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Submitted via Email

U.S. Dept. of Energy
Hydrogen & Fuel Cell Technologies Office
Forrestal Building
1000 Independence Ave, SW
Washington, DC 20585

RE: Clean Hydrogen Production Standard Draft Guidance

REsurety, Inc. respectfully submits the following comments to the Department of Energy (DOE) in response to the Clean Hydrogen Production Standard (CHPS) Draft Guidance. REsurety is an analytics provider dedicated to advancing the clean energy economy, with expertise developed in analyzing the value, risk, and emissions impact of clean energy generation and energy consumption in power markets.

Section 1(b) of the CHPS Draft Guidance asks:

> *Lifecycle analysis to develop the targets in this draft CHPS were developed using GREET. GREET contains default estimates of carbon intensity for parameters that are not likely to vary widely by deployments in the same region of the country (e.g., carbon intensity of regional grids, net emissions for biomass growth and production, avoided emissions from the use of waste-stream materials). In your experience, how accurate are these estimates, what are other reasonable values for these estimates and what is your justification, and/or what are the uncertainty ranges associated with these estimates?*

In order to accurately assess the emissions consequences of using grid electricity to produce hydrogen—both for the selection of CHPS projects and calculation of the Section 45V tax credit—the carbon impact of hydrogen production should be assessed using high resolution data that reflects the reality of how electricity is produced, transmitted, and transacted. The use of **marginal emission rates** (CO_2/MWh) with high **locational** and **temporal** resolution is well recognized as one of the most accurate methods of measuring the carbon impact of incremental activity. This methodology relies upon on the following key features:

- A **marginal emissions rate** is the emissions rate (CO_2/MWh) associated with incremental generation or load on the power grid. Changes in incremental generation or load are met by marginal generators, which respond to grid conditions to keep supply and demand in balance and manage transmission constraints. The emissions impact of adjusting these marginal generators is considerably different from average emissions rates, which simply measure the emissions output of the average generator without giving any consideration to whether the output of that generator is actually impacted by the activity in question.

- **High locational resolution** is important because grid conditions and emissions vary substantially by location. Some grids are dominated by fossil-fueled resources, while others have high penetrations of zero-carbon generation. Even within the same grid, transmission constraints mean that different parts of the grid are served by different generators. Spatial averages obscure this variation and can also introduce biases in emissions footprints. Importantly, the emissions avoided by clean generation should be calculated at the location of generation, and the emissions induced by electricity consumption should be calculated at the location of consumption.

- **High temporal resolution** is important because grid conditions vary substantially over time, as do the emissions implications of power consumption. Some of this variation consists of seasonal, weekly, and diurnal cycles, or is driven by hourly weather variability. Some of this variation is driven by fundamental drivers, such as the relative price of coal and natural gas, or the relative abundance of clean vs. fossil generators. Temporal averages obscure this variation and can introduce systematic biases in emissions calculations. To address this, hourly or sub-hourly emissions rates should be used when calculating the emissions avoided by clean generation or induced by hydrogen production.

Use of marginal emissions, high locational resolution, and high temporal resolution will increase the accuracy of estimates of the carbon impact of hydrogen production, specifically, by measuring the grid emissions *avoided* by clean generation and the grid emissions *induced* by load. The emissions induced by electrolytic clean hydrogen production can be calculated as the hourly or sub-hourly product of energy consumed and the marginal emissions rate at the location of consumption. Similarly, the emissions avoided by clean energy generation can be calculated as the hourly or sub-hourly product of energy generated and the marginal emissions rate at the location of generation. The net of these two values would accurately reflect the total carbon impact of hydrogen production.

By contrast, GREET relies on an annual-average approach to estimating emissions, which could significantly miscalculate emissions from some hydrogen production.[1] Modeling by REsurety has found that, in some cases, use of annual-average grid-wide emissions rates can overestimate the actual emissions impact of an activity by 120% or underestimate by as much as -38%.[2] This meaningful misalignment between actual emissions impacts and annual-average estimates (such as those produced by GREET) could drive the development of hydrogen infrastructure to suboptimal locations.

Alternatively, a marginal emissions approach much more effectively optimizes alignment of capital investment in clean hydrogen infrastructure and actual carbon reductions by incentivizing clean hydrogen production when and where renewable generation would otherwise be curtailed, and by

[1] https://greet.es.anl.gov/files/elec-greet-net-2016
[2] https://resurety.com/wp-content/uploads/2022/10/Making_It_Count_White_Paper.pdf

promoting procurement of clean energy generation when and where that generation can avoid the most emissions.[3]

Lastly, it is important to note that marginal emissions data is readily available throughout the United States. A number of public and private providers currently supply marginal emissions data.[4]

REsurety respectfully submits that CHPS should be implemented with a primary focus on measuring actual emissions using marginal emissions rates in order to more effectively and consistently capture progress toward systemwide emissions reductions via the actions and investments of individual market participants.

Section 3(c) of the CHPS Draft Guidance asks:

> *Should renewable energy credits, power purchase agreements, or other market structures be allowable in characterizing the intensity of electricity emissions for hydrogen production? Should any requirements be placed on these instruments if they are allowed to be accounted for as a source of clean electricity (e.g. restrictions on time of generation, time of use, or regional considerations)? What are the pros and cons of allowing different schemes? How should these instruments be structured (e.g. time of generation, time of use, or regional considerations) if they are allowed for use?*

In "characterizing the intensity of electricity emissions" associated with clean hydrogen production, there is benefit to using existing constructs including renewable energy credits, power purchase agreements and other market mechanisms, because these constructs provide proven and effective means of establishing and conveying ownership interests in clean energy generation and associated emissions reductions. However, for these emissions reductions to be accurately assessed, they must be calculated using marginal emissions with high locational and temporal granularity. Failure to do so would most likely misrepresent the emissions impact of the clean energy procured. Accordingly, any methodology implemented should utilize emissions data with the following characteristics: (1) hourly rather than annual temporal increments, (2) marginal rather average emissions, and (3) local rather than regional geographic scope.

REsurety appreciates the opportunity to submit these comments and would welcome the opportunity to answer additional questions or provide additional information.

Respectfully,

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[3] https://resurety.com/wp-content/uploads/2022/03/REsurety-Locational-Marginal-Emissions-A-Force-Multiplier-for-the-Carbon-Impact-of-Clean-Energy-Programs.pdf
[4] https://media.rff.org/documents/Report_22-08.pdf