Institute of Clean Air Companies
Clare Schulzki, Executive Director
Cschulzki@icac.com
703-980-6144

November 14, 2022

TO: U.S. DEPARTMENT OF ENERGY HYDROGEN PROGRAM
FR: THE INSTITUTE OF CLEAN AIR COMPANIES
RE: DEPARTMENT OF ENERGY CLEAN HYDROGEN PRODUCTION STANDARD DRAFT GUIDANCE

The Institute of Clean Air Companies (ICAC) appreciates the opportunity to offer comments in response to DOE's Clean Hydrogen Production Standard (CHPS) Draft Guidance.
ICAC is the national trade association of companies that supply greenhouse gas management and air pollution control and monitoring systems, equipment and, services for stationary sources. For over 60 years, ICAC member companies have helped to clean the air by developing and installing reliable and cost-effective control and monitoring systems. ICAC is recognized as a trusted, unbiased technical resource for government and other stakeholders to understand the feasibility and relevant costs associated with innovative technologies.

ICAC's response will provide an overview of our perspective on developing pathways toward a low-carbon hydrogen economy. We support technology-neutral and flexible policies that enable cost-competitiveness and a diverse set of solutions to compete in the market. In addition, ICAC will provide responses to a number of DOE's questions on the CHPS Draft Guidance.

Again, ICAC appreciates the opportunity to offer input to DOE and we look forward to answering any further questions should DOE seek additional information.

Sincerely,

Clare Schulzki
Executive Director, ICAC

Introduction

The Institute of Clean Air Companies (ICAC) appreciates this opportunity to respond to the Department of Energy's Clean Hydrogen Production Standard (CHPS) Draft Guidance. ICAC supports DOE's effort to establish CHPS.

ICAC is a trade association headquartered in Arlington, VA, and represents more than 30 companies in the air pollution control, greenhouse gas management, and emissions measurement industry. ICAC members have successfully developed and deployed solutions to address emissions challenges for more than 60 years and are uniquely positioned to provide their expertise developing the low-carbon hydrogen economy in the United States. ICAC members have successfully commercialized solutions for the industrial, power, oil and gas, and maritime sectors, and have worked to address challenges that emerge at the nexus of air and water pollution management. Pollutants managed by member technologies include mercury, acid gases, PM, NOx, SOx, VOCs, HAPs, GHGs, HCl, and coal ash. Our members have operations in all 50 states and range from multi-national corporations with thousands of employees to small businesses focused on local emission challenges.

ICAC is recognized as a trusted, unbiased technical resource for government and other stakeholders to understand what is technologically achievable and the relevant costs associated with technologies. ICAC members' experience in meeting emissions challenges equips our organization with valuable insights that can help inform the development of successful policies, regulations, and other mechanisms to support the advancement of low-carbon hydrogen. We support policies that are technology-agnostic and flexible to enable cost-competitiveness. All solutions will be needed to meet the anticipated demand for low-carbon hydrogen and to reach our mid-century decarbonization goals.

ICAC members have decades of experience with hydrogen and represent the full value chain for of all types of low-carbon hydrogen production methods and utilization options, from production and processing, through distribution and storage, to everyday industrial and consumer applications. Member companies are participating in ongoing low-carbon hydrogen projects around the globe, spanning all levels of technology development and production methods (e.g., green and blue hydrogen).

In order to successfully secure American leadership in enabling net-zero carbon technologies, support sustainable development around the world, and benefit all Americans, a technology-neutral approach should be taken that focuses on carbon intensity and adequately supports the scale-up of proven technologies while de-risking earlier stage technologies from R&D to deployment. By allowing flexibility in government policies and initiatives, rather than prescribing specific solutions, the market will enable the best solutions to flourish.

Again, ICAC supports DOE's effort to establish CHPS and our members stand ready to provide support to DOE's Hydrogen Program and welcome the opportunity to further meet to communicate our industry's perspective on the low-carbon hydrogen economy.

Response to DOE's Proposal for a Clean Hydrogen Production Standard (CHPS)

1) Data and Values for Carbon Intensity

a) Many parameters that can influence the lifecycle emissions of hydrogen production may vary in real-world deployments. Assumptions that were made regarding key parameters with high variability have been described in footnotes in this document and are also itemized in the attached spreadsheet "Hydrogen Production Pathway Assumptions." Given your experience, please use the attached spreadsheet to provide your estimates for values these parameters could achieve in the next 5-10 years, along with justification.

