FRONTLINE BIOENERGY, LLC

Capture the energy ⚡ Release the potential

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Electronic Submission via the Federal Portal at www.regulations.gov

Department of Treasury
Internal Revenue Service

Re: Section 45V of the Internal Revenue Code (IRS and REG-117631-23)

Frontline BioEnergy, LLC ("Frontline") submits these comments on section 45V of the IRS Code entitled "Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election to Treat Clean Hydrogen Production Facilities as Energy Property," published at 88 Fed. Reg. 89220 (referred to as "45V Proposed Rule"). Frontline believes that the IRA and specifically the 45V Proposed Rule is a key component of an overall effort to accelerate the decarbonization of the nation's energy supply by incentivizing innovative technologies such as Frontline's biomass gasification processes. Frontline's comments focus on the definition and utilization of clean hydrogen and the 45VH2-GREET model.

Frontline is a technology company that has developed a variety of gasification processes and equipment that are used to convert biomass and waste-derived feedstocks into a variety of high-value renewable energy or chemical products.

A biomass gasification project using Frontline's patented gasification process has four attractive attributes:

- **First,** a Frontline gasification project can produce large volumes of clean hydrogen (up to 30 million kilograms per year, or more) that are derived from biomass feedstocks, not fossil fuels.
- **Second**, a Frontline gasification project produces clean hydrogen that can be used as a feedstock for various hydrogen-carrier fuels or chemicals (ammonia, ethanol, methanol, renewable natural gas, etc.) and other high-value renewable energy end-products.
- **Third**, a Frontline gasification project is very efficient. For example, the electrical input required to produce clean hydrogen through a Frontline project can be self-generated using waste heat from the process and a small fraction of the biomass energy obviating the need for the enormous electrical input required for a hydrogen electrolysis facility having similar clean hydrogen production capacity.

- **Fourth**, a Frontline gasification project can capture the residual carbonaceous matter remaining after gasification is complete in a stable, carbon-rich biochar co-product that has significant carbon sequestration capabilities. For example, in 2020 the EPA credited 90% of the carbon in biochar from a Frontline project as permanently sequestered (https://www.epa.gov/sites/default/files/2020-05/documents/san-joaquin-deter-ltr-2020-05-11.pdf).

Frontline Comments Relating to Hydrogen in a Gas Mixture:

In reviewing the 45V Proposed Rule guidance document issued by the Treasury/IRS, Frontline has identified some potential issues that do not appear to be clearly addressed by either the Treasury/IRS request for comments or by the submissions furnished by the parties. The issues that Frontline has identified arise when the clean hydrogen produced by a project is not sold to a third party, but is used by the project, itself, as a feedstock for producing hydrogen-carrier fuels or other commercial end-use products.

As a rule, commercial hydrogen is produced when molecules containing hydrogen are subjected to a process that "breaks" the chemical bonds between the hydrogen atoms and the other atoms in the feedstock molecule, thereby forming elemental dihydrogen (H_2) molecules. In the case of an electrolytic process, electrical energy is used to break the chemical bonds between the hydrogen atoms and oxygen atoms in a water molecule. Once these chemical bonds are broken, hydrogen atoms combine to form elemental dihydrogen (H_2) and the oxygen atoms recombine to form elemental dioxygen (O_2).

In a biomass thermal gasification process, a similar process is used to break chemical bonds, except that heat in the gasification process provides the energy necessary to break the chemical bonds between the hydrogen atoms and the other atoms in the biomass feedstock molecules like cellulose. The resulting product of biomass gasification is a "syngas" containing approximately 50% elemental dihydrogen (H_2) mixed in with other gases that are co-produced in the gasification process (mostly carbon monoxide and carbon dioxide, with traces of tars and other gasification by-products).

In a simple case, the clean hydrogen produced by either a hydrogen electrolysis process or a biomass gasification project can be separated into a "clean hydrogen only" stream and sold to an end-use customer. However, the hydrogen-specific infrastructure necessary to support industrial-scale clean hydrogen production streams—the storage facilities, pipelines, transportation networks, etc.—are not well-developed in the U.S. In many cases, this means that the clean hydrogen produced by a project can be "stranded" because there is no economically viable way to transport that clean hydrogen from the project site to an end-user. As a result, many biomass gasification projects are designed to include further gas treatment processes so that the clean hydrogen entrained in the syngas produced by a biomass gasification project can be used as a feedstock for downstream processes that produce hydrogen-carrier fuels (such as ammonia, methanol, ethanol, renewable natural gas, etc.) and other commercially viable end-use products that can be distributed through existing

commercial networks. Biomass or waste gasification projects can make use of the H_2 in the syngas as a direct input into downstream processes without any requirement that the H_2 be separated, purified, or pressurized to meet any specific requirement.

