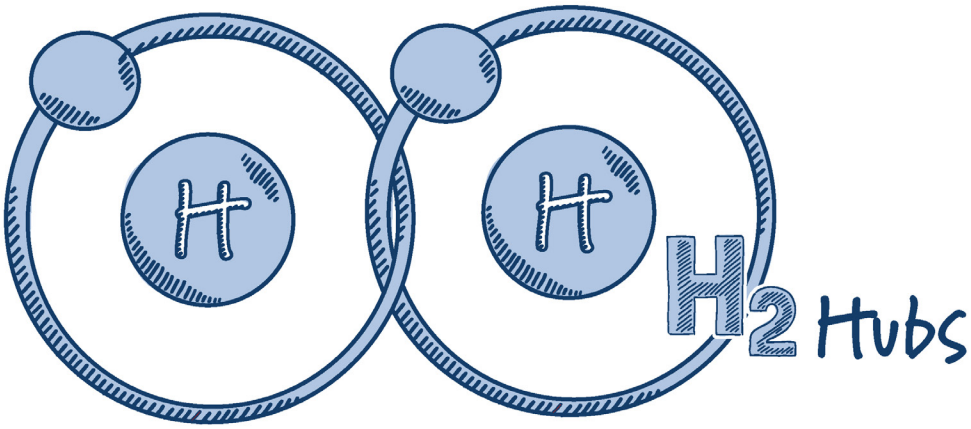

Recommendations for Implementing a Regional Clean Hydrogen Hub Program

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Purpose

The purpose of this memo is to provide recommendations for the successful deployment of regional clean hydrogen hubs by the Department of Energy (DOE), as authorized under Section 40314 of the Infrastructure Investment and Jobs Act (IIJA).

Background

IIJA included multiple hydrogen related authorizations and appropriations including $1 billion for a Clean Hydrogen Electrolysis Program, $500 million for a Clean Hydrogen Manufacturing program, $8 billion for Regional Clean Hydrogen Hubs, and a reauthorization of DOE's hydrogen activities with no appropriated funding. IIJA is the first time the DOE's hydrogen activities have been reauthorized since the Energy Policy Act of 2005; this reorientation reflects the modern understanding of the future of hydrogen. Hydrogen is a decarbonization tool that can be utilized in multiple energy sectors, acting as both a chemical and an energy carrier. The regional clean hydrogen hubs exemplify the DOE's change in perspective about hydrogen, and enough funding is provided to demonstrate how hydrogen can reliably and cleanly move energy between sectors.

Key Elements of Section 40314

- **$8 billion for at least four hydrogen hubs.** Hubs must demonstrate the production, processing, delivery, storage, and end-use of clean hydrogen and could eventually be connected into a national clean hydrogen network.
- **Feedstock diversity.** Three of the total hubs have feedstock requirements, with primary production in each of the three resulting from low-emissions fossil fuels, nuclear energy, and renewable energy.
- **End-use diversity.** Of the total hubs chosen, each of the following end-uses must be demonstrated in at least one of the hubs: power generation, the industrial sector, heating, and transportation.
- **Geographic diversity.** All of the hubs shall be located in different regions, but at least two hubs must be in regions with the greatest natural gas resources.
- **Timing.** Funding must be awarded by FY26.

Recommendations

Program Implementation

- **Consider awarding more than four regional hydrogen hubs -** Program language requires minimums for number of projects, types of production, and end-uses but there is no mention of the maximum number of projects or the amount of funding that must be directed toward each project. The open-ended prompt, and the absence of definitions for "regional" and allowed project partners, provide a lot of flexibility to not only to prove multiple full-scale hub demonstrations but also to seed the infrastructure and industry that will eventually connect them.

