

# FY21 M2FCT Discretionary Funding Award Opportunity Instructions

**Timeline:**

06/09/21: Call release date

06/21/21: Letter of intent to submit a proposal

07/09/21: Deadline for proposal submission by email by 5 p.m. Pacific Daylight Time  
(e-mail restricted to <20 MB for entire email with all attachments)

August 2021: Selection and announcement of awards

October 2021: Start of award

**Objective:**

Through this request for proposals (RFP) being issued by the Million Mile Fuel Cell Truck (M2FCT) consortium, we seek to accelerate and improve the performance and lifetime of hydrogen fuel-cell systems for heavy-duty applications by funding capabilities and concepts that are synergistic with and additive to the M2FCT consortium. This RFP also seeks to increase academic and national laboratory involvement with M2FCT researchers and bring them into the consortium as PIs.

**Contact:**

The full proposal and any technical inquiries or communications should be directed by email to [m2fct-discretionary@lbl.gov](mailto:m2fct-discretionary@lbl.gov)

## OVERVIEW

The DOE's Million Mile Fuel Cell Truck Consortium (M2FCT, [millionmilefuelcelltruck.org](http://millionmilefuelcelltruck.org)) is overseeing a request for proposals (RFP) to accelerate innovation and research and development of hydrogen proton-exchange-membrane fuel cells (PEMFCs) for heavy-duty applications in order to meet the 2025 target of 2.5 kW/g<sub>PGM</sub> power (1.07 A/cm<sup>2</sup> current density) at 0.7 V after 25,000 hour-equivalent accelerated durability test. M2FCT is the DOE's premier fuel-cell research consortium focused on optimizing fuel-cell efficiency, durability, and performance for heavy-duty transportation applications.

## BACKGROUND

While significant advances have been made and early commercial PEMFC light-duty vehicles (LDVs) are starting to be produced, PEMFCs in the heavy-duty-vehicle (HDV) transportation sector (including trucks, long-haul semitrailers, maritime, trains, etc.) are nascent, despite the fact that advantages of PEMFCs compared to both diesel and electric powertrains are very compelling in terms of emissions, charging/refueling time, efficiency, power-to-weight ratio, among others. Furthermore, HDVs are traditionally more polluting in terms of criteria pollutants and greenhouse gas emissions, and HDV applications are more regular in their drive cycle and routes, thereby alleviating the initial hydrogen infrastructure issues. However, the fuel-cell technology for HDVs requires a paradigm shift in fuel-cell research and development compared to LDVs, where the emphasis becomes efficiency and 4 to 5x improvements in durability instead of a focus on increased power densities and lower cell costs.

M2FCT advances efficiency and durability of PEMFCs at a pre-competitive level to enable their commercialization for HDV applications and operates mainly within the TRL 2 to 4 range. The key tenet driving M2FCT is that through understanding the intrinsic behavior of materials and their interfaces and interactions, one can rationally and rapidly develop and design assemblies to meet HDV application needs. To meet the goals, M2FCT is seeking proposals that develop new capabilities, advance knowledge of component properties, and develop advanced structures and materials, integration strategies, and evaluation methods. This rationally based design approach, which relies less on empiricism and more on understanding, will subsequently enable rapid improvements in the technology for a variety of HDV applications.

M2FCT is an integrated consortium that includes: (i) modeling analysis to define drive cycles, operating conditions and requirements, (ii) material development for design/synthesis of durable high-performing materials, (iii) integrating these and other state-of-the-art materials into MEAs, testing and modeling of material performance and enabling their scale-up and manufacturing, and (iv) accelerated stress test (AST) development and durability evaluation to enable these MEAs and materials to meet the efficiency/durability targets.