The target for 95% carbon capture is valid and based on reasonable assumptions. ICAC anticipates this carbon efficiency level in future years can be increased to the 97% and 98% level by employing optimized auto thermal reforming and gas heated reforming (ATR/GHR) technologies.

b) Lifecycle analyses 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?

It is important to include reductions in local upstream emissions from methane, ethanol, ammonia, and other H_2 feedstocks/carriers to be used in calculating H_2 carbon efficiency. Using the GREET model, verifiable upstream emission reductions can be incorporated in H_2 carbon intensity calculations. EPA's eGrid Region by Zipcode tool[1] can also be used to calculate the carbon intensity of electricity used upstream or in the H_2 production process.

Incorporating upstream emission reductions in the assessment of an entity's compliance with the 4.0 $kgCO_2e/hgH_2$ standard will provide three significant benefits. First, it will provide a more accurate assessment of life cycle emissions reductions associated with the production and use of H_2. Additionally, it will send a strong market signal encouraging private sector investment in cost-effective upstream emission reductions that otherwise might not happen. Lastly, transparent life cycle accounting will provide the government, industry, and all public stakeholders with visibility on future opportunities to accelerate GHG emission reductions associated with H_2 production. This could, in turn, inform future policy actions and programs aimed at combatting climate change more aggressively and effectively.

e) Atmospheric modelling simulations have estimated hydrogen's indirect climate warming impact (for example, see Paulot 2021).19 The estimating methods used are still in development, and efforts to improve data collection and better characterize leaks,

---

[1] Accessed via: [Power Profiler ZIP Code Tool]

releases, and mitigation options are ongoing. What types of data, modelling or verification methods could be employed to improve effective management of this indirect impact?

DOE should consider requiring project developers to produce a plan outlining how fugitive hydrogen emissions at the production facility will be minimized. Publication of aggregated plan information would better enable supporting technology development focused on better emissions measurement and monitoring tools, data reporting and analysis, and more cost-effective emission management solutions. This approach has been used repeatedly by EPA and other environmental agencies to inform and accelerate emission management tools and technologies for conventional and toxic emission challenges. For example, successful efforts to measure, monitor, and capture mercury emissions from power plants began with similar public discussions of possible management plans and technology need identification.

ICAC would encourage DOE and other stakeholders to fund further research into the indirect impact of hydrogen on climate warming, to enable better quantification of the impact, and development of a more accurate global warming coefficient for hydrogen.

f) How should the lifecycle standard within the CHPS be adapted to accommodate systems that utilize CO2, such as synthetic fuels or other uses?

Other CHPS's (e.g., current UK regulations) do not credit CCUS applications unless captured CO_2 is permanently sequestered. We believe this is a sensible approach. It might be possible and appropriate to include utilization or temporary storage for captured CO_2 in some limited cases. In such cases, it would be necessary that subsequent re-releases of CO_2 be well characterized, and the life cycle carbon intensity of the H_2 can accurately reflect reduction of climate forcing enabled by non-permanent CO_2 solutions. Given the complexity of developing accurate re-emission scenarios, and the expense and difficulty of measurement and monitoring related to non-permanent solutions, their exclusion seems appropriate at this time.

2) Methodology

a) The IPHE HPTF Working Paper (https://www.iphe.net/iphe-working-papermethodology-doc-oct-2021) identifies various generally accepted ISO frameworks for LCA (14067, 14040, 14044, 14064, and 14064) and recommends inclusion of Scope 1, Scope 2 and partial Scope 3 emissions for GHG accounting of lifecycle emissions. What are the benefits and drawbacks to using these recommended frameworks in support of the CHPS? What other frameworks or accounting methods may prove useful?

It is best to limit the analysis methodology to that proposed by DOE (which includes Scope 1, Scope 2 and partial Scope 3 emissions). This approach is consistent with H_2 strategies being implemented elsewhere. Any other approach will likely put the U.S. CHPS at odds with other such schemes and further complicate efforts to develop global CHPS approaches to facilitate global trade in clean H_2 with a common approach to the system boundaries etc., of such schemes.

