H2ALO hydrogen hub

LOUISIANA • OKLAHOMA • ARKANSAS

HALO HYDROGEN HUB RFI SUBMISSION FOR U.S. DEPARTMENT OF ENERGY

Per DE-FOA-0002664: BIPARTISAN INFRASTRUCTURE LAW –
2022 REGIONAL CLEAN HYDROGEN HUBS IMPLEMENTATION STRATEGY
March 21, 2022

The HALO three-state hydrogen hub coalition, a partnership between Louisiana, Oklahoma and Arkansas appreciates the opportunity to provide assistance to the U.S. Department of Energy (DOE) in setting parameters and shaping the discussion for implementing clean hydrogen hub strategies going forward. The work of forming the initial coalition and the cooperative efforts involved in preparing our response to the Request For Information (RFI) document have given us a head start in examining the areas where our respective states can support each other in both resources and strengths we have in common and in areas where each member state's unique assets complement those of the other partners in the shared effort. Our states are well-situated from an industry and resource standpoint, and our administrations are excited to work together to make clean hydrogen affordable and available as part of a wider clean energy future. In light of that, please review our RFI responses and feel free to reach out to the points of contact below for any further information.

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Louisiana, Oklahoma, and Arkansas Response to DOE's Regional H2Hub RFI

Category 1: **Regional Clean Hydrogen Hub Provisions and Requirements**

1. ***The BIL defines a "regional clean hydrogen hub" as "a network of clean hydrogen producers, potential clean hydrogen consumers, and connective infrastructure located in close proximity."***

    a. ***What should qualify as 'close proximity' in context of the hub requirements?*** Proximity should be determined on a case-by-case basis depending upon the applicants' concepts for a networked hub, however, the movement of hydrogen from the point of production to the point(s) of consumption, as well as for carbon sequestration, are limited to about 350-mile radii.

    b. ***What existing facilities and infrastructure, including pipelines and storage facilities, could be most easily leveraged by the H2Hubs?*** Existing hydrogen production and consumption facilities, (including ammonia production), which can be leveraged by new low-carbon and carbon-neutral production facilities to both back stand supplies and provide a market for new hydrogen ecosystems, economical and abundant sources of renewable energy with the potential to add substantial generation capacity in the future, sustainable water sources water, plentiful and affordable natural gas, existing carbon capture use and geological storage facilities with the capabilities to expand sequestration and associated monitoring and data robustness to manage geostorage, an environment monitoring network to assess impacts to urban and rural community air and water quality by hydrogen transition, existing collaborations within research universities for research, testing, and workforce development, diversified workforce within energy focused corridors, engaged and participating Tribes, nuclear power production, extensive highways with strategic crossroads and large annual tonnage movements, power generation willing to blend hydrogen with natural gas and ultimately utilize pure hydrogen, reliable interstate high voltage electricity power transmission capacity to assure multi-state hubs have the ability to transmit renewable energy across the entire hub, inland sea ports and seaports with associated drayage equipment and tugs, major airports and military installations with ground transportation vehicles that can be converted to hydrogen fuel, and extensive natural gas pipeline networks that can support hydrogen transport and diverse blending opportunities.

    c. ***What types of new 'connective infrastructure' will be needed by the H2Hubs (e.g., pipelines, storage, etc.)?*** Hydrogen storage below ground in depleted oil and gas reservoirs, salt formations, salt domes, existing and expansion of geology targets for hydrogen and carbon capture, use and storage, monitoring networks for managing geostorage. Environmental, weather, and geological monitoring networks to ensure safety and compliance, and decision making for weather and geological related controls to enhance electrical grid reliability and asset

optimization. Connected data transmission and computing infrastructure for AI/ML enabled decision making to aide grid optimization. Hydrogen fuel stations along network of high tonnage highways. Alternatives for H2 transport including existing and modified natural gas pipelines, and newly installed H2-rated pipelines.

