DOE Hydrogen Program
Request for Information # DE-FOA-0002664
Regional Clean Hydrogen Hubs Implementation Strategy

Subject: Response to RFI # DE-FOA-0002664

Response Date: March 21, 2022

Contact:
Janice Lin
President and Founder
Green Hydrogen Coalition
2150 Allston Way, Suite 400, Berkeley, CA 94704
jlin@ghcoalition.org
O: +1 (510) 665-7811 x101
M: +1 (415) 595-8301
www.ghcoalition.org

RE: Regional Clean Hydrogen Hubs Implementation Strategy
(RFI # DE-FOA-0002664)

Green Hydrogen Coalition ("GHC")[1] submits these responses to the Request for Information ("RFI") issued by the Department of Energy's ("DOE") Hydrogen Program, on behalf of the Energy Efficiency and Renewable Energy ("EERE") Hydrogen and Fuel Cell Technologies Office ("HFTO"), the Office of Fossil Energy and Carbon Management ("FECM"), the Office of Nuclear Energy ("NE"), and in collaboration with DOE's newly formed Office of Clean Energy Demonstrations ("OCED"). GHC appreciates the DOE's leadership in advancing the critical role of regional clean hydrogen hubs ("H2Hubs"). This effort will drive global leadership, jobs development, industry invigoration, decarbonization, recognition, and green economy development targeted by the current administration.

GHC is an educational 501(c)(3) non-profit organization formed in 2019 to recognize the game-changing potential of "green hydrogen" to accelerate multi-sector decarbonization and combat climate change. GHC defines green hydrogen as hydrogen produced from non-fossil fuel resources and has climate integrity – emits zero or de minimis[2] greenhouse gas emissions on a life cycle basis. GHC's mission is to facilitate policies and practices that advance green hydrogen production and use in all sectors of the economy to accelerate a carbon-free energy future.

GHC is architecting a low-cost, scaled hub for green hydrogen in the Los Angeles ("LA") Basin. This initiative – HyDeal LA – has identified a pathway to achieve <$2/kg delivered green hydrogen in the LA Basin (consistent with the DOE Hydrogen Earthshot production goal of $1/kg by 2030) for high-volume off-takers, including power generation, oil refining, hydrogen fueling stations for on-road transport, and alternative fuel production for maritime shipping and aviation. A summary of key findings from Phase 1 of HyDeal LA can be found here.

Per DOE's request, GHC responses include corresponding category numbers and sub numbers for easy reference. GHC's specific responses on the DOE's RFI # DE-FOA-0002664 are below.

[1] https://www.ghcoalition.org/

[2] "De minimis" means an insignificant amount of non-renewable energy resources (does not exceed 10 percent of the total energy inputs) allowed to be counted as RPS-eligible. See Green, Lynette, Christina Crume. 2017. Renewables Portfolio Standard Eligibility Guidebook, Ninth Edition. California Energy CEC, Publication Number: CEC-300-2016-006-ED9-CMFREV.

RESPONSES:

Category 1: Regional Clean Hydrogen Hub Provisions and Requirements

C1. 2a: What CO2 equivalent emissions should be met within the project and its supply chain?

A 2 kgCO2e/kgH2 – which represents the clean hydrogen production standard set forth in Section 822(a) of the Bipartisan Infrastructure Law ("BIL") – is a reasonable equivalent for all GHG emissions associated with the production of hydrogen. However, this standard should be met based on onsite *and* upstream production emissions. This accounting approach includes all emissions associated with feedstock production, transportation, losses, flaring, hydrogen production, and carbon capture and storage (*if applicable*). This life cycle assessment ("LCA"), referred to as "well-to-gate,"[3] is crucial because it rigorously accounts for the climate impacts associated with hydrogen production pathways. Further, evaluating hydrogen production from well-to-gate will help reduce subjectivity and support a scientific approach focused on decarbonizing systems, not individual value chains. It is also a technology-agnostic approach, as it only considers the GHG emissions associated with hydrogen production based on a common and appropriately inclusive methodology. As a result, it opens a pathway for competition to flourish if the hydrogen can meet the desired life cycle emissions threshold, regardless of production technology.

C1. 2b: Please specify CO2e/kgH2 you anticipate at the point of production in addition to well to gate (i.e., including upstream emissions).

A well-to-gate LCA will need to be performed to determine the kgCO2e/kgH2. Thus, an LCA should be an essential component of the initial phase of H2Hub development. The DOE should adopt an LCA approach from the work conducted through the IPHE Hydrogen Production Analysis Task Force or utilize the GREET model or successor well-to-gate LCA model.

