid or liquid bioproducts that may also be used to displace fossil fuels.[7] To ensure coverage under forthcoming final regulations or other guidance and the "most recent GREET model," we request that pyrolysis be expressly included as a clean hydrogen production pathway in the current 45VH2-GREET model.

3. Insufficiency and ambiguity of the provisional emissions rate process.

While we acknowledge that omission of a feedstock or a production technology does not exclude a project from the Hydrogen Credits since a PER may be obtained from DOE/IRS to determine the project's lifecycle GHG emissions, we believe that Congressional policy is significantly furthered by limiting the need for such additional process to the extent possible. A most-often existential factor in the economic viability of low-carbon hydrogen projects in the United States is eligibility for the Hydrogen Credits. Any process that introduces uncertainty into Hydrogen Credit availability (and at which credit tier) of a project makes the construction, financing, and operation of that project uncertain. Excluding a type of project from a 45VH2-GREET model hydrogen production pathway forces a developer to incur

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[5] *See, e.g.*, Robert C. Brown, *The Role of Pyrolysis and Gasification in a Carbon Negative Economy, 9(5), 882 Processes 14 (2021)* ("Pyrolysis and gasification of biomass can produce both energy and carbon sequestration agents in the form of biochar and/or CO2. Gasification of biomass to hydrogen for use in . . . power generation is attractive for the large amounts of carbon that can be sequestered. . . . Pyrolysis is attractive for its relative simplicity and suitability for operation at scales more aligned with the distributed nature of biomass resources."); Xianxian Xu et al., *The Future of Hydrogen Energy: Bio-hydrogen Production Technology*, 47 Int'l J. of Hydrogen Energy 33677, 33679, 33688, 33692 (2022) ("[H]ydrogen production from biomass (bio-hydrogen) has attracted much attention since biomass is considered a carbon-neutral source of energy.") (identifying the high hydrogen production rate and low pollution of pyrolysis-reforming and biomass gasification, noting challenges of gas production rate and cost of bio-hydrogen production, and recommending more research to "improve the efficiency of hydrogen production[.]").

[6] *See, e.g.*, Tina Casey, *Hydrogen from Biomass: Beyond Decarbonization*, Triple Pundit (Nov. 2, 2023), https://www.triplepundit.com/story/2023/hydrogen-biomass-decarbonize/787261 ("Drawing hydrogen from biomass is another new area of activity. Within that field, attention has focused on pyrolysis, which refers to the gasification of biomass in an oxygen-free environment. . . . Pyrolysis is considered to be a carbon-negative system because it produces a charcoal-like, carbon-sequestering substance called biochar, in addition to hydrogen and other fuels.").

[7] According to *The role of biomass gasification in low-carbon energy and transport systems*, authored by Korberg et al., biomass gasification is one of the leading biomass conversion technologies. Gasification is the intermediate step between pyrolysis and combustion that extracts the energy from biomass to a syngas. Another thermochemical route is pyrolysis, a process that decomposes solid biomass at high temperatures in the absence of oxygen. Fast pyrolysis co-produces biochar (biocarbon), gas and a high oxygen content bio-oil. The Facility will utilize the pyrolysis process to produce both a hydrogen as well as a biocarbon product.

significant costs in the development of the project to the point where it could even petition the DOE for an emissions value, which costs we believe could be in the magnitude of millions of dollars depending on the type of project. We believe this result provides a significant roadblock in the build-out of clean hydrogen facilities in a way that directly contradicts Congressional intent. We accordingly believe that the Congressional policy underlying the Hydrogen Credits is significantly furthered by making the 45VH2-GREET model's hydrogen production pathways as broad as possible, including in the ways described in this recommendation. This will help expedite and support investment and construction of clean hydrogen production facilities.

While we believe the above changes will address our specific concerns, we also provide the following conceptual comments regarding the viability of the PERs petition process as set forth in the proposed regulations and share the following concerns from an industry perspective. The process for petitioning the DOE for an emissions value, including the critical issue of whether there will be required timeframes for a response from the DOE in response to a submission, remains undefined at this time pending the release of promised DOE emissions value submission rules. We believe that interested taxpayers will be extremely focused on this forthcoming guidance and will appreciate the opportunity to comment on this guidance as well as provide further comments to how this guidance impacts the PERs petition process as provided in the Proposed Regulations more generally. At this time more specific comments on this process without the benefit of the DOE guidance would be premature. Once this necessary guidance from the DOE is released, more fulsome comments regarding this process will be possible and the opportunity to provide comments would be welcome.