The 45V Proposed Rule clearly recognizes that the clean hydrogen created by any project may be used as a feedstock to make commercial end-use products. The 45V Proposed Rule includes specific language that confirms that such clean hydrogen may be "sold or used" in the ordinary course of business (subject to third-party verification). Biomass or waste gasification projects are particularly well suited to use clean hydrogen as a feedstock for hydrogen-carrier fuels or other commercial chemicals or end-products because in many cases the non-hydrogen components of the project's syngas can also be usefully incorporated into the end-use products. Frontline requests that the IRS provide clear guidance that hydrogen sold or used does not have to exist as a 'pure' hydrogen stream but instead can be used or sold as one many constituents in a gas mixture.

Further, there does not appear to be any statutory or policy basis for imposing any requirement for separation of clean hydrogen into separately identifiable "streams" or adding stringent requirements for purity and pressure of such clean hydrogen streams. The IRA defines "clean hydrogen" **solely** by reference to lifecycle greenhouse gas emissions, as determined by the 45VH2-GREET model. Frontline applauds this technology neutral, feedstock neutral, and product neutral approach.

As a practical matter, the volume of elemental hydrogen (H_2) produced by any clean hydrogen project can be easily determined (and verified by third parties) using commercially available gas measurement equipment. Further, similar gas measurement equipment can be used to verify how much of the clean hydrogen produced by any project is incorporated in any downstream end-use product. Thus, the amount of clean hydrogen produced by any project, and incorporated by that project into commercially viable end-use products, can be accurately measured and verified.

There is simply no need for any additional restrictions relating to separation of clean hydrogen streams, or imposition of clean hydrogen purity and pressure requirements, on any project producing hydrogen that otherwise meets the greenhouse gas requirements of the applicable GREET model. Moreover, such restrictions would be counter-productive and unnecessarily stunt the growth of clean hydrogen supply. To the extent that potential offtake parties or transportation providers require that clean hydrogen meet specific purity and/or pressure requirements, or that end-use products include "tracking" information about the source of the clean hydrogen embedded in such products, then those requirements can be achieved through typical commercial arrangements, without the need to impose those requirements on all potential clean hydrogen outputs through regulatory actions.

The policy objectives of the IRA for supporting the expansion of the nation's hydrogen infrastructure would not be advanced by imposing any of these burdensome and inefficient restrictions. To the contrary, adoption of such restrictions would only serve to hamper the

development of additional clean hydrogen projects which runs counter to the policy objectives set for in the IRA.

Frontline Comments Relating to the 45VH2-GREET Model:

We appreciate the work that Argonne National Laboratories has done to provide a GREET model that directly supports the 45V tax credit and have long supported use of GREET as a transparent and well-respected lifecycle emission model that relies on the science of greenhouse gas (GHG) emissions, including the recognition of unique global warming impacts of specific GHG emissions. The 45V Proposed Rule seems to suggest that a project use the most recent GREET model available for the calendar year in which a tax credit is claimed. If this interpretation is correct, that means a project might have to apply 10 different GREET models over the life of the tax credit. This is an unnecessary complication, and more importantly, results in substantial risk to the project, as likely changes in legislation and rules could put project eligibility at risk. Such risk will be deemed unmanageable by project stakeholders and investors, thereby reducing investment in projects and the production of clean hydrogen.

The 45V Proposed Rule clearly describes that a project must use the most recent version of the 45VH2-GREET model to evaluate the carbon intensity of the hydrogen in the first year of production. Frontline suggests that a project be given the choice to i) use the 45VH2-GREET model applied in the first year of operation to the carbon intensity analysis of the hydrogen produced in subsequent years, which would mean that it would be possible for a project to only a one version of the 45VH2-GREET model over the entire 10-year tax credit eligibility period, or ii) have the option to re-evaluate a project in any given year using the then current 45VH2-GREET model, along with the option to use those results for the remaining tax credit eligibility period. This approach would eliminate the risk associated with legislative or regulatory changes that could result in a project no longer meeting the current requirements for clean hydrogen production because of a subsequent change in the rules.

Summary:

Considering the foregoing discussions, Frontline respectfully requests that the forthcoming rules to be issued by Treasury/IRS with respect to the implementation of Section 45V address the following issues:

1. The definitions of "qualified clean hydrogen" and/or "qualified clean hydrogen production facility" should make clear that the amount of clean hydrogen produced by in any process employed by the clean hydrogen facility can be measured using commercially available gas measurement equipment (subject to third party verification) but without any requirements for either (a) separation of such clean hydrogen into a separate process stream or (b) imposing any requirements as to the purity or pressure of such clean hydrogen. It should also make clear that "hydrogen" refers to elemental dihydrogen molecules (H_2).
2. The 45V rules should not require a project to use the most recent version of the 45VH2-GREET model in each year of operation. Such a requirement would unnecessarily place

unmanageable regulatory risk on a project and undermine investment in clean hydrogen production projects. A project should be given the option to continue using a 45VH2-GREET model for multiple years or choose to use the then current model in that tax year.

Frontline believes that the IRA is a key component of an overall effort to accelerate the decarbonization of the nation's energy supply by incentivizing innovative technologies such as Frontline's biomass gasification processes. Accordingly, we appreciate the opportunity to submit these comments.

Sincerely,

Jerod Smeenk
CEO