C1. 2c: Given the level of funding, and with the ultimate goal of developing a national clean hydrogen network, would four (4) large H2Hubs that each produce more than a certain amount of hydrogen (e.g., more than 1,000 tonnes/day, see question 3 to specify amount) or 6-10 H2Hubs of varying size be more effective?

Four large hubs will provide the best opportunity for economies of scale and demand aggregation, which will create a clear pathway for hydrogen to reach $1/kg by 2030. This approach also creates the opportunity for those larger hubs to expand organically over time and for those business models

[3] We define a well-to-gate life cycle emissions boundary to include the scope set forth by the IPHE in its recent white paper. Methodology for Determining the Greenhouse Gas Emissions Associated with the Production of Hydrogen, IPHE Hydrogen Production Analysis Task Force, https://www.iphe.net/_files/ugd/45185a_ef588ba32fc54e0eb57b0b7444cfa5f9.pdf

to be exported to future hubs that could be self-sustaining or connected to a larger hub already in place. DOE's primary target should be moving the hub concept forward to an inflection point, where private sector investment can take over and rapidly advance development based on tangible economic drivers.

Further, larger but fewer hubs have greater CO2e reduction potential due to the efficiency gains associated with economies of scale and diverse end-use sectors. With a larger hub, a more comprehensive range of end-users can purchase offtake, which provides additional learnings for the industry while also enabling the system value framework to provide efficiency gains to the hub and its stakeholders more broadly. For example, GHC's HyDeal LA Initiative identified a potential 2.3 Mt of qualified demand for green hydrogen in the LA Basin mainly from four types of off-takers – thermal power generation plants, refineries, cement plants, and mobility.[4] That said, regional demand needs to exist for the larger hub approach to be desirable. For each hub, sizing should be based on end-user demand and the diversity of representative sectors of demand. Hubs with a more diverse set of end-users will be more effective in the economic scaling of hydrogen infrastructure.

If DOE does decide to select additional H2Hubs beyond what is required in the BIL, DOE should prioritize those with the lowest carbon intensity. Selecting additional H2Hubs with the lowest carbon intensity is consistent with DOE's goal of selecting projects for Phase 2 funding that "meet or exceed the clean hydrogen production standard" and will have the most potential for decarbonization and pollutant emission reductions, compared to other pathways.

C1. 2d: What policies, infrastructure, or other considerations could be put in place to enable the H2Hubs to develop into a national clean hydrogen network in the future?

National Pipeline Transport and Storage Infrastructure: Mass-scale adoption of clean hydrogen requires the development of a substantial interstate pipeline network, much like the natural gas and oil pipelines in place nationally today. However, unlike the known regulatory governing bodies overseeing natural gas and oil pipelines, ambiguity exists regarding interstate regulatory authority for the economic regulation of blended and 100% hydrogen pipelines. If left unresolved, this ambiguity will impede project development, capital investment, and stall the mass-scale hydrogen market. Therefore, the DOE should identify the appropriate regulatory authority(s) to approve and regulate interstate blended and 100% hydrogen pipelines. Additionally, since a hydrogen economy will require vast pipeline infrastructure, GHC recommends that the DOE creates a policy vision for a US hydrogen backbone. This vision can replicate the same steps as the European Backbone initiative.

[4] https://www.ghcoalition.org/hydeal-la

Green Electricity Tariffs for Electrolyzers: The current leading green hydrogen production technology, electrolysis, faces barriers to mass-scale adoption, with the most significant being production cost. One way to reduce production costs is by developing compensation pathways that properly value the full range of benefits available from electrolytic hydrogen. One critical compensation pathway for electrolyzers is to value their ability to provide services such as capacity, curtailment, frequency support, voltage support, and ramping. Load serving entities and wholesale market operators can play a crucial role in developing this compensation pathway through tariff development.

Create a National Taskforce: The creation and support from a collaborative national clean hydrogen task force (*including representation from industry partners, non-profit stakeholders, DOE, and state leads*) can accelerate clean hydrogen deployment at scale and provide a platform for advancing innovation. An excellent example of an effective task force is the Western Green Hydrogen Initiative ("WGHI"). WGHI is a public-private partnership to assist interested states and partners in advancing and accelerating the deployment of clean hydrogen infrastructure in the West to benefit the region's economy and environment. WGHI cosponsors include the National Association of State Energy Officials ("NASEO") and the Western Interstate Energy Board ("WIEB"). This initiative engages interested western states and two Canadian provinces. It serves as the steering committee to assist in developing a regional green hydrogen strategy, including the development of large-scale, long-duration clean hydrogen-based renewable energy storage. This regional task force structure could be replicated for a national approach.