d. ***What supportive activities would make the hydrogen hubs successful and sustainable (e.g., workforce development, community-based organization engagement, domestic manufacturing, labor standards, etc.)?*** Partnerships with research universities for the workforce development, industrial research and testing, partnerships with community colleges for workforce development upskilling and reskilling, coordination with Tribal Nations, military, and other federal entities, Environmental, Social and Governance (ESG) and other energy-science training, streamlining required federal permits (for both hydrogen, carbon capture, and supply chain activities), domestic supply chain support and development (pivoting manufacturers into the hydrogen economy), and support with stakeholder engagement to include a focus on the creation of technical jobs for under-represented minorities. Outreach and education to ensure that key components of the hub (e.g., carbon capture and disposal in depleted oil formations) are well understood and supported by the stakeholders/residents of host communities. Preference should be given to plans that identify and address such concerns in the early stages of the program.

2. ***The BIL states that H2Hubs must (1) demonstrably aid the achievement of the clean hydrogen production standard developed under Section 822(a) [defined as 2 kg CO_2e/kg H_2 at the point of production]; (2) demonstrate the production, processing, delivery, storage, and end-use of clean hydrogen; and (3) can be developed into a national clean hydrogen network to facilitate a clean hydrogen economy.***

a. ***What CO2 equivalent emissions should be met within the project and its supply chain? What strategies are available for, and how can DOE incentivize, the H2Hubs to reduce emissions not only at the point of production but also including upstream emissions? What challenges are there in measuring CO2 equivalent emissions?*** Measuring improvements from today's baseline CO2 associated with hydrogen production using a multi-year progression toward Section 822(a) objectives, which includes an "all of the above" solution approach to attain emission levels within boundaries of the H2Hubs. Leverage established partnerships with scalable carbon monitoring efforts such as emerging satellite technologies like GeoCarb. A thorough guideline for life cycle inventory analysis and life cycle impact assessment.

b. ***Please specify CO2e/kg H2 you anticipate at the point of production in addition to well to gate (i.e., including upstream emissions). Include range?*** Total CO2e/kg H2 as an average across the total H2Hub portfolio should strive to attain Section

822(a) for all new hydrogen production facilities (those facilities entering commercial operations no earlier than 1/1/2022), striving to attain 970gCO2e/kg H2 with renewable electrolysis approaching 9kg CO2e/kg of H2 (GREET 2019).

c. ***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 (4) well-funded hubs formed by an alliance spanning regional geographies with diverse production and consumption characteristics that can fulfill multiple deliverables, attain no less than 2 million kg per year, and provide the best platform for highly probable and sustainable growth post DOE funding initiatives, focusing on regional GHG reduction pathways with hundreds of millions of tons per year emission reduction potential.

d. ***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?*** Timely permitting and clear framework for Class 6 disposal wells for carbon sequestration supported by research with pilot scale experiments, and a framework for Class 2 hydrogen injection. Coordination of complementary grants and funding for infrastructure initiatives which will support the complexities of implementing the H2Hubs, including but not limited to, electricity grid infrastructure modernization initiatives that provide transmission flexibility for electricity system load balancing which fully utilizes the flexibility of electrolyzer technologies.

e. ***How should the H2Hubs be asked to measure progress toward the administration's goal of transforming the economy by 2050 to achieve net-zero emissions goals? Please be as specific as possible***. CO2e progressive improvements from a 2021 baseline greenhouse gas footprint, computed following generally accepted methodologies utilized for corporate sustainability reporting. Industrial adoption of H2-based solutions, clean energy investments in the region, academic innovations commercialized, graduation of students able to take the H2 economy further.

3. ***FEEDSTOCK DIVERSITY: "To the maximum extent practicable– (i) at least 1 regional clean hydrogen hub shall demonstrate the production of clean hydrogen from fossil fuels; (ii) at least 1 regional clean hydrogen hub shall demonstrate the production of clean hydrogen from renewable energy; and (iii) at least 1 regional clean hydrogen hub shall demonstrate the production of clean hydrogen from nuclear energy."***

a. ***Should DOE require a minimum level of hydrogen production per regional clean hydrogen hub, and if so, what should that minimum amount be (i.e., X***

tonnes/day)? Should this requirement vary for clean hydrogen produced from fossil fuels with carbon capture and storage (CCS), renewable energy, and nuclear energy? If a minimum is not specified, how may DOE incentivize larger capacity hubs? DOE should consider the most robust and diversified hub concept that can sustainably strive toward the Section 822(a) objective with existing technologies in the full supply chain while providing dependable supplies for a diverse group of first movers in the consumer sector for the hydrogen produced, with a minimum total production within each hub of 2 million kg per year by the end of the funding period.