B. Recommendation 2 – The Proposed Regulations and/or current 45VH2-GREET should be clarified to take into account that carbon that leaves a facility in a solid or liquid product and is not emitted to the atmosphere during clean hydrogen production using pyrolysis should be calculated to reduce lifecycle "well-to-gate" GHG emissions.

Background

Section 45V(c)(1)(B) provides that a facility's tested lifecycle GHG emissions only includes emissions through the point of production (well-to-gate), as determined under the most recent Greenhouse gases, Regulated Emissions, and Energy use in Transportation model (commonly referred to as the "GREET model") developed by Argonne National Laboratory, or a successor model (as determined by the Secretary). Proposed Section 1.45V-1(a)(8)(iii) would provide that the following definition for this "well-to-gate" emissions standard.

> The term emissions through the point of production (well-to-gate) means the aggregate lifecycle GHG emissions related to hydrogen produced at a hydrogen production facility during the taxable year through the point of production. It includes emissions associated with feedstock growth, gathering, extraction, processing, and delivery to a hydrogen production facility. It also includes the emissions associated with the hydrogen production process, inclusive of the electricity used by the hydrogen production facility and any capture and sequestration of carbon dioxide generated by the hydrogen production facility.

The GREET User Manual provides that the tested well-to-gate emissions of hydrogen production associated with gasification includes "(7) whether or not the facility includes CCS, [and] (8) the amount

of carbon capture for subsequent sequestration (in tonnes) consistent with reporting to the EPA's Greenhouse Gas Reporting Program." The GREET User Manual also provides that "[i]n hydrogen production pathways that use allowable feedstocks, 45VH2-GREET assumes that biogenic CO2 emissions that result from gasification equal CO2 emissions that were captured during growth of the feedstock."[8]

Based on the above, since Section 45V(c)(1)(B) requires that lifecycle GHG emissions are only determined through the point of production of hydrogen, carbon that is not emitted to the atmosphere because it leaves a hydrogen production facility in solid or liquid form (and is not emitted to the atmosphere) appears to be excluded from that facility's lifecycle GHG emissions calculation. However, it is unclear how 45VH2-GREET would account for biocarbon (or other similar carbon containing outputs such as biooil) resulting from hydrogen-producing biomass pyrolysis.

Recommendation

We respectfully request that the Proposed Regulations and/or current 45VH2-GREET should be clarified to take into account that carbon that leaves a facility in a solid or liquid product and is not emitted to the atmosphere during clean hydrogen production using pyrolysis should be calculated to reduce lifecycle "well-to-gate" GHG emissions.

We believe that this result is required by the Code. Section 45V(c)(1)(B) provides that a facility's tested lifecycle GHG emissions only include emissions through the point of production of hydrogen (well-to-gate). A "well-to-gate" analysis should expressly exclude potential GHG emissions from carbon that is sequestered in a product co-produced via pyrolysis. As carbon that is contained in such products has been removed from the atmosphere through photosynthesis and is not released into the atmosphere in the production of hydrogen, it should not count as contributing GHG emissions and should be subtracted from the well-to-gate lifecycle GHG emissions. For example, where clean hydrogen from biomass is co-produced with biocarbon, over 65% of carbon in the biomass feedstock is retained in solid form and not released to the atmosphere. It is only when this product is used in a further industrial process as a substitute for a separate carbon-emissions-intensive product that the attendant biogenic CO2 may be released into the atmosphere. Again, this does not occur within the hydrogen production well-to-gate process required by the Code.

Accordingly, the amount of carbon encompassed into a product resulting from pyrolysis-based hydrogen production would effectively reduce the facility's lifecycle GHG emissions as compared to the approach in the current 45VH2-GREET model for biomass gasification. This treatment makes sense for gasification where the majority of carbon in the feedstock is emitted to the atmosphere during hydrogen

[8] The GREET Manual provides the following in a footnote regarding biomass gasification biogenic emissions:

> In the case of corn stover, as these materials are grown and harvested within a year, it is assumed in 45VH2-GREET 2023 that net carbon fluxes directly related to this material (the fiber itself) is zero or carbon neutral (i.e., that carbon dioxide emissions generated by gasifying corn stover are equal to those captured during growth of the feedstock). In the case of forest logging residues, as these materials otherwise would have likely decayed over time or been pile-burned, the resulting emissions associated with using the materials to produce hydrogen are expected to be negligible or about the same as if the material were not collected and used. . . .

production. In pyrolysis, however, and as noted above, the majority of carbon in the feedstock typically is *not* emitted to the atmosphere when producing hydrogen.