C1. 3f. Should H2Hub funding be made available to upgrade or develop newly dedicated clean electric or heat-generating energy resources (e.g., renewables or other clean generation sources) needed to produce clean hydrogen?

The renewable energy industry is competitive and mature, and we would suggest that the DOE generally refrain from allocating H2Hub funding to renewable sources. Stimulating additional demand through a clean H2Hub is sufficient. However, we would strongly encourage DOE to make funding available to 1) retrofit existing conventional power plants to run on a mix of natural gas and hydrogen or 100% hydrogen; and 2) offset installation costs of early at scale clean hydrogen projects, including electrolysis equipment and hydrogen transport and storage.

C1. 4a. What are the ideal timing and desirable features, terms, and conditions of off-taker agreements that would encourage construction and development of hydrogen hub infrastructure and long-term sustainability leading to local economic prosperity, including union jobs and benefits to disadvantaged communities?

Off-taker agreements are critical to the development of large-scale assets. Many things are required to provide H2Hub financing certainty, including investment-grade offtake, long-term contracting with some degree of price certainty baked in to offer the security of supply to the seller and buyer,

and a take or pay clause to offer financial security for the seller and buyer. Agreements should be like other long-term supply agreements across the energy industry to enable project finance and multiple-year tenor agreements. For instance, including long-term purchase and sales agreements, with a minimum of 20 years, will be vital for allowing stable revenues for clean hydrogen projects.

Furthermore, since these projects will need private capital to complement DOE funding, a key constraint will be the uncertainty of the clean hydrogen projects. For example, the newness and unproven nature of electrolysis at scale in the US will undoubtedly cause challenges with capital investment opportunities due to risk appetite. In essence, some form of federal guarantee – a type of insurance to protect banks and investors from project risks – would be a critical tool in building clean hydrogen projects.

C1. 5a. A region could be defined as anything from a city, a state, multiple states, tribal communities, or a geographic area. Should DOE define the regions or allow applicants to define them within their proposal? If a definition is preferred, explain how regions should be defined for the purposes of this FOA and provide the rationale.

H2Hubs are unique due to a geographic area's available resources, existing infrastructure, and stakeholders. A regional H2Hub is, therefore, a means by which some combination of existing infrastructure owners/operators, demand off-takers/suppliers, and additional co-located stakeholders can design and build a hydrogen system that effectively produces, stores, transports, and applies or converts hydrogen at scale. Due to the variance that presides over a geographic area, the DOE should not define the regions but should require applicants to address how their regional H2Hub will support neighboring H2Hubs and ultimately help DOE stitch together a national framework.

C1. 7a. What tools should H2Hubs utilize to meet the goals of creating good union jobs and work opportunities for local residents in the construction phase of the project and in the long-term operations phase of the project?

One of our critical national assets is our existing infrastructure and skilled workforce. Clean hydrogen enables us to accelerate our clean energy transition dramatically and will require repurposing much of this infrastructure and massive workforce training. Phase 1 awardees should identify all required skills and jobs for the construction and operation of the H2Hub infrastructure. They should then engage local labor unions representing those jobs as part of the H2Hub planning process. The local labor unions can identify existing job classifications with skillsets that will be transferrable to hydrogen jobs. They can also identify skill gaps and create training programs. The labor unions and H2Hubs can then collaborate to leverage existing collective bargaining agreements that allow for new jobs or modify existing jobs within the bargaining unit to better support H2Hub projects. Additionally, the H2Hubs should work with higher education institutions,

apprenticeship programs, and other workforce development agents to certify the local workforce to create highly skilled workers and tradespeople with skills related to hydrogen infrastructure.

Category 2: Solicitation Process, FOA Structure, and H2Hubs Implementation Strategy

C2. 12. How much time will be needed to complete the Phase 1 activities?

Ideally, Phase 1 should be a 24-month process to allow hub design, financing, jobs and emissions studies, preliminary National Environmental Policy Act (NEPA), and related reviews. A condensed Phase 1 timeline could hinder larger H2Hubs that require more complex scope activities to satisfy DOE requirements.

C2. 14. How much funding should DOE allocate for adding new technologies, capabilities/end uses, or Partners to the existing hubs (i.e., Launches 3 and 4)?