b. ***Related to 3a, how should DOE take into account specifying minimum required hydrogen production when considering capacity factors and the potential intermittency of generation, which would increase the cost and requirement for hydrogen storage?*** DOE should consider all possible solutions to match supply with demand, including underground storage in salt formations and depleted fossil fuels reservoirs, mechanisms to reward ancillary electric grid congestion relieve, and other solutions.

c. ***What terms should be required for an H2Hub powered by renewable energy to demonstrate clean production (e.g., a power purchase agreement with a renewable generator, or direct connection to a co-located renewable generator)?*** Access to renewable energy delivered to the production via purchase power agreement, utility tariff, or other acceptable proof of renewable energy supplies.

d. ***Should DOE prioritize the repurposing of historic fossil infrastructure in the regional hub(s) focused on production from fossil fuels and if so, over what time frame? If yes, should DOE incentivize an eventual transition from fossil fuels to another fuel source? What conditions should DOE place on the carbon intensity of the fossil fuels (with CCS) used in this hub other than what is already specified in the BIL?*** The DOE should encourage cooperation within historic fossil infrastructure as we transition to low-carbon energy, leveraging an H2Hub's existing hydrogen production facility for reliable back-up supplies during operational situations which negatively impact low carbon hydrogen producers to assure markets have readily available fuel. Diversifying supplies of hydrogen during the early stages of implementation could reduce price and supply volatility across commodities.

e. ***How might hydrogen production be constrained by the availability of clean electricity or natural gas supply and distribution? Will hydrogen producers provide a sustainable market/revenue stream for clean electricity and natural gas that encourages new investments to expand electricity generation and natural gas production capacity? Are separate federal, state, or local incentives to expand clean electricity generation or natural gas production capacity available, necessary, or adequate?*** All solutions should be considered and analyzed, while a hub should provide a forum for optimization concepts that maximize availability

and dependability with a focus on profitability for all methods of hydrogen production, while simultaneously maintaining off-setting of historic higher carbon intensive industries; diversification is key to resilient supply to assure new demand side market participants have hydrogen they require, which will lead to reduced volatility. Additionally, electricity grid enhancement funding within the Infrastructure Bill should be considered for the implantation of the hydrogen hubs to complement the operational benefits of electrolyzers for grid operations.

f. ***Should H2Hub funding be made available to upgrade or develop new dedicated clean electric or heat generating energy resources (e.g., renewables or other clean generation sources) needed to produce clean hydrogen?*** Yes, retrofitting existing assets for hydrogen economy should be supported, which can include, but not limited to, natural gas fired power generation retrofitting, replacement fleet vehicle expense abatement, natural gas pipeline upfitting for blending, and drayage mobile equipment support.

4. ***END-USE DIVERSITY: "To the maximum extent practicable– (i) at least 1 regional clean hydrogen hub shall demonstrate the end-use of clean hydrogen in the electric power generation sector; (ii) at least 1 regional clean hydrogen hub shall demonstrate the end- use of clean hydrogen in the industrial sector; (iii) at least 1 regional clean hydrogen hub shall demonstrate the end-use of clean hydrogen in the residential and commercial heating sector; and (iv) at least 1 regional clean hydrogen hub shall demonstrate the end-use of clean hydrogen in the transportation sector."***

a. ***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? Would hubs that supply multiple end users provide advantages, and in what ways?*** Ten years or longer duration off-taker agreements should be a minimum for hubs that engage multiple end users into the hydrogen ecosystem (multiple off-taker hubs should have priority); diversification of the hydrogen ecosystem is a key to success**.** Preference should be provided to a hub that has established and modern hydrogen producers and consumers that can be leveraged during the early phases of the new hydrogen ecosystems, to aide in attaining critical mass and economies of scale from production to consumption and all processes in between.

