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## Notice of Funding Opportunity

**Title:** Hydrogen and Fuel Cell Technologies Office (HFTO) FY 2021 Funding Opportunity Announcement  
**Website:** <https://www.grants.gov/web/grants/view-opportunity.html?oppld=330309>  
**Funding:** Total: \$33,500,000. Maximum awards: \$1M-\$5M, depending on technology.  
**Dates:** Deadline for Concept Papers: January 15, 2021  
Application Submission Deadline: March 8, 2021

**Summary:** This FOA supports research and development (R&D) to enable “H2@Scale” – a DOE initiative to achieve large scale production, storage, transport, and utilization of hydrogen across multiple sectors. Supporting EERE’s core priorities of energy affordability, integration and storage, H2@Scale research, development and demonstration (RD&D) aims to advance the adoption of hydrogen and fuel cell technologies in integrated energy systems across key applications that provide a value proposition as well as reduce emissions. This year, HFTO launched two major collaborative research initiatives leveraging world-class expertise and state-of-the-art equipment at the national laboratories: the Million Mile Fuel Cell Truck (M2FCT) consortium and the H2NEW consortium. Under each consortium, DOE national laboratories are working together in cutting-edge R&D and collaborating with the hydrogen and fuel cell communities to identify innovative ways to make hydrogen and fuel cell technologies more affordable and competitive in today’s market. Each consortium is planned at \$50 million over five years, along with a similar level for industry and university FOAs, to advance progress in specific hydrogen production and fuel cell RD&D areas: M2FCT includes Los Alamos and Lawrence Berkeley National Laboratories as co-leads, and focuses on fuel cell durability, performance, and cost to better position fuel cell trucks as a viable option in the long-haul trucking market; H2NEW includes National Renewable Energy Laboratory and Idaho National Laboratory as co-leads, and focuses on R&D to enable affordable, durable and efficient large-scale electrolyzers, which produce hydrogen from electricity and water (at both high and low temperatures). This HFTO FY21 RD&D FOA will provide more than \$33,500,000 in Federal funding for topics designed to supplement the current HFTO RD&D portfolio in the advancement of hydrogen and fuel cell technologies, with an emphasis on incentivizing collaborative progress among industry, university and national laboratory stakeholders, including coordination with the M2FCT and H2NEW Consortia.

### Project Topic Areas:

#### Subtopic 1A: Fuel Cell R&D for Heavy-Duty Applications – Low-Cost, Durable Bipolar Plates

This subtopic solicits applications that will develop innovative bipolar plates to reduce the cost and enhance the durability and performance of PEM fuel cell stacks for heavy-duty applications. Both metallic and carbon-based materials are of interest. Applications are to focus on innovative, low-cost materials with high corrosion resistance and minimal degradation to achieve lifetimes of 25,000 hours suitable for heavy-duty applications. Projects will be coordinated with the Million Mile Fuel Cell Truck Consortium. Supports EERE core priorities of energy affordability, storage, and integration and advancement of heavy-duty fuel cell technology targets.

#### Subtopic 1B: Fuel Cell R&D for Heavy-Duty Applications – Innovative, Low-Cost Air Management Components

This subtopic solicits applications that will develop air management components for heavy-duty fuel cell applications capable of improved reliability, efficiency, durability, application flexibility, and lower overall system costs. The final project deliverable will be a sub-scale prototype heavy-duty vehicle air management system with the target specifications. Projects will be coordinated with the Million Mile Fuel Cell Truck Consortium. Supports EERE core priorities of energy affordability, storage, and integration and advancement of heavy-duty fuel cell technology targets.

#### Subtopic 2A: High Temperature Electrolyzer Manufacturing R&D

This subtopic solicits applications in R&D of manufacturing techniques to produce advanced components, stacks, sub-systems, and systems for multi-MW-scale high temperature electrolyzers at high production volumes. Applicants are expected to leverage innovations/approaches including reduced part count, increased automation, in-line diagnostics, improved materials deposition processes, and reduced high temperature firing steps. Applicants are encouraged to focus on existing commercial manufacturing techniques rather than entirely novel approaches. The Advanced Manufacturing Office (AMO) is contributing 50% of the total federal funding for manufacturing focused topic. Projects will be coordinated with the H2NEW Consortium. Supports EERE core priorities of energy affordability, storage, and integration and advancement of hydrogen production technology targets.

