Notice of Intent No. DE-FOA-0002919

Notice of Intent to Issue
Funding Opportunity Announcement No. DE-FOA-0002920

The Office of Energy Efficiency and Renewable Energy (EERE) intends to issue, on behalf of the Hydrogen and Fuel Cell Technologies Office, a Funding Opportunity Announcement (FOA) entitled "Hydrogen and Fuel Cell Technologies Office FOA in Support of Hydrogen Shot."

Clean hydrogen and fuel cell technologies are important elements of a comprehensive energy portfolio, particularly for use in hard-to-decarbonize sectors of the economy (such as heavy-duty transportation and industrial applications) and to enable long duration energy storage for a clean electric grid. These elements directly support administration goals to put the United States on a path to achieving carbon pollution–free electricity by 2035 and net-zero emissions economy-wide by no later than 2050 to benefit all Americans.[1] This FOA will support research, development, and demonstration (RD&D) of affordable hydrogen and fuel cell technologies, as aligned with the vision outlined in DOE's draft national clean hydrogen strategy and roadmap[2] – *affordable clean hydrogen for a net-zero carbon future for a sustainable, resilient, and equitable economy*. This FOA will address significant challenges to successful implementation of the national clean hydrogen strategy and roadmap, including the need for cost reductions and performance improvements for both fuel cell and hydrogen infrastructure technologies.

The Department of Energy (DOE) is committed to pushing the frontiers of science and engineering, catalyzing clean energy jobs through research, development, demonstration, and deployment, and ensuring environmental justice and equity for underserved communities. Examples include DOE's Hydrogen Shot,[3] which targets ***affordable*** clean hydrogen production at $1/kg within a decade, and the H2@Scale Initiative,[4] which aims to advance affordable hydrogen production, transport, storage, and utilization to enable decarbonization and revenue opportunities across sectors. This FOA will focus on key hydrogen delivery and storage technologies as well as affordable and durable fuel cell technologies, particularly for heavy duty trucks to reduce carbon dioxide emissions and eliminate pollution from the tailpipe.

These hydrogen and fuel cell technologies can help create opportunities for the improvement of communities that have been historically underserved, and can also create jobs, including

[1] Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021
[2] U.S. Department of Energy, "DOE National Clean Hydrogen Strategy and Roadmap (Draft)", https://www.hydrogen.energy.gov/clean-hydrogen-strategy-roadmap.html
[3] U.S. Department of Energy, Hydrogen Shot, https://www.energy.gov/eere/fuelcells/hydrogen-shot
[4] U.S. Department of Energy, Hydrogen at Scale, https://www.energy.gov/eere/fuelcells/h2scale

good-paying union jobs, which benefits everyone. Consistent with DOE's strategy to benefit all Americans, this anticipated FOA will encourage the participation of underserved communities and underrepresented groups.

EERE anticipates that the FOA may include the following Areas of Interest (AOI):

1) Hydrogen Carrier Development
This topic seeks applications for R&D of novel hydrogen carriers and/or hydrogen carrier hydrogenation/dehydrogenation catalysts with the goal of providing quantitative cost and performance advantages over conventional compressed gas or liquid hydrogen (LH2) systems. Hydrogen carriers are a unique storage and delivery medium that have the potential to enable efficient, compact, and low-cost transport, on-site generation, and storage of hydrogen across multiple sectors in the economy. Carriers exhibit a wide range of properties and behaviors, allowing for the matching of different hydrogen-rich materials to the needs of a specific end use. The needs for different end-use applications must be considered within this topic, addressing issues such as required pressure, temperature, rates of hydrogen release, purity, and cost at scale. One example of interest includes catalysts that are based on perovskite materials or that use perovskite materials as catalyst supports. Such materials and other innovative concepts with potential to meet specific metrics are of interest, and projects will be expected to collaborate with HFTO's HyMARC consortium.[5]

2) Onboard Storage Systems for Liquid Hydrogen
This topic solicits applications for the development of liquid hydrogen storage vessels and the required balance-of-plant hardware to enable low-cost, energy dense LH_2 storage onboard medium- and heavy-duty (MD/HD) on-road vehicles. Hydrogen fuel cell systems can offer benefits in MD/HD vehicles, particularly for long-haul trucks, such as long driving ranges, short refueling times, and high payload capacities. However, to do so, significant quantities of hydrogen are required (40–120 kg, depending on the application). As LH_2 has a considerably higher energy density, compared to 700-bar compressed hydrogen gas, there is significant interest in the development of onboard LH_2 storage systems. Analyses have shown the potential of LH_2 systems to meet capacity requirements for MD/HD applications and achieve the storage cost target of less than or equal to $8/kWh.[6,7]

3) Liquid Hydrogen Transfer/Fueling Components and Systems
This topic seeks applications to develop LH_2 transfer and vehicular fueling technologies and approaches to enable high-flow LH_2 transfers and/or LH_2 fueling of MD and HD vehicles. Fueling stations for MD/HD fuel cell vehicles—similar to those for off-road, marine, and rail use—are expected to dispense tons of hydrogen per day. The large-scale storage and transfer of liquid

[5] U.S. Department of Energy, Hydrogen Materials Advanced Research Consortium (HyMARC), https://www.hymarc.org/.
[6] DOE Hydrogen and Fuel Cells Program Record 19006: Hydrogen Class 8 Long Haul Truck Targets (energy.gov)
[7] Million Mile Fuel Cell Truck Consortium, https://millionmilefuelcelltruck.org/

hydrogen for such end-users requires the development of advanced LH_2 transfer and fueling components and systems that address the challenges of hydrogen losses, materials compatibility, and safety, while enabling fueling times comparable to incumbent technologies (i.e., liquid fuels). This will require much higher hydrogen flow rates, for instance over five times greater (at least 10 kg/min) than those in current light-duty vehicle hydrogen fueling stations.