b. ***What approaches can applicants use to guarantee off-taker commitments and matching of supply and demand?*** Incentivize off-takers' economics to assure cost indifference (e.g.: Class 8 vehicle overall cost of ownership compared to diesel fuel) with a commitment to participate for the duration of the funding

cycle with a structure similar to open access pipelines' and LNG facilities' firm capacity precedent agreement format.

c. ***The climate value of displacement may vary across end uses. How should the climate benefit of different hydrogen end uses be considered?*** Greenhouse gas reduction computed on a CO2e basis utilizing generally accepted analytical methods, similar to that of natural gas versus coal power generation, or electric vehicles versus gasoline-powered vehicles.

5. ***GEOGRAPHIC DIVERSITY: "To the maximum extent practicable, each regional clean hydrogen hub– (i) shall be located in a different region of the United States; and (ii) shall use energy resources that are abundant in that region."***

   a. ***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.*** Applicants should be allowed to define regions.

   b. ***In addition to sufficient energy and feedstock/water resources, what other regional factors should be considered when identifying and selecting regional hubs (e.g., economic considerations, policy considerations, environmental and energy justice considerations, geology, workforce availability and skills, current industrial and other relevant infrastructure and storage available/repurposed/reused, industry partners, minority-serving institutions [MSIs], minority-owned businesses, regional specific resources, security of supply, climate risk, etc.)?*** Considerations for lowest cost of living, sizeable workforce that can readily pivot into the hydrogen economy, business friendly states (states which promote and provide support for new enterprises), renewable energy, abundance of opportunity for additional renewable energy production in the future, plus all of the following which contributes to the economies of scale necessary for a hub to thrive: existing hydrogen production and consumption facilities which can be leveraged by new low-carbon production facilities to both back stand supplies and provide a market for new hydrogen ecosystems, existing collaborations within research universities for research, testing, and workforce development, economical and abundant sources of renewable energy with the potential to add substantial generation capacity in the future, plentiful water/water reuse, plentiful and affordable natural gas and existing natural gas infrastructure and subsurface pore space, existing carbon capture use and storage facilities with the capabilities to expand sequestration, diversified workforce within energy focused corridors, engaged and participating Tribes, nuclear power production, extensive highways with strategic crossroads and large annual tonnage movements, power generation

willing to blend hydrogen with natural gas and ultimately utilize pure hydrogen, reliable interstate high voltage electricity power transmission capacity to assure multi-state hubs have the ability to transmit renewable energy across the entire hub, inland sea ports and seaports with associated drayage equipment and tugs, major airports and military installations with ground transportation vehicles that can be converted to hydrogen fuel, and extensive natural gas pipeline networks that can support diverse blending opportunities.

6. ***HUBS IN NATURAL GAS-PRODUCING REGIONS: "To the maximum extent practicable, at least 2 regional clean hydrogen hubs shall be located in the regions of the United States with the greatest natural gas resources."***

    a. ***What level of natural gas resources should be required to qualify as a region with the "greatest natural gas resources"? How should DOE consider the difference between the available natural gas resources and the current natural gas production of an area when considering hub candidates? How should DOE consider the volatility of natural gas prices and its effect on production levels when defining these regions?*** (1) historical production highs, (2) historical production averages, (3) Estimated Ultimate Recovery ("EUR") for the average well in the given basin, (4) total Proved Developed Producing reserves ("PDP"), (5) total Proved & Probable reserves ("2P"), (6) total Proved, Probable & Possible reserves ("3P"), (7) carbon intensity of the upstream and midstream sectors in the given basin and (8) renewable electricity penetration within the given basin.

    b. ***How should DOE consider the volatility of natural gas prices and its effect on production levels when defining these regions? Should annual (or average over a five-year period) production and/or available proven reserves be the criteria for the above provision?*** Yes, a five-year average would be an appropriate criterion.