#### Subtopic 2B: Innovative Hydrogen Production from Biomass Waste Streams

This subtopic solicits applications focusing on conversion of waste feedstocks (including industrial wastewater, food waste, municipal solid waste, and other non-fossil waste streams) to hydrogen via microbial conversion technologies at large or distributed/community scales. Early stage R&D is needed to optimize and/or integrate microbial electrolysis cells (MEC), fermentation and/or other novel systems to bring down cost, improve yield, and enable

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scale-up. University and industry proposals are being solicited for R&D to design novel MEC reactors, improve MEC lifetime, optimize hybrid systems, and develop innovative biological approaches to waste conversion. Supports EERE core priorities of energy affordability, storage, and integration and advancement of hydrogen production technology targets.

#### Subtopic 3A: Domestic Supply Chain for High-flow Hydrogen Fueling Stations

This subtopic solicits applications focusing on the development of low-cost, reliable, domestically supplied hydrogen fueling station components to enable high-flow hydrogen fueling of heavy-duty trucks. These components may include hoses, couplings, nozzles, chillers, compressors, high-precision flowmeters, and shut-off/control valves. Applicants are encouraged to seek support of industry stakeholders, and applications are assessed against their ability to achieve interim and ultimate DOE targets for hydrogen fueling. Supports EERE core priorities of energy affordability, storage, and integration and advancement of hydrogen infrastructure technology targets.

#### Subtopic 3B: Validation of High-flow Refueling Models

This subtopic solicits applications to support development and validation of a fueling model suitable for high-flow gaseous fueling processes. This topic is aimed at identifying fueling process characteristics to support the development of international codes and standards for high-flow gaseous fueling process control. Applicants are expected to demonstrate that the model may be validated below full scale, and that the model is capable of valid full-scale predictions. Supports EERE core priorities of energy affordability, storage, and integration and advancement of hydrogen infrastructure technology targets.

#### Subtopic 4A: Fuel Cells

This subtopic solicits applications for heavy-duty fuel cell system techno-economic analyses. The analyses will envision, define, and determine the cost of current and future advanced fuel cell systems for various sizes, applications, and manufacturing volumes. The applicant will be expected to conduct a bottom-up assessment of the projected current and future costs (2025 and beyond) that are based on scenarios with the potential to meet HFTO interim and ultimate targets. The analyses are to include a ground-up cost projection based on conceptual designs and related costs of fuel cell system and component manufacturing equipment and processes as well as material disposal requirements. Supports EERE core priorities of energy affordability, storage, and integration and advancement of heavy-duty fuel cell technology targets.

#### Subtopic 4B: Hydrogen Production

This subtopic solicits applications for comprehensive techno-economic analyses of distributed- and/or centralized-hydrogen production pathways that include, but are not limited to: waste and/or biomass conversion technologies; high and low temperature electrolysis; solar thermochemical and photoelectrochemical water splitting; and other innovative concepts. The applicant will be expected to conduct a bottom-up assessment of the projected current and future costs (2025 and beyond) that are based on scenarios with the potential to meet HFTO interim and ultimate targets. Production pathways that enable emerging hydrogen end uses, such as heavy-duty transportation, grid resiliency, data centers, and steelmaking, are of particular interest. Analyses will also consider disposal costs for materials and waste streams generated via each proposed process. Supports EERE core priorities of energy affordability, storage, and integration and advancement of hydrogen production technology targets.

#### Subtopic 4C: Hydrogen Storage

A key component of the HFTO portfolio is a comprehensive set of analysis projects involving all aspects of hydrogen and fuel cell technologies. Through analysis work, HFTO seeks to define the current state-of-the-art in all areas, develop and refine system configurations and designs, provide guidance on R&D gaps, and help to direct future R&D priorities. Analysis efforts enable HFTO to identify technology gaps to help develop cost targets and direct future R&D efforts to meet industry needs, strengthening national hydrogen technology advancement in 2025 and beyond. Applicants will provide life cycle and cost assessment analyses of advanced hydrogen storage technologies. Material and manufacturing costs covering systems from onboard to bulk storage systems will be provided. Analysis will support hydrogen storage use for data centers, industrial, and others including, 350 bar, 700 bar, liquid & cryo-compressed, and hydrogen carriers. Supports EERE core priorities of energy affordability, storage, and integration and advancement of hydrogen storage technology targets.

#### **Funding:**

EERE expects to make a total of approximately \$33,500,000 of federal funding available for new awards under this FOA; \$28,500,000 from HFTO, \$5,000,000 from AMO, all subject to the availability of appropriated funds. EERE anticipates making approximately 16 to 24 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between \$1,000,000 and \$5,000,000. Topic Areas 1A, 1B, 2A, 2B, 3A, and 3B: The cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total



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allowable cost of the project) and must come from non-federal sources unless otherwise allowed by law. Topic Areas 4A, 4B, and 4C: Cost sharing is not required under this FOA for analysis activities.