It is critical that DOE strive for consistency with other governments and non-government stakeholders regarding calculations methodologies and reporting requirements. The global introduction and use of decarbonized H_2 presents an important opportunity to transition to a significantly less carbon intensive economy. However, the challenges are myriad and complex. Consistency in calculation and reporting approaches will reduce some of the potential for confusion and increase private and public sector collaboration needed to accelerate clean H_2 production and scaleup.

b) Use of some biogenic resources in hydrogen production, including waste products that would otherwise have been disposed of (e.g., municipal solid waste, animal waste), may under certain circumstances be calculated as having net zero or negative CO_2 emissions, especially given scenarios wherein biogenic waste stream-derived materials and/or processes would have likely resulted in large GHG emissions if not used for hydrogen production. What frameworks, analytic tools, or data sources can be used to quantify emissions and sequestration associated with these resources in a way that is consistent with the lifecycle definition in the IRA?

In the IRA, lifecycle emissions factors are established based on the Argonne National Laboratory (ANL) GREET model. ANL should also administer the program to facilitate adjustments and refinements to assumptions and associated carbon intensities. Adoption of recommendations in the IPHE HPTF working paper should remain under ANL program guidance. GREET is widely seen as an effective tool administered based on a science-based decision-making process. Numerous recent examples illustrate ANL consideration of GREET model modifications based on new information provided by both trade organizations (e.g., agriculture and ethanol sector) and NGOs.

c) How should GHG emissions be allocated to co-products from the hydrogen production process? For example, if a hydrogen producer valorizes steam, electricity, elemental carbon, or oxygen co-produced alongside hydrogen, how should emissions be allocated to the co-products (e.g., system expansion, energy-based approach, mass-based approach), and what is the basis for your recommendation?

ICAC believes it makes sense to calculate GHG emissions on an energy allocation basis using lower heating values (LHV) energy content of the relevant products – as has been employed in CHPS calculations elsewhere.

3) Implementation

a) How should the GHG emissions of hydrogen commercial-scale deployments be verified in practice? What data and/or analysis tools should be used to assess whether a deployment demonstrably aids achievement of the CHPS?

Existing environmental attribute market programs should provide DOE with an excellent foundation for establishing efficient and effective verification and analysis tool. Best practices have already been created for low carbon and renewable fuel and power markets. Complex emission reductions are cataloged against appropriate baselines, documented in established data management systems, and subject to audit and verification protocols. Many of these markets already include calculations and methodologies that are directly applicable to verification of H_2 carbon intensity at commercial scale. DOE should utilize best practices drawn from the federal Renewable Fuels Standard, clean fuel standards implemented by various other jurisdictions, and renewable electricity programs in North America and Europe.

Additionally, DOE should consider how best to work with other agencies to implement a clean hydrogen standard in a manner that accelerates – rather than impedes – commercial deployment of H_2 solutions. While some portion of the H_2 supply should be able to meet the proposed standard by 2030, it may not be possible for the entire H_2 supply given various infrastructure demands and capital needs. DOE should seek strategies to reward the maximum progress toward this standard – including ways to encourage and reward decarbonization efforts that may be close, but still fall short of the standard. Failure to reward partial progress for the segment of H_2 that is unable to meet the proposed standard may result in a significantly slower progress toward full achievement of the standard by all H_2 suppliers. Finally, 2030 may be an aggressive target to meet the 4.0 standard. While there may be decent progress in the next 7 years, hydrogen infrastructure will need more time to mature so 2035/2040 seems more reasonable.

b) DOE-funded analyses routinely estimate regional fugitive emission rates from natural gas recovery and delivery. However, to utilize regional data, stakeholders would need to know the source of natural gas (i.e., region of the country) being used for each specific commercial-scale deployment. How can developers access information regarding the sources of natural gas being utilized in their deployments, to ascertain fugitive emission rates specific to their commercial-scale deployment?

As discussed above, project developers should have the option to utilize regional fugitive emissions data, as long as developers can demonstrate appropriate documentation, traceability, and verification for emission reduction claims associated with their project.

c) 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?

The primary aim of GHG emission reduction incentives is to unlock and accelerate private sector investment in decarbonizing solutions. DOE should not erect barriers to the use of multiple incentive structures for delivering decarbonized H_2. It is important and necessary to distinguish between incentives and compliance. It is equally important to distinguish between voluntary and mandatory compliance systems. Emission reductions should be counted a single time under national regulatory compliance requirements. But in some cases (e.g., the federal RFS, and the California LCFS) the same reduction of emissions from a transportation fuel can be counted appropriately for compliance with both programs – and calculated as part of meeting voluntary corporate ESG targets. Transitioning to a decarbonized economy will be difficult. Needless and counterproductive actions to prevent the appropriate stacking of incentives will only slow the transition. Enabling the private sector to utilize the most appropriate combination of incentives – paired with accurate and clear rules for regulatory compliance where appropriate – will do the most to accelerate the energy transition.