7. ***EMPLOYMENT: DOE "shall give priority to regional clean hydrogen hubs that are likely to create opportunities for skilled training and long-term employment to the greatest number of residents of the region."***

    In keeping with the administration's goals, and as an agency whose mission is to help strengthen our country's energy prosperity, the Department of Energy strongly supports investments that expand union jobs, improve job quality through the adoption of strong labor standards, increase job access, strengthen local economies, and develop a diverse workforce for the work of building and maintaining the country's energy infrastructure and growing domestic manufacturing. The Department intends to use the H2Hubs to support the creation of good-paying jobs with the free and fair choice to join a union and the incorporation of strong labor

standards and training and placement programs, especially registered apprenticeship. Respondents to this RFI are encouraged to include information about how this program can best support these goals.

a. ***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****?* Implement workforce training, workshops, short-courses, and college programs to prepare the local workforce. Utilize state universities to develop training programs for both young students, apprenticeships, post-graduate programs and local residents in transition.

b. ***What tools should H2Hubs utilize to meet the goals of providing opportunities for workers displaced from fossil industries and other industrial or resource-based industries in decline?*** Colleges and universities associated with the H2Hubs should have existing educational capabilities in energy, energy transition, and energy management to enable reskilling, and be at the forefront of energy technology research.

c. ***How should short-term build-out (i.e., construction phase) employment and long-term operational employment opportunities be measured and evaluated?*** N/A

d. ***What would "success" look like, especially related to Diversity, Equity, and Inclusion (DEI) and support for union and energy transition jobs?*** N/A

e. ***How should H2Hubs include workforce development and training activities (e.g., by including institutions of higher education, such as MSIs, community-based organizations, registered apprenticeship programs, joint labor-management apprenticeship programs and quality community-based pre-apprenticeship programs, as project partners)? In addition to each H2Hub having its own workforce development and jobs plan, should there be a nationally coordinated effort between hubs (and other hydrogen activities) to ensure an adequately trained workforce is available? If so, how should this be designed?*** H2Hubs should have universities with existing energy, energy transition, and energy management undergraduate and graduate programs can collaborate to provide for degrees and certifications that include coursework and fieldwork to build the needed workforce and to transition existing workforce along with robust community college systems.

f. ***How will the H2Hub training model offer opportunities for a range of jobs across the hydrogen supply chain?*** Pivot US manufacturing into the hydrogen supply chain from their existing operational focus which will require workforce training, associated with retooling, while simultaneously diversifying their

portfolio and bolster Made in America domestic supply chain (NIST MEP deliverable pursuant to EO 14005 Section 7).1

g. ***How should labor standards be incorporated in project planning stages to support the creation of high-quality, good-paying jobs?*** N/A

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

8. ***DOE is evaluating funding mechanisms for the H2Hubs projects in accordance with the BIL. What applicable funding mechanisms are best suited to achieve the purposes of the H2Hubs (e.g., Cooperative Agreements, Grants, Other Transactions Authority)?*** Consider DOE-Basic Energy Science (BES) and DOE-Fossil Energy/Carbon Management (FECM) funding coordination, as well as CRADA mechanisms.

9. ***What are the key review criteria (e.g., technical merit, workplan, market transformation plan, team and resources, financial, regional economic benefits, environmental justice, DEI) that DOE should use to evaluate and select the H2Hubs as well as evaluate readiness to move from Phase 1 to Phase 2?*** All the above criteria, with preference to a multi-state, cross industry and substantially diversified energy portfolio with the large GHG off set potential. See 5b of this response above for additional specific details

10. ***Does offering multiple launches roughly a year apart, as shown above in Figure 2, help facilitate expanding the hydrogen hub concept to more regions?*** Timing of implementation should be commensurate with H2Hub's ability to permit, build, and bring to commercial operations the necessary facilities. Timing delays associated with required permitting, supply chain challenges and the time needed to pivot existing domestic manufacturing into the hydrogen economy, and other normal construction delays should be considered.

