H Cycle
444 Castro Street, Suite 710
Mountain View, CA 94041

December 5, 2022

Internal Revenue Service
CC:PA:LPD:PR (Notice 2022-58)
Room 5203
P.O. Box 7604
Ben Franklin Station
Washington, DC 20044

Submitted electronically via the Federal eRulemaking Portal at www.regulations.gov

RE: Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production

Dear Internal Revenue Service:

H Cycle, LLC ("H Cycle") appreciates the opportunity to comment on the implementation process for the § 45V clean hydrogen production credit that was recently codified into law under the Inflation Reduction Act of 2022 (the "IRA"). Below you will find our comments and recommendations regarding a number of the questions posed within the Internal Revenue Service's ("IRS") formal request for comments document. We believe the following recommendations will enhance the effectiveness of the IRA in fomenting a robust clean hydrogen economy in the United States, as well as benefit the Hydrogen Hubs initiative and Clean Hydrogen Production Standard ("CHPS") under the Bipartisan Infrastructure Law.

About H Cycle

H Cycle is a developer of low-cost, low-carbon, renewable hydrogen production facilities that deploy a proven waste-to-hydrogen thermal conversion technology. H Cycle is currently developing multiple projects in the Western United States. Our process can utilize a diverse composition of waste biogenic feedstocks (post-separated municipal solid waste, agricultural residues, woody biomass from wildfire risk reduction projects) to produce a renewable hydrogen product, thereby reducing methane emissions from landfill and other waste disposal methods. The H Cycle process delivers low-carbon hydrogen that can be used as an energy source for decarbonizing hard-to-abate sectors such as low-carbon fuel refining, heavy-duty trucking and sustainable aviation. We are excited to work with the federal government to deploy our solution and support the nation in meeting its climate, sustainability and air quality goals.

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Comment Scope

H Cycle's comments broadly address three topic areas related to the clean hydrogen production credit:

1. **Scope of lifecycle greenhouse gas emissions**. For fuels derived from waste biomass, H Cycle recommends that the lifecycle carbon emissions calculation used to determine the value of the § 45V production credit include the avoided emissions from the "base fate" of the waste feedstock material, such as the avoided methane emissions from landfilling the waste.
2. **Coordination with § 45Q.** H Cycle requests that the IRS clarify when the clean hydrogen production facility is deemed to "include" carbon capture equipment. H Cycle requests that the IRS consider separate project additions to facilities for which the hydrogen production lifecycle carbon emissions without carbon capture already qualify the facility for the full value of the § 45V production credit, but which stand to further reduce their carbon footprint with the addition of carbon capture. In this circumstance, such as for projects utilizing bioenergy with CCS ("BECCS"), the § 45Q credit provides an additional incentive for the addition of CCS in support of the United States' carbon reduction objectives.
3. **Renewable electricity indirect accounting for process energy**. H Cycle strongly supports the allowance of indirect book accounting mechanisms, such as through renewable energy credit ("REC") purchases or power purchase agreements ("PPAs"), for hydrogen production facilities to claim zero-carbon electricity as inputs in the calculation of lifecycle carbon emissions. H Cycle further recommends that a) any time-matching requirements be limited to a period no shorter than 30 days, b) additionality provisions be limited to a requirement for producers to retire the green attributes (i.e. RECs) associated the renewable electricity, and c) the indirect accounting provision require renewable electricity to be sourced from a generator within the same or adjacent balancing authority as the hydrogen production facility.

We hope that the IRS will consider our input and analysis as Congress pursues implementation of the § 45V clean hydrogen production credit. Further, we are hopeful these comments are just the start of ongoing discussions. H Cycle encourages the IRS to seek additional stakeholder input through issue-specific workshops, stakeholder roundtables and/or individual meetings.

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Comments Detail and Background

Section 45V defines "lifecycle greenhouse gas emissions" to "only include emissions through the point of production (well-to-gate)." Which specific steps and emissions should be included within the well-to-gate system boundary for clean hydrogen production from various resources?