4) M2FCT: High Performing, Durable Membrane Electrode Assemblies for Medium- and Heavy-duty Applications

This topic solicits applications that, in coordination with DOE's Million Mile Fuel Cell Truck (M2FCT) consortium, will develop membrane electrode assemblies (MEAs) that will reduce the cost and enhance the durability and performance of proton-exchange membrane (PEM) fuel cell stacks for MD/HD applications. R&D needs for both applications have been identified with industry, university, and national laboratory expert stakeholder input. The topic targets advances in MEAs to enable significant progress towards meeting 2030 system-level HD truck targets of 25,000-hour durability and $80/kW system cost.

For all topic areas, EERE envisions awarding financial assistance awards in the form of cooperative agreements. The estimated period of performance for each award will be approximately two to four years.

In general, teaming arrangements that include multiple stakeholders across academia, industry, and national laboratories as appropriate—and across technical disciplines—are strongly encouraged. For example, teams that include multiple partners are preferred over applications that only include a single organization. Teams that include representation from diverse entities—such as, but not limited to Minority Serving Institutions (MSIs), including Historically Black Colleges and Universities (HBCUs)/Other Minority Institutions (OMIs), or through linkages with Opportunity Zones—are encouraged.[8] Applicants are highly encouraged to include individuals or student organizations from groups historically underrepresented in Science, Technology, Engineering and Math (STEM) education on their project teams.

EERE is compiling a Teaming Partner List to facilitate the widest possible national participation in the formation of applicant teams for this potential FOA. The list allows organizations who

[8] Minority Serving Institutions (MSIs), including HBCUs/OMIs as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html. Opportunity Zones were added to the Internal Revenue Code by section 13823 of the Tax Cuts and Jobs Act of 2017, codified at 26 U.S.C. 1400Z-1. The list of designated Qualified Opportunity Zones can be found in IRS Notices 2018-48 (PDF) and 2019-42 (PDF). Further, a visual map of the census tracts designated as Qualified Opportunity Zones may also be found at Opportunity Zones Resources. Also see, frequently asked questions about Qualified Opportunity Zones.

may wish to participate in an application to express their interest to other potential applicants and to explore potential partnerships.

Any organization that would like to be included on this list should access EERE eXCHANGE at https://eere-Exchange.energy.gov and choose the menu item labelled Teaming Partners. From the pulldown menu, select this FOA, DE-FOA-0002920. Enter your organization, contact information, the topic in which you are interested, and any background information on your particular interests and capabilities (including MSI designation or disadvantaged community status, if relevant) and press Register. Each entry should only include one topic area. Submit multiple entries if you are interested in partnering on more than one topic area. For further information regarding teaming partner lists, see https://eere-exchange.energy.gov/Manuals.aspx.

By submitting a request to be included on the Teaming Partner List, the requesting organization consents to the publication of the above-referenced information. By facilitating this Teaming Partner List, EERE does not endorse or otherwise evaluate the qualifications of the entities that self-identify themselves for placement on the Teaming Partner List. EERE will not pay for the provision of any information, nor will it compensate any applicants or requesting organizations for the development of such information.

This Notice is issued so that interested parties are aware of the EERE's intention to issue this FOA in the near term. All of the information contained in this Notice is subject to change. EERE will not respond to questions concerning this Notice. Once the FOA has been released, EERE will provide an avenue for potential applicants to submit questions.

EERE plans to issue the FOA on or about January 2023 via the EERE eXCHANGE website https://eere-exchange.energy.gov/. If applicants wish to receive official notifications and information from EERE regarding this FOA, they should register in EERE eXCHANGE. When the FOA is released, applications will be accepted only through EERE eXCHANGE.

In anticipation of the FOA being released, applicants are advised to complete the following steps, which are **required** for application submission:

- Register and create an account in EERE eXCHANGE at https://eere-eXCHANGE.energy.gov. This account will allow the user to apply to any open EERE FOAs that are currently in EERE eXCHANGE.

  To access EERE eXCHANGE, potential applicants will be required to have a Login.gov account. As part of the eXCHANGE registration process, new users are directed to create an account in Login.gov. Please note that the email address associated with Login.gov must match the email address associated with the eXCHANGE account. For more information, refer to the Exchange Multi-Factor Authentication (MFA) Quick Guide in the Manuals

This is a Notice of Intent (NOI) only. EERE may issue a FOA as described herein, may issue a FOA that is significantly different than the FOA described herein, or EERE may not issue a FOA at all.

section of eXCHANGE.

It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission. Questions related to the registration process and use of the EERE Exchange website should be submitted to: EERE-eXCHANGESupport@hq.doe.gov

- Register with the System for Award Management (SAM) at https://www.sam.gov. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in SAM registration. Please update your SAM registration annually. Upon registration, SAM will automatically assign a Unique Entity ID (UEI).

  NOTE: Due to the high demand of UEI requests and SAM registrations, entity legal business name and address validations are taking longer than expected to process. Entities should start the UEI and SAM registration process as soon as possible. If entities have technical difficulties with the UEI validation or SAM registration process they should utilize the HELP feature on SAM.gov. SAM.gov will work entity service tickets in the order in which they are received and asks that entities not create multiple service tickets for the same request or technical issue. Additional entity validation resources can be found here: GSAFSD Tier 0 Knowledge Base - Validating your Entity.

- Register in FedConnect at https://www.fedconnect.net/. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf

- Register in Grants.gov to receive automatic updates when amendments to a FOA are posted. However, please note that applications will not be accepted through Grants.gov. http://www.grants.gov/. All applications must be submitted through EERE eXCHANGE.