11. ***What specific activities should be conducted in Phase 1 vs. Phase 2? Should Phase 2 be further broken into multiple sub-phases, and if so, what should be included in each sub- phase?*** Phase 1 should focus on initial hub planning and rate recovery mechanisms. Without rate recovery the investment will not happen. Specific activities include: a) analysis of key metrics such as the decarbonization potential and energy resources/infrastructure/ workforce in the proposed region; b) hub design, financing, and preliminary National Environmental Policy Act (NEPA) and related reviews; c) key partners for each potential H2Hub; d) engagement by the H2Hub teams with all communities in the region; e) Identification of potential role of community engagement throughout the project; and f) critical reviews, approvals, financing, permitting, safety, partnering agreements, power purchase agreements, long-term hub sustainability, etc.

12. ***How much time will be needed to complete the Phase 1 activities? Have some regional teams already completed analysis and design activities?*** Phase 1 will require approximately one year.

13. ***Are the proposed funding levels for Phase 1 and Phase 2 appropriate/adequate?*** N/A

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)?*** Support for collaborative efforts within H2Hubs research universities and existing DOE investments in developing innovative technologies through announced grants and the major research laboratories, which should target 10% of the annual funding for hydrogen research.

15. ***What safety criteria (e.g., safety plan reviews, outreach to Authority Having Jurisdiction [AHJ] entities such as code/fire officials, training) should DOE use to evaluate readiness to move from Phase 1 to Phase 2?*** Nominated suite of existing regulations with gap analysis followed with codification of new regulations to assure safety standards are documented.

16. ***What resources might H2Hubs need regarding safety, permitting, and siting, particularly in relation to the Hydrogen Safety Panel and submission of safety plans?*** Seismic and well-pressure monitoring with remote sensing for fugitive gases quantification, inclusive of academia, research institutions, industry, and regulatory agencies (state and federal).

17. ***What environmental reviews and permitting challenges might H2Hubs encounter? Where can approaches such as "dig once" relating to buried conduits, pipelines, and other infrastructure (e.g., CO_2 pipelines) be developed and incentivized to reduce impact? Please provide examples of how community consultation and consent-based siting can successfully be included in the environmental and permitting review process.*** Priority should be provided to those state(s) permitting organizations which have existing robust and efficient methodologies to assure risks of delays are minimized.

18. ***Are there existing draft or final federal NEPA documents (e.g., environmental assessments and/or environmental impact statements) for similar or related proposals that could inform DOE NEPA reviews for the H2Hubs?*** N/A

19. ***What external non-project partners/stakeholders (e.g., CBOs, DACs, tribal groups, state and local governments, economic development organizations, labor representatives) will be critical to the success of the H2Hubs? What types of outreach and engagement strategies are needed to make sure these stakeholders are involved during each phase of the H2Hubs? Are there best practices for equitably and meaningfully engaging stakeholders?*** Hub leadership should be tasked with programmatically engaging stakeholders throughout the Phases, and prior to kick-off of Phase 1. Priority should be

conveyed to hub applicants that have engaged Tribal groups for collaboration, as well as best practice procedures identified in a social license to operate should be adopted throughout the development of the hubs.

20. ***The H2MatchMaker tool will be available to help identify potential regional project partners. What specific fields/information would be valuable to include in the tool?*** What other mechanisms can DOE use to help facilitate teaming? NIST MEP National Network centers and Supplier Portal.

21. ***Based on EPAct 2005, Section 988, the cost share requirement for demonstration and commercial application projects is 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 feasible to meet 50% cost share and should be measured on an annual reporting basis with semi-annual status updates.

22. ***Is there sufficient manufacturing capacity to produce the necessary hydrogen related components/equipment within the U.S. to supply all the eventual H2Hubs? What incentives/programs exist or can be put in place to encourage and foster U.S. manufacturing? What potential challenges or opportunities might exist to meet the new Buy American requirements in the BIL?*** Supply chain support for all equipment and critical supplies, with high level of focus on sensitive technologies, are required to support H2Hub. Fully utilize the NIST MEP National Network resources pursuant to Executive Order 14005 for supply chain (Section 7. Supplier Scouting) as well as for workforce development and internships.