For fuels derived from waste biomass, such as municipal solid waste, H Cycle recommends that the lifecycle well-to-gate emissions include the avoided emissions from the "base fate" of the waste material, and in doing so credit the fuel generated for the avoidance of emissions from the "base fate". This approach is in line with recognized lifecycle approaches, such as California's Low Carbon Fuel Standard ("LCFS") Tier 1 Organic Waste Calculator, Argonne National Laboratory's GREET model and the EPA Waste Reduction Model ("WaRM"). Furthermore, such treatment is in line with ISO 14040 in that the net greenhouse gas ("GHG") emissions correspond to the difference between the system and the reference or "base" system.

A simplistic approach for biomass assumes that biogenic CO_2 emissions are carbon neutral, provided that biogenic carbon is sourced sustainably. The base fate for the biogenic carbon in waste results in significant anthropogenic emissions owing to the production of methane, NO_x and other non-CO_2 emissions from landfilling, composting and other organic diversion options. The United States disposes of approximately 300 million tons per year of municipal solid waste ("MSW"), of which approximately 60% is organic in nature – this in turn contributes to 3.2% of all US GHG emissions per year[1]. Pathways utilizing waste biomass offer a significant opportunity to combat this critical source of emissions, but would require the consideration of the base fate of the waste material in their lifecycle carbon assessments.

Coordination with § 45Q. Are there any circumstances in which a single facility with multiple unrelated process trains could qualify for both the § 45V credit and the § 45Q credit notwithstanding the prohibition in § 45V(d)(2) preventing any § 45V credit with respect to any qualified clean hydrogen produced at a facility that includes carbon capture equipment for which a § 45Q credit has been allowed to any taxpayer?

H Cycle requests that the IRS clarify when the clean hydrogen production facility is deemed to "include" carbon capture equipment. H Cycle notes that a distinction that can be made amongst hydrogen production methods is whether carbon capture and sequestration ("CCS") is necessary to meet the carbon intensity thresholds under § 45V. In situations where CCS is not required for the facility to qualify for the full $0.60 per kg credit value, H Cycle posits that the carbon capture

[1] US EPA, Basic Information about Landfill Gas, September 6 2022; https://www.epa.gov/lmop/basic-information-about-landfill-gas#:~:text=Methane%20Emissions%20from%20Landfills,-Note%3A%20All%20emission&text=The%20methane%20emissions%20from%20MSW,energy%20use%20for%20one%20year.

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unit is not integral to the hydrogen production facility, but is instead a supplemental form of decarbonization, and could therefore be incentivized by the § 45Q capture credit. Such facilities may be owned by separate legal entities, effectively creating two separate projects. H Cycle believes that in such situations, allowing the § 45V credit for the hydrogen producer and the § 45Q credit for the carbon capture facility does not constitute a "double dip" but rather provides an incentive to two independent decarbonization projects.

The case of bioenergy with carbon capture and storage, also known as "BECCS", is a practical example of the opportunity described above. When paired with CCS, thermal conversion of waste organic materials offers one of the most economic and significant carbon dioxide removal strategies, which will be needed to achieve carbon neutrality in the US, as identified by the DOE's Energy Earthshot and Carbon Negative Shot Initiatives. For instance, the Lawrence Livermore National Laboratory's 2019 report *Getting to Neutral* determined that BECCS can provide the majority of the carbon-negative emissions needed by the state of California to reach carbon neutrality by 2045, stating, "Gasifying biomass to make hydrogen fuel and CO_2 has the largest promise for CO_2 removal at the lowest cost and aligns with the State's goals on renewable hydrogen."[2] This concept is similar to direct air capture ("DAC") but utilizes plant matter's ability to capture and concentrate carbon to provide a cost-effective solution for direct drawdown of CO_2 emissions by sequestering biogenic carbon.

In the case of BECCS, it is expected that the waste-organics hydrogen producer can achieve the full §45V credit due to a <0.45 kg CO_2/kg H_2 lifecycle score without the use of CCS. The site is however physically able to install carbon capture technology to sequester CO_2 for additional GHG reductions. As noted above, H Cycle believes that such projects should be incentivized to additionally provide BECCS as a viable service. H Cycle is concerned that without additional incentive, BECCS projects would be functionally inhibited and this critical tool for decarbonization would go without appropriate incentive or support.