Topic Area	Total Funding Level	Anticipated Number of Awards	Federal Funding per Award	Max. Project Duration (years)	Min Required Non-Federal Cost Share %
1a	\$4M	2 to 4	\$1-2M	3	20%
1b	\$4M	2 to 4	\$1-2M	3	20%
2a	\$10M	2 to 3	\$3-5M	3	20%
2b	\$2M	1 to 2	\$1M	3	20%
3a	\$8M	4 to 6	\$1-3M	3	20%
3b	\$2M	1 to 2	\$1-2M	3	20%
4a	\$1.5M	1	\$1.5M	4	N/A
4b	\$1M	1	\$1M	3	N/A
4c	\$1M	1	\$1M	3	N/A

**Project Requirements:**

Subtopic 1A: A domestic bipolar plate manufacturer as part of the team is encouraged. Upon selection, applicants are expected to partner with M2FCT; coordination will include testing and utilizing appropriate accelerated stress tests, as well as system-modeling efforts to assess the proposed technology’s impact on heavy-duty fuel cell cost and performance.

Subtopic 1B: A domestic air management component/system manufacturer and a fuel cell system developer (OEM or OEM supplier) knowledgeable in the requirements for polymer electrolyte membrane fuel cell systems for heavy-duty transportation applications as part of the team is encouraged. Upon selection, applicants are expected to partner with the M2FCT national lab consortium; coordination will include system-modeling efforts to assess the proposed technology’s impact on heavy-duty fuel cell cost and performance, as well as performance and durability testing.

Subtopic 2A: Collaborative projects comprising appropriate industrial and manufacturing expertise are strongly encouraged. Applicants should describe succinctly the qualifications, experience, and capabilities of the proposed project team to execute the project plan successfully. If the project lead does not have the facilities/capabilities to carry out the electrolyzer/electrolyzer component production on a high-volume relevant manufacturing scale, it will be necessary to include a project partner or partners who can perform that role. Applicants are highly encouraged to develop teaming arrangements between stack/system integrator and stack and component suppliers. Applicants are encouraged to coordinate and leverage activities funded by the Advanced Manufacturing Office and other relevant DOE Offices, and avoid duplicative efforts. Applicants are encouraged to engage, team and/or collaborate where appropriate with one or more of the H2NEW HTE labs with the expectation that the manufacturing R&D projects resulting from this FOA topic will support H2NEW and be complementary to the national lab H2NEW R&D efforts. Strong preference is given to applicants with domestic manufacturing capabilities and intent to manufacture in the United States.

Subtopic 2B: Applicants are highly encouraged to team with waste producers/managers that are interested in adopting the technology and can provide the waste feedstock for the project.

Subtopic 3A: Teams that include fueling component developers are strongly encouraged. Partnerships with domestic entities are strongly preferred, and a foreign work waiver will be required for any work performed outside the United States. Strong preference is given to applicants with domestic manufacturing capabilities and intent to manufacture in the United States.

Subtopic 3B: Industry led efforts are highly encouraged. Applicants should consider leveraging the world-class capabilities of the DOE’s national laboratories and should engage relevant stakeholders. Applications should detail: 1) the manner in which national laboratory capabilities will be effectively leveraged (if used), and 2) proposed engagement of stakeholders for work.

All Subtopics: Teaming arrangements that include multiple stakeholders across academia, industry, national laboratories as appropriate, and across technical disciplines are strongly encouraged. 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.

**Eligible Applicants:**

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The following are eligible to apply for funding as a prime recipient or subrecipient: U.S. citizens and lawful permanent residents; For-profit entities, educational institutions, and nonprofits that are incorporated (or otherwise formed) under the laws of a particular state or territory of the United States and have a physical location for business operations in the United States; State, local, and tribal government entities; and Incorporated and Unincorporated Consortia, which may include domestic and/or foreign entities. Unincorporated Consortia must designate one member of the consortium to serve as the prime recipient/consortium representative. The prime recipient/consortium representative must be incorporated (or otherwise formed) under the laws of a state or territory of the United States. Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the EERE Contracting Officer. If a foreign entity applies for funding as a prime recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a state or territory of the United States to be the prime recipient. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate. A foreign entity may receive funding as a subrecipient. The following are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient: DOE/NNSA FFRDCs; Non-DOE/NNSA FFRDCs; and Federal agencies and instrumentalities (other than DOE). Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995 are not eligible to apply for funding.

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