23. ***Please identify any iron, steel, manufactured goods, or construction materials that will be crucial for building out the H2Hubs that would not typically be procured domestically. For each, please specify how H2Hubs could work to procure these items domestically, and any potential barriers to domestic procurement, such as lack of availability or cost.*** The Departments of Commerce, Energy, and Defense could provide useful insight regarding domestically available supply chain items critical for the implementation of the hydrogen economy and the H2Hub initiative could utilize internal supply chain resources in collaboration with those mentioned here (see Executive Order 14005).

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?*** National labs, NIST MEP, EPAm, and others could provide valuable support for the H2Hub developers.

25. ***What data should DOE collect from the H2Hubs to evaluate the impact of the program?***

How should this data and the program outcomes be disseminated to the public? In addition, EPAct 2005 Section 817 requires that three national labs (the National Energy Technology Laboratory, the Idaho National Laboratory, and the National Renewable Energy Laboratory) will work together to serve as a 'clearinghouse' for the H2Hubs and for the Clean Hydrogen Manufacturing and Recycling Program (Section 815). What data or information should be part of this 'clearinghouse'? Installed H2 production capacity, additional demand created for low carbon hydrogen, renewable energy optimization metrics (off peak electricity that would otherwise be de-rated, used for H2 production), GHG reduction metrics for displaced mobile and stationary sources, expanded and improved existing hydrogen production facilities. Systemic data collection should ensure statewide representation including the ability to focus on regional differences and ensuring that diverse populations and underrepresented communities and included.

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?*** Optimize all infrastructure funding opportunities, (Carbon Capture, Grid Reliability to enhance localized grids to optimize electrolyzers and enhance grid operations, etc.) should augment the H2Hub's funding mechanisms.

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

EEEJ benefits will be a high priority as the H2Hubs are developed. For the purposes of this RFI, DOE has identified the following non-exhaustive list of policy priorities as examples to guide DOE's implementation of Justice40 in DACs: (1) decrease energy burden; (2) decrease environmental exposure and burdens; (3) increase access to low-cost capital; (4) increase the clean energy job pipeline and job training for individuals; (5) increase clean energy enterprise creation (e.g., minority-owned or diverse business enterprises); (6) increase energy democracy, including community ownership; (7) increase parity in clean energy technology access and adoption; and (8) increase energy resilience.

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?*** NEPA Analysis with public outreach.

28. ***What EEEJ concerns or priorities are most relevant for the H2Hubs****?* FERC NEPA Analysis, environmental impacts to underserved communities, effectiveness of workforce development, enhanced STEM education, meaningful engagement of stakeholders, fair and sustainable distribution of risks and benefits across the diverse populations and host communities in the H2Hub region.

29. ***What measures should H2Hub project developers take to ensure that harm to communities with environmental justice concerns, including local pollution, are mitigated?*** Implementation of best practices among H2Hub states with new project

construction containing a federal nexus conducting a NEPA analysis.

30. ***How can H2Hubs ensure community-based stakeholders/organizations are engaged and included in the planning, decision-making, and implementation processes (e.g., including community-based organizations on the project team)?*** State level environmental protection organizations (Oklahoma Department of Energy & Environment, Louisiana's Department of Natural Resources, and Arkansas Department of Energy & Environment) maintain community-based and organizational stakeholder engagements embedded within the permitting process for large scale facilities contemplated within the H2Hub initiatives, and for those instances where the States' respective departments do not contain regulations for smaller scale projects, the respective States' departments can lead similar stakeholder engagement processes as those mandated by regulation. Request documentation of host states' permitting process stakeholder engagement processes, as well as demonstrate through additional documentation effective community engagement, all within the H2Hub application process.

31. ***How can DOE support meaningful and sustained engagement with H2Hub relevant disadvantaged communities?*** Require documentation of engagement with Tribal Nations, disadvantaged communities, and other important stakeholders as part of the H2Hub application process.