Should indirect book accounting factors that reduce a taxpayer's effective greenhouse gas emissions (also known as a book and claim system), including, but not limited to, renewable energy credits, power purchase agreements, renewable thermal credits, or biogas credits be considered when calculating the § 45V credit?

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[2] 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 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. 5, available at https://www gs.llnl.gov/content/assets/docs/energy/ Getting_to_Neutral.pdf.

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H Cycle strongly supports the allowance of "indirect accounting", such as through renewable energy credit purchases, power purchase agreements or energy procurement through community choice aggregation, for hydrogen producers to claim zero-carbon electricity process energy input in the calculation of hydrogen lifecycle carbon emissions. H Cycle defines indirect accounting (also referred to as book-and-claim or virtual electricity supply arrangements) as the chain-of-custody model in which decoupled environmental attributes (such as RECs) are used to represent the ownership and transfer of zero-carbon electricity without regard to physical traceability. We view indirect accounting as critical to rapidly scaling clean hydrogen production in the United States and meeting the DOE's Hydrogen Shot target of $1.00 per kilogram levelized cost of hydrogen ("LCOH") this decade.

Hydrogen molecules are significantly more difficult to move than electrons. Electricity today takes advantage of a vast network of transmission and distribution lines that can easily flow power across thousands of miles. There is no analogous infrastructure network for the transportation and distribution of hydrogen. Moreover, hydrogen is the lightest known molecule in the universe, and is extremely difficult to move without tube trailers or pipelines that are specifically designed to prevent hydrogen leakage. Hydrogen production facilities should therefore be located as close to end-use customers as possible, such as adjacent to industrial complexes or urban heavy-duty transmission corridors.

By allowing indirect accounting, hydrogen producers can take advantage of zero-carbon electricity while avoiding the siting constraints associated with constructing co-located wind and solar generation. Without indirect accounting, hydrogen producers would be limited to building dedicated renewable energy facilities "behind the meter" at remote production facilities to claim zero-carbon electricity. Current renewable electricity sources such as wind and solar require a significant amount of land and make siting hydrogen production close to demand centers extremely challenging if not impossible. While developing dedicated transmission lines to deliver renewable power to hydrogen producers from afar is possible, this would add material development and construction cost and increase the ultimate LCOH; as well as take years of permitting to accomplish.

Indirect accounting is also critical to offering hydrogen producers the lowest possible levelized cost of electricity. Today's wind and solar projects take advantage of ever-increasing scale to offer competitive electricity prices to the market. This scale advantage disappears if hydrogen producers are forced to develop smaller, land-constrained, behind-the-meter generation in order to claim zero-carbon electricity. A better solution would be to dissociate the physical location of hydrogen production from wind and solar generation, thereby allowing for a lower LCOH via electricity prices supported by economies of scale.

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It should also be noted that the producers of clean hydrogen may not have the expertise or risk appetite to develop wind and solar generation alone. As the hydrogen sector is currently in its infancy, producers tend to focus more on de-risking hydrogen production technologies and developing the infrastructure to deliver their product to customers. Producers are unlikely to possess the knowledge, bandwidth or desire to simultaneously pursue wind and solar project development. This risk is better allocated to the many established renewable energy development companies across the country, who can leverage decades of experience and favorable financing terms to deliver zero-carbon electricity at highly competitive prices. Indirect accounting therefore serves to assign project risk to the appropriate entities, instead of compounding untenable cost burden and project risk on the hydrogen producer.

Importantly, H Cycle's recommendation on indirect accounting has been affirmed by a prior colloquy on August 6, 2022 in US Senate floor debate regarding Section 13204 (Clean Hydrogen) of the *Inflation Reduction Act* between Senator Tom Carper of Delaware and Senator Ron Wyden of Oregon. In the colloquy, Senator Carper mentions that it is his understanding that "in determining 'lifecycle greenhouse gas emissions' for this section, the Secretary shall recognize and incorporate indirect book accounting factors, also known as a book and claim system, that reduce effective greenhouse gas emissions, which includes, but is not limited to, renewable energy credits, renewable thermal credits, renewable identification numbers, or biogas credits"; to which Senator Wyden concurs.[3] The clarification by the Senators on the intent to allow indirect accounting for purposes of the *Inflation Reduction Act's* clean hydrogen sections (including the clean hydrogen production credit) is a key marker in support of book-and-claim as part of the federal legislation.