- **Take a multi-solicitation, milestone approach -** Project size, scope, and grant amount will vary significantly; in order to maximize spending and technology development, there should be multiple solicitation rounds and the funding for projects over a certain size should be provided in phases contingent on completing project milestones.
    - ***Multi-solicitation -*** The first solicitation would award the four large hydrogen hubs and satisfy the requirements set out in IIJA. The second (and potentially third) solicitation would seed medium to small projects that begin to interconnect hubs and expand them regionally. The medium to small projects could also be used to explore technologies that were not a part of the first solicitation. Multiple solicitations would also allow DOE time to provide feedback on project proposals.
    - ***Milestones -*** These large hub projects are intended to be complex and integrate multiple energy sectors, but this adds to project risk. When developing their milestone approach, the DOE could reference Sec. 9005 of the Energy Act of 2020, titled "Milestone-Based Demonstration Projects," which lays out proposal requirements and award management.
    - ***Multi-solicitation + Milestones -*** If a project is not able to move forward or meet a milestone, that funding can be reallocated to other projects.

- **Clarify the role of the DOE National Laboratories -** The language in IIJA did not specify which stakeholders would be able to participate in hub projects. Because of the expected size of the hub projects, each will likely have a consortia of entities involved. The DOE National Laboratories have the benefit of existing user facilities and computational capabilities that are designed to accelerate the scaling of emerging technologies through technical assistance, testing, and validation. The labs can also draw on the prior work of their technical experts. While these demonstrations should be led by industry, allowing the National Labs to participate on project teams could be beneficial.

- **Create thoughtful and realistic deadlines -** While the potential of the hub program is exciting and interest in hydrogen technologies is high, it is imperative that the DOE take its time to build and implement this program. The $8 billion of funding appropriated in IIJA for the regional clean hydrogen hubs is roughly 50x the FY21 budget of the Hydrogen and Fuel Cell Technology Office (HFTO), and an additional $1.5 billion was appropriated for other hydrogen programs in IIJA. Realistically, in order to implement the many programs funded by IIJA, there will need to be a significant personnel increase across the DOE in addition to inter-office program development and implementation. The statutory deadlines for hydrogen hubs should not be disregarded, but artificial deadlines should not rush proper program implementation.

Project Selection

- **Prioritize projects that not only focus on technology diversity, but also multi-sector integration -** Hydrogen is valued as a multi-sector decarbonization tool; large hub projects should demonstrate hydrogen as an integrated energy commodity. Multi-user hydrogen distribution and storage infrastructure is especially important to the potential of a hub to become a "network to facilitate a clean hydrogen economy" that is statutorily a key goal of the hydrogen hubs program.

- **Projects must have clear timelines and match production with end-use -** The hubs program addresses the barrier of simultaneous development by funding projects throughout a regional supply chain. Because most of these projects are of significant size compared to existing hydrogen economies in most regions, the project timelines should coordinate completion of production and end-use facilities. For projects that only demonstrate production, there should be high confidence that the hydrogen produced has a demand market; likewise, end-use demonstrations should have reliable access to an adequate amount of clean hydrogen.

- **Choose locations with positive permitting structure -** Permitting processes can also delay timelines and result in increased project costs. Siting of these projects must take into account local and state ordinances; therefore, these projects should be sited in locations where the existing regulatory regime facilitates timely deployment.

Additional Recommendations

- **Focus on demonstrating diverse and integrated technologies; scale later -** Because hydrogen technologies are currently expensive and there is little existing infrastructure that can be utilized, simultaneous development has been a major barrier for the industry. The hub program was established to "demonstrate the production, processing, delivery, storage, and end-use of clean hydrogen," and the DOE should focus on choosing projects that emphasize an interconnected supply chain to seed infrastructure that will continue to scale independently after the program is successful.

- **Co-locate fossil hydrogen hubs with other IIJA carbon capture projects -** Any clean hydrogen hub utilizing fossil fuels with carbon capture will need CO_2 transportation and storage infrastructure. Several other programs appropriated in IIJA, such as the direct air capture hubs, and the carbon capture and industrial demonstration projects, will require similar infrastructure. Co-locating these projects and evaluating ways to leverage opportunities across programs would lead to better stewardship of funds and help launch a regional carbon storage industry.