Category 4: **Market Adoption and Sustainability of Hubs**

32. ***What mechanisms (e.g., tax/other incentives, offtake structures, prizes, competitions, alternative ownership structures for hydrogen production bundling demand, contracts for difference, etc.) would be valuable to incentivize market-based supply and demand?*** All possible tools should be used to incentivize economic indifference for early entrants on the demand side (support for retrofitting natural gas combustion generation, Class 8 operators on a per mile basis compared to diesel, etc.) along with producers of low-carbon hydrogen. Creating robust demand for the low carbon hydrogen is of paramount importance and should be encouraged using all possible pathways to secure economic indifference which will lead to economies of scale for demand side supply chains. Create and implement additional tax incentives similar to 45Q.

33. ***What role/actions can DOE take to support reliable supply and demand for potential hydrogen producers and customers?*** Collaborate with the regulatory bodies to remove hurdles for the development of distribution, storage, carbon capture, use and sequestration permitting, blending initiatives, and trans-continental hydrogen supply chain partnerships (joint statements of intent).

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?*** See response 1 b to this document above.

35. ***What can DOE provide/do that would be helpful to a project to facilitate its collaborations with potential financing partners?*** Loan guarantees or DOE backed "green bonds" which can also support domestic production of innovative technologies to maintain intellectual property protection, federal tax incentives for those entities that invest in hydrogen and carbon capture innovations, manufacturers, and service providers (engineering, and operational support).

36. ***How can DOE support the H2Hubs in working together to increase competitiveness and scale?*** Within Phase 2 and beyond, encourage hubs to expand operations to include neighboring states and/or those states which provide a logistical advantage (e.g.: expanded use of hydrogen in Class 8 vehicles through the build out of infrastructure for refueling).

37. ***Which regional and site-specific metrics should DOE track to estimate the impact of hydrogen production on regional water availability?*** Potential metrics, as applicable for specific locations: gallons/acre-ft/barrels of marginal quality water reused (i.e.., produced water, wastewater, stormwater, etc.), stream flows, ground-water levels, reservoir levels. This could be modeled through machine learning algorithms coupled with forecasting models to optimize water use from various sources. The impact of hydrogen production would need to be isolated through modeling from other water stressors such as urbanization, climate change, increased agricultural use, etc.

38. ***Other than greenhouse gas emissions, what sustainability metrics should DOE include in evaluating the hubs (e.g., impact on regional water resources, availability of decarbonized electricity production resources, climate risk impacts on the resilience of the H2Hubs)?*** Improved optimization of renewable energy assets through economic and reliability dispatching of hydrogen production facilities, as well as hydrogen production that is stored for later use during high demand conditions. Additionally, water quality impacts to ground water and surface waters, air quality (relative particle emissions), water reuse, resilience against water stressors such as urbanization or increased agricultural use, impacts or benefits to endangered species, urban climate change, and public perception of benefits.

39. ***The goal is for the H2Hubs to be sustainable beyond the BIL funding (i.e., without additional government funding). To what extent will the H2Hubs be capable of demonstrating a path to economic viability after the BIL funded phases and how should the FOA and project (once awarded) be structured to ensure this outcome?*** For the H2Hubs to continue viable and sustainable operations beyond the BIL funding, H2Hubs should focus on multi-state collaborations which have the following assets in operation before Phase 1: see response 1 b above.

Category 5: Other

40. ***Please provide any additional information or input not specifically requested in the questions above that you believe would be valuable to help DOE develop a Regional Clean Hydrogen Hub FOA, including any specific criteria that DOE may take into consideration in implementing the Hub program.***

    Include research universities, specifically those that have long-standing collaboration history with industry and energy companies, in all phases of H2Hub implementation to assure innovative technologies advance to commercialization at an accelerated pace to support long term sustainability post DOE H2Hub funding, as well as support for internships in all technical and workforce related matters. Universities with a collaborative focus and demonstrated ability to manage multi-institutional, multi-institutional partnerships should be supported to create a "hub within hub" framework to facilitate knowledge, data, and information gathering and dissemination of the current state in engineering and sciences (across the technology readiness levels spectrum) within each H2Hub. Universities should be supported to facilitate entry into the hydrogen economy of smaller business by providing a de-risking service through techno socioeconomic analysis, bridges to policy makers, and readily available interns and visiting scholar programs within H2Hubs. Engagement within each H2Hub with entities that support and coordinate technical colleges in the region to support workforce development.