This recommendation could be implemented via either an update to the parameters of 45VH2-GREET to specifically account for pyrolysis and its resulting carbon-based biproduct not being emitted into the atmosphere or by treating the carbon encompassed in this biproduct as having been sequestered under the approach currently applied by 45VH2-GREET for CCS.

B. Recommendation 3 – The Section 45V anti-abuse rule set forth in Proposed Section 1.45V-2(b) should be revised to promote on-site hydrogen generation for beneficial use in processes that produce hydrogen and other products of value by clarifying that this provision applies only where hydrogen is wasted and used "solely" for the production or hydrogen for the primary purpose of obtaining tax credits.

Background

Section 45V does not include an anti-abuse rule excluding otherwise Section 45V-eligible hydrogen production from receiving a Section 45V credit. Proposed Section 1.45V-2(b)(1) would set forth the following as such an anti-abuse rule for Section 45V:

> The rules of section 45V of the Code (and so much of sections 6417 and 6418 of the Code related to the section 45V credit) and the section 45V regulations (as defined in §1.45V-1(a)(13)) must be applied in a manner consistent with the purposes of section 45V and the section 45V regulations. A purpose of section 45V and the regulations in this part under section 45V (and so much of sections 6417 and 6418 and the regulations in this chapter under sections 6417 and 6418 related to the section 45V credit) is to provide taxpayers an incentive to produce qualified clean hydrogen for a productive use. Accordingly, the section 45V credit is not allowable if the primary purpose of the production and sale or use of qualified clean hydrogen is to obtain the benefit of the section 45V credit in a manner that is wasteful, such as the production of qualified clean hydrogen that the taxpayer knows or has reason to know will be vented, flared, or used to produce hydrogen. A determination of whether the production and sale or use of qualified clean hydrogen is inconsistent with the purposes of section 45V and the regulations in this part under section 45V of the Code is based on all facts and circumstances.

The preamble to the Proposed Regulations in section IV describes this anti-abuse rule as follows:

> Proposed §1.45V-2(b)(1) would provide an anti-abuse rule that would make the section 45V credit unavailable in extraordinary circumstances in which, based on a consideration of all the relevant facts and circumstances, the primary purpose of the production and sale or use of qualified clean hydrogen is to obtain the benefit of the section 45V credit in a manner that is wasteful, such as the production of qualified clean hydrogen that the taxpayer knows or has reason to know will be vented, flared, or used to produce hydrogen.
>
> If the cost of producing qualified clean hydrogen were to be less than the amount of the section 45V credit that would be available with respect to such hydrogen, the Treasury Department and the IRS are concerned that taxpayers may have an incentive to produce

> qualified clean hydrogen solely for the purpose of exploiting the section 45V credit in a manner that is inconsistent with a purpose of section 45V, which is to provide an incentive to produce qualified clean hydrogen for a productive use. Producing and selling or using qualified clean hydrogen with the primary purpose of obtaining the benefit of the section 45V credit in a wasteful manner would not, in certain circumstances, satisfy the requirement in section 45V(c)(2)(B)(i)(II) for hydrogen to be produced in the ordinary course of a trade or business of the taxpayer. Proposed §1.45V-2(b)(2) would provide an example illustrating this anti-abuse rule.

Recommendation

We respectfully request the Section 45V anti-abuse rule set forth in Proposed Section 1.45V-2(b) be clarified to exclude non-abusive situations in which hydrogen is used to produce clean hydrogen. Specifically, we request that the scope of the Proposed Section 1.45V-2(b) anti-abuse rule be clarified to allow production and use of hydrogen where such production and use is not "wasteful." We accordingly request the third sentence of Proposed Section 1.45V-2(b)(1) be revised to include the word "solely" as follows:

> Accordingly, the section 45V credit is not allowable if the primary purpose of the production and sale or use of qualified clean hydrogen is to obtain the benefit of the section 45V credit in a manner that is wasteful, such as the production of qualified clean hydrogen that the taxpayer knows or has reason to know will be vented, flared, or used ***solely*** to produce hydrogen.