If indirect book accounting factors that reduce a taxpayer's effective greenhouse gas emissions, such as zero-emission credits or power purchase agreements for clean energy, are considered in calculating the § 45V credit, what considerations (such as time, location, and vintage) should be included in determining the greenhouse gas emissions rate of these book accounting factors?

We strongly urge the IRS to limit any requirements on time-matching electricity production and usage to a period no shorter than 30 days. In other words, the number of megawatt-hours of electricity used to produce clean hydrogen should match the number of megawatt-hours purchased at the end of each month. Any settlement period shorter than one month (e.g. hourly or daily) would impose a difficult parameter for hydrogen producers to overcome in the procurement of renewable electricity – such a provision may for instance require the installation of batteries in order to more consistently deliver zero-carbon power, increasing the cost of power and ultimate LCOH. We therefore recommend a 30-day (or longer) settlement period to promote the most competitive prices of renewable energy for clean hydrogen producers.

[3] Congressional Record Volume 168, Number 133 (Saturday, August 6, 2022), Senate, pgs. S4165-S4195, from https://www.govinfo.gov/content/pkg/CREC-2022-08-06/html/CREC-2022-08-06-pt1-PgS4165-3.htm

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We further recommend that the IRS avoid any additionality provisions that would require hydrogen producers to source zero-carbon electricity from new renewable generation; in other words, hydrogen producers should be able to contract for zero-carbon electricity with existing generators, where such generators have not yet committed to retiring their renewable attributes through alternate means. Given the momentum of renewable generation build-out across the US, as well as the policy tailwinds offered to renewable energy developers in the *Inflation Reduction Act,* we see little risk in hydrogen producers "cannibalizing" existing renewable electrons from the grid. There are many existing wind and solar assets that operate on a merchant basis – these projects offer a quick and simple contracting opportunity for hydrogen producers to claim zero-carbon electricity, thereby accelerating the deployment of clean hydrogen production in the country. H Cycle moreover suggests that any proof of additionality be limited to requiring the retirement of RECs by or on behalf of the hydrogen producer. This measure would ensure that green attributes are not double counted by the producer and other entities seeking to utilize such credits, such as electric utilities. Requiring producers to retire RECs would also increase the demand for these green attributes, sending a positive market signal to renewable energy developers to increase the supply of wind and solar generation assets on the grid.

Lastly, H Cycle recommends that any indirect accounting provision require electricity to be sourced from a generator within the same or adjacent balancing authority as the hydrogen producer. This ensures a "wires-to-wires" connection on the grid that supports the virtual supply arrangement.

H Cycle recognizes Congress' and regulatory agencies' need to continue strengthening the clean hydrogen production industry – we welcome the opportunity to collaborate further with the federal government to refine the development of the indirect accounting regulation.

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Conclusion

H Cycle appreciates the opportunity to offer feedback and recommendations in response to the IRS request for comments on the § 45V clean hydrogen production credit. We hope that our comments regarding a) the inclusion of base fate avoided emissions for clean hydrogen production processes utilizing organic waste materials, b) coordination of the § 45Q credit for projects producing clean hydrogen that include CCS but which do not rely on carbon capture to qualify for the full § 45V credit, and c) the allowance of (and parameters regarding) indirect accounting in the procurement of zero-carbon electricity for clean hydrogen production, are taken into consideration as part of Congress' ongoing efforts to foster a robust clean hydrogen economy in the United States. H Cycle looks forward to continuing engagement with the federal government as the clean hydrogen production credit is rolled out. We are available at your convenience to discuss our comments in further detail.

Sincerely,

Robert G. Morgan
Chief Executive Officer