A $1 billion reserve for new technologies, capabilities/end uses, or partners to the existing H2Hubs is sufficient. Realization of opportunities and needs as H2Hubs come to fruition may require future investment so that the clean hydrogen industry can continue to scale in a coordinated manner. Importantly, reserved funding to solve challenges identified can have a multiplier effect that boosts demand for hydrogen and may encourage further hydrogen supply cost reductions through improvements in efficiency and economies of scale. Lastly, it can also help grow new technology, manufacturing, and service businesses that provide highly competitive solutions to the hydrogen industry.

C2. 21. Based on EPAct 2005, Section 988, the cost share requirement for demonstration and commercial application projects are 50% cash and/or in-kind and must come from non-Federal resources (50% of the total project cost which includes both DOE share and recipient cost share). For example, a $1B award for the Phase 2 Hub Deployment will require $1B in matching cost share. Is it feasible for projects to meet this 50% cost share requirement on an invoice-by-invoice basis?

It is not feasible for H2Hub projects to meet a 50% cost share requirement on an invoice-by-invoice basis. This requirement will be administratively burdensome and should not be considered. Instead, H2Hub projects at this scale should meet a 50% cost share requirement based on the overall project cost.

C2. 24. What types of cross-cutting support (e.g., technical assistance) would be valuable from the DOE/national laboratories, and/or from other federal agencies, to provide in proposal development or project execution? Are there other entities that DOE could fund to provide technical assistance across multiple H2Hubs?

- ***DOE***: Increase intergovernmental collaboration to involve other federal agencies in supporting common permitting issues and processes, timelines, hydrogen outreach and training, and codes and standards efforts.

- ***National laboratories***: Provide technical assistance on emerging technologies, demonstrations, and various issues and concerns. Also, the DOE should provide follow-on funding that partners national lab researchers with H2Hubs to support the R&D process, demonstrate new technologies, and help transition those technologies out of the lab and into commercialization.

- ***Federal or State Occupational Safety and Health Agency (OSHA)***: Guidance on compliance with occupational safety and health regulations to ensure safe and healthful working conditions through advising on standards, providing training, outreach, education, and assistance related to the installation of hydrogen systems.

- ***Pipeline and Hazardous Materials Safety Administration (PHMSA)***: Support H2Hub development activities to ensure that hydrogen is transported safely. This includes providing clear technical guidance regarding safety implications of infrastructure materials, designs, and systems; research supporting additional industry consensus standards; [and] efforts to educate and prepare emergency responders.

C2. 26. How could funding under other BIL provisions (e.g., Section 40303, Carbon Capture Technology Program) be leveraged by the H2Hubs to maximize the impact of BIL funding?

The DOE should leverage its Carbon Capture Technology Program funding with the planned clean H2Hub development to support the production of low carbon liquid fuels. The DOE's H2Hub effort should be closely coordinated with planned investment in needed carbon sequestration and utilization infrastructure – which will be critical to capturing mass scale CO2 sources needed to create decarbonized derivative liquid fuels with clean hydrogen. Further, the DOE could also consider leveraging the Carbon Capture Technology Program funding to expand H2Hub efforts to support the production of carbon-negative chemicals and polymers from clean hydrogen and CO2, which would both open new pathways for decarbonizing the petrochemical value chain and open new routes to sequester CO2.

Category 3: Equity, Environmental, and Energy Justice (EEEJ) Priorities

C3. 27. What strategies, policies, and practices can H2Hubs deploy to support EEEJ goals (e.g., Justice40)? How should these be measured and evaluated for the H2Hubs?

Phase 1 awardees should be required to assess community impacts from hydrogen production and use and co-create a path forward with these communities. Phase 1 awardees should be required to 1) develop an EEEJ stakeholder engagement plan aimed at engaging and educating impacted communities; 2) Evaluate pollution reductions and health effects in impacted communities, demonstrating that the emissions benefits of this new system will be equitably spread; and 3) Assess Economic development/jobs evaluation opportunity, demonstrating that the economic benefits of this new system can be equitably spread.

Category 4: Market Adoption and Sustainability of Hubs

C4. 34. If DOE asks for a market analysis as part of the application process, what should the analysis include so that DOE can be confident that a proposed project will be successful.

DOE should request that applicants identify and verify relationships and commitments with producers and off-takers. Additionally, DOE should request that applicants structure a plan that outlines near-term and long-term growth in demand for hydrogen. Applicants who provide concrete evidence of existing demand and detailed plans to increase demand should be prioritized.

CONCLUSION

GHC appreciates the opportunity to submit these responses and would like to stay actively involved in this process as DOE moves forward and considers actions that may impact clean H2Hubs.

Respectfully submitted,

/s/ Janice Lin
Janice Lin
Founder and President
GREEN HYDROGEN COALITION