The Proposed Regulations in Section 1.45V-1(a)(9)(ii) define "sale or use" to mean "for the primary purpose of making such hydrogen ready for sale or use." The preamble to the Proposed Regulations specifies that the anti-abuse rule should only apply in "extraordinary circumstances" where the primary purpose of the production and sale or use of qualified clean hydrogen is to obtain the benefit of the Section 45V credit in a manner that is wasteful. This reflects that the anti-abuse rule should be narrowly tailored to address only those factual scenarios of concern in which hydrogen is produced in a wasteful manner that distorts Congressional intent in providing the Section 45V credit.

Applying the anti-abuse rule in the context of electrolysis-based hydrogen makes sense as the circular production of hydrogen to make electricity to make hydrogen is not a productive use and is wasteful.[9]

Conversely, in certain non-electrolysis hydrogen production pathways, including thermal production of hydrogen via pyrolysis, clean hydrogen may be produced on site and used for the productive purpose of providing necessary process energy to thermochemically convert feedstock into hydrogen as well as other valuable products. Thermal production of hydrogen is endothermic and requires energy. As energy is necessary for such processes, and alternatively will be supplied by fossil fuels such as natural gas, the hydrogen is in no way being "wasted," and its productive use should be incentivized to support low carbon intensity processes.

[9] We observe that the directly analogous provision in Proposed Section 1.45V-5(d)(2) for substantiating a "verifiable use" of hydrogen only excludes "hydrogen to *generate electricity that is then directly or indirectly used* in the production of more hydrogen" as compared to the anti-abuse rule's "hydrogen that . . . will be . . . used to produce hydrogen."

Where hydrogen is being used to co-produce a renewable low carbon intensity product, such as biocarbon or biofuels, Section 45V's purpose of producing clean hydrogen for a productive use is satisfied and introducing doubt as to the validity of such credit could encourage use of fossil natural gas and higher carbon intensity processes. Further, as the primary economic driver of such facilities is production of biocarbon or biofuel (not hydrogen tax credits), excess conversion of feedstock to hydrogen (beyond what is needed for use in process requirements) is inherently disincentivized. The primary purpose of such hydrogen production is to provide needed energy—not to waste hydrogen. The "facts and circumstances" are clear that hydrogen is not being produced for the "primary purpose" of "wasting" such gas and Section 45V clearly provides a tax credit where hydrogen is produced and used in a such a productive manner.

Importantly, without clarification, the proposed anti-abuse rule could disincentivize on-site hydrogen production for a productive use and instead require that hydrogen be compressed, stored, and shipped in order to qualify for the Section 45V tax credit. Nothing in the text of Section 45V supports this outcome and we believe this is contrary to Congressional intent. On-site production and use of biohydrogen has the lowest carbon intensity and significant potential to facilitate decarbonization of processes that presently are powered by fossil fuels. Alternatively, hydrogen leakage and energy required for compression, storage, and transport of hydrogen create significant climate warming potential.[10] Such an interpretation is contrary to the language and intent of Section 45V and will increase GHG emissions and hinder decarbonization.

Accordingly, use of self-produced biohydrogen (instead of fossil fuel) to provide thermal energy necessary for pyrolysis is a productive use, is not wasteful, and yields the greatest net reduction of carbon intensity. The regulations that implement Section 45V should reflect this and clearly provide the tax credit for such production and use of clean hydrogen.

Conclusion and Signature Page to Follow

[10] *See, e.g., Climate Consequences of Hydrogen Emissions*, Atmos. Chem. Phys., 22, 9349-93688 (2022) (noting significant potential for climate impacts from transport and leakage of hydrogen).

V. Conclusion

SDI Biocarbon Solutions LLC and its members appreciate the opportunity to submit comments regarding the Proposed Regulations and the Hydrogen Credits. We would welcome the opportunity to meet with you to discuss our comments, to provide additional information regarding the industry, our business, the Facility, and to answer any questions you might have as you consider finalization of these important regulations.

Thank you again for your time and consideration. Please feel free to contact us via the contact information below if we can provide any additional information or support with respect to the Proposed Regulations.

Sincerely,

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