Notice of Intent No. DE-FOA-0002787

Notice of Intent to Issue
Funding Opportunity Announcement No. DE-FOA-0002788

The Office of Energy Efficiency and Renewable Energy (EERE) intends to issue, on behalf of the Building Technologies Office (BTO), a Funding Opportunity Announcement (FOA) entitled "Buildings Energy Efficiency Frontiers & Innovation Technologies (BENEFIT) - 2022".

This potential FOA is expected to support the development, validation, and demonstration of novel building technologies and retrofit practices that have significant potential for equitable carbon savings through building electrification, energy efficiency, and demand flexibility. The FOA will also enhance building and grid resilience, affordability of efficient technologies and practices, and ensure environmental justice and inclusion of underserved communities.

It is anticipated that the FOA may include the following Areas of Interest:

Area of Interest: Heating, Ventilation, and