M2FCT focuses on achieving an aggressive target for PEMFC HDV membrane-electrode assemblies (MEAs) that combines efficiency, durability, power density, and implicitly, cost in a single metric: 2.5 kW/g<sub>PGM</sub> power (1.07 A/cm<sup>2</sup> current density) at 0.7 V after 25,000 hour-equivalent accelerated durability test. Beyond the 2025 target, the consortium will increase the system efficiency with targets of 68% (2030) and 72% (ultimate); durability of 30,000 hrs (ultimate) for HDV, 35,000 hrs for locomotive, and 100,000 hrs for marine. Beyond the overall target, there are four main goals for M2FCT

- Goal 1: Develop predictive models for cells and systems and exercise them to define real-world operation and component and assembly targets
- Goal 2: Develop materials that enable high efficiency and durable performance
- Goal 3: Evaluate rationally designed multicomponent MEAs comprised of tailored interfaces and components that exhibit transformational cell-level performance and efficiency
- Goal 4: Realize and interrogate ensembles of materials to elucidate and mitigate degradation

## **OPPORTUNITY**

To meet the above goals, M2FCT has set aside \$1M of discretionary funding over 2 years (\$500k per year) to fund innovative materials, concepts, and diagnostics that are not currently available or being explored in the consortium. This funding is for academia or non-primary national laboratories (see eligibility section) and successful proposers will become principle investigators (PIs) within M2FCT. Proposals from minority serving institutions are especially encouraged. Specific proposed work should complement and not duplicate existing M2FCT research, and proposers are encouraged to examine the consortium website ([millionmilefuelcelltruck.org](http://millionmilefuelcelltruck.org)) and annual merit review (AMR) presentation.

### **Areas of Interest**

#### **Area of Interest 1: Material or integration innovative concepts**

As one moves towards HDV applications, efficiency and durability become more critical. Proposals are solicited that focus on novel strategies or materials that provide high performance under typical conditions and over the extended lifetimes of HDVs, including operating temperatures up to 120°C, low relative humidity, and potentials in excess of 0.9 V. Either component-specific solutions (e.g., catalyst, ionomer, supports) or solutions at the integrated membrane-electrode-assembly level, such as novel architectures, are solicited.

#### **Area of Interest 2: Characterization and related theoretical and experimental capabilities**

As one explores the HDV operating space and to improve the technology to meet the M2FCT goals and overall targets, novel characterization methods (either computational or experimental) are required. These should be complementary to existing techniques and approaches at the M2FCT national laboratories (see consortium website) and provide key insights for understanding, elucidating, understanding, and mitigating PEMFC durability and efficiency concerns. In particular, multimodal, and *operando* techniques with increased spatial or temporal resolution are encouraged for either components or integrated membrane-electrode assemblies. Mechanistic studies into specific degradation modes including contamination are also solicited. Interface discovery and operation under relevant conditions is of interest. In addition, proposals exploring advanced data-analysis methods and methodologies are encouraged.

### **Specific areas NOT of interest**

Non-PEM fuel cells and their components including, but not limited to, solid oxide, molten carbonate, anion-exchange membrane, and PBI/Phosphoric acid

Non-PGM catalysts and related materials

Research focused exclusively on increasing performance at low PGM loadings and at low cell

potentials or operating temperatures  
Research that duplicates efforts within the consortium or previously funded through recent FOAs  
Research solely focused on scale-up of materials or components  
Proprietary developments including components and studies (e.g., flowfield design)  
Funding for equipment purchases

### **ELIGIBILITY**

This opportunity is open to US-based institutions only. Each application must be led by an academic or non-primary National Laboratory (Primary labs are NREL, ANL, LANL, ORNL, LBNL). Co-PIs are allowed but must be academic or non-primary National Laboratory. Only one proposal is allowed per PI. Minority Serving Institutions (MSIs), including Historically Black Colleges and Universities/Other Minority Institutions) 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 are highly encouraged to participate. See <https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>.

### **FUNDING AND NUMBER OF AWARDS**

For academic led projects, the budget should be in the range of \$50k to \$100k per year for 2 years, and National Laboratory led projects should be in the range of \$100k to \$200k per year for 2 years. It is anticipated that 3 to 4 projects will be chosen with nominally at least 1 in each area of interest, although M2FCT reserves the right to award no proposals depending on quality. There is no predetermined target for number of academic versus National Laboratory proposals.

### **SUBCONTRACT REQUIREMENTS IF AWARDED**

If selected for negotiation, a National Laboratory proposal will submit an Annual Operating Plan (AOP) document for negotiation with DOE. An academia-led proposal will undergo negotiation to establish a subcontract with LBNL under their procurement policies and procedures established under the University's Prime Contract No. DE-AC02-05CH11231 with the U.S. Government, represented by the Department of Energy (DOE), for management and operation of LBNL. Proposals submitted will be treated as offers and any resulting award(s) will be a Subcontract under the University's Prime Contract.

### **PROPRIETARY DATA IN PROPOSAL**

An applicant should not include proprietary information in the proposal unless such information is necessary to understand and evaluate the proposed project. If proprietary information is required to be included in the proposal, the proprietary information should be marked as such on the specific pages that contain this information. DOE, the national laboratories, and the reviewers will treat properly marked proprietary information as confidential to the extent allowable under U.S. law.

### **LETTER OF INTENT GUIDELINES**

A single PDF file should be submitted to [m2fct-discretionary@lbl.gov](mailto:m2fct-discretionary@lbl.gov) by 5 PM PDT on June 21, 2021. The PDF should contain Project title, PIs and co-PIs, overall proposed budget, and area of interest responding to (proposals may respond to more than one area of interest). The letter of

intent is non-binding and solely for determining what proposals will be submitted. It will neither be reviewed nor any feedback given.

### PROPOSAL GUIDELINES

A single PDF file should be submitted to [m2fct-discretionary@lbl.gov](mailto:m2fct-discretionary@lbl.gov) by 5 PM PDT on July 9, 2021. The PDF should contain:

- Cover page stating Project title, PIs and co-PIs including name, mailing address, email address, phone number, overall proposed budget, area of interest responding to (proposals may respond to more than one area of interest), and non-proprietary summary (200 words or less).
- Technical volume detailing the proposed approach and innovation. This content must be within a **4 page** length limit including references and figures, with main text being Times New Roman, 12 pt and with 1 inch margins. The technical volume should address:
  - Introduction and background including identification of the issue being resolved and its importance to HDV applications
  - Approach taken to resolve or study the innovation including the specific product, component, analysis, or process being developed, refined, or validated. Describe the project in enough detail that it may be evaluated for its feasibility, impact, relevance to area-of-interest objectives
  - R&D challenges that, if addressed, will result in significant technological advances
  - How the proposed research is synergistic with and complements existing M2FCT efforts and how those efforts will be leveraged
  - Identification of risks and risk mitigation strategies
  - Appropriateness of and need for government funding
- Budget and timeline including annual SMART milestones, key personnel, and direct and indirect costs.

Any questions should be sent to [m2fct-discretionary@lbl.gov](mailto:m2fct-discretionary@lbl.gov) and answers will be posted on the M2FCT website.

### REVIEW AND SELECTION PROCESS

Proposals will initially be screened to ensure that they meet the funding and scope metrics. Once passed this initial screen, proposals will be reviewed by a panel of experts. The review team shall score each of the applications according to the application criteria stated below. M2FCT shall then select from the top ranked proposals to build a strategic project portfolio with the available resources. The primary categories and relative ranking criteria used to evaluate submissions will be as follows.

- **Technical (65%)**
  - Relevance of proposed work to the goals of M2FCT.
  - Overall technical merit.

- Potential impact of the collaboration on the technical challenge being addressed including proposed interaction with M2FCT.
- Degree to which the current state of the technology and the proposed advancement are clearly described.
- Extent to which the collaboration specifically and convincingly demonstrates how the applicant will move the state of the art and help meet the M2FCT goals and overall target.
- **Programmatic (35%)**
  - Adequacy and feasibility of proposed work plan to meet clearly articulated goals of the project.
  - Appropriate use of M2FCT capabilities, resources, and expertise.
  - Clear estimated level of support requested.
  - Qualifications and expertise of the key technical personnel who are active participants in the proposed project.
  - Technical qualification and availability of resources

#### **POST-AWARD**

All projects will be subject to DOE reviews and reporting requests including a quarterly report as part of M2FCT and PIs should commit to attend and interact at the monthly team meeting and the two biannual in-person meetings. Any awardee must be willing to accept the M2FCT NDA and establish MTAs as appropriate.