Power generation tied to the grid from all resources is accurately measured with revenue quality meters. The resolution of this information is commonly data logged in 1-5 second increments and reported to ISOs or self-balancing facilitators as their requirements dictate. Hydrogen production powered by intermittent generation sources is an emerging market that still has several years before wide-spread adoption of a workable approach using existing available data. Ability to quickly start and/or stop electrolyzers is in many cases cited as a simple solution for ensuring renewable power actually produced the claimed MWh. Unfortunately, some electrolyzers have significant start-up and shutdown timing that is not being adequately considered. This situation is similar to the EPA regulations excluding start-up and shutdown criteria pollutant emission levels for fossil generators. Renewable electricity credits (RECs) provide an approach that balances flexibility and accountability. However, current REC data and reporting requirements vary by location and have delivered uneven incentives for renewable deployment.

The ability to leverage the renewable carbon-free generation sources for competitive generation of electrolyzer hydrogen should not pick generation technology winners. Doing so would only introduce additional complexity and friction in the effort to deploy clean hydrogen. Rather, a technology neutral carbon accounting approach should be employed for power input calculations. Fair and equitable provisions should be established to support inclusion in the market of these valuable intermittent resources, but also limit to the maximum extent possible electrolyzer hydrogen generated by high-CI sources during REC periods that are too long or do not incorporate a start-up / shut-down provision. Leveraging available data, it would be practical to establish a 5-minute renewable energy credit. In order to effectively leverage renewable power, time operated outside of available 5-minute REC periods could be considered to generate grey hydrogen not applicable for qualification of IRA of 2022 hydrogen credits. This approach would resolve accounting for start-up and shutdown electrolyzer energy utilizing fossil resources, which in practicality produce every additional MWh for the grid in the Midwest utilizing coal and its associated higher CO_2 emissions.

Disallowing electrolyzer start-up and shutdown periods would hinder further development of more efficient solid state electrolyzer solutions that could reduce cost significant and spur increased production in the market. It would also effectively pick PEM technology as a clear technology winner, which should not be the intent of the DOE at this stage of large-scale electrolyzer technology development.

4) Additional Information

a) Please provide any other information that DOE should consider related to this BIL provision if not already covered above.

The DOE should endeavour to implement the CHPS in a manner intended both to minimize GHG emissions during clean hydrogen production and to facilitate global trade of clean hydrogen. For both reasons, DOE should consider opportunities to implement a standard with a clear pathway for delivering carbon intensities below the proposed 4 *$kgCO_2e/kgH_2$*. Allowing for and rewarding lower carbon intensities would drive minimization of GHG emissions during clean hydrogen production and would further intensify efforts to mitigate upstream fugitive emissions. It would also be a key enabler of global trade in clean H_2. The IRA creates an opportunity for the U.S. to establish a globally-leading position to export clean H_2 using tax credits to lower domestic production costs. This export potential will be facilitated by the U.S. having a CHPS aligned to, or even lower than, CHPS levels in other jurisdictions. Other CHPSs are moving to a lower intensity than the 4 kg/kg – for example the EU is expected to implement a 3.3 kg/kg standard, and the UK may set an even more stringent target at 2.4 kg/kg. If the DOE takes a more ambitious long-term view, it will also allow the U.S. to take a more prominent leadership position within the IPHE and other discussions about how best to develop and facilitate global trade in clean hydrogen.

ICAC supports the approach proposed by DOE to ensure CHPS is focused on the production of low carbon hydrogen. Other constituents derived from clean hydrogen, including clean ammonia, clean methanol, and sustainable fuels, should have separate carbon intensity standards that address the unique production and use case characteristics of those chemical.

Conclusion

Again, ICAC would like to thank DOE for the opportunity to respond to the Clean Hydrogen Production Standard Draft Guidance. ICAC members have a strong history in tackling emissions challenges, and we hope to provide you with valuable insights on hydrogen deployment strategies. We welcome an opportunity to further discuss these thoughts with you and are happy to answer additional questions or clarify any points made.

Contributing ICAC Members:

Burns & McDonnell
Johnson Matthey
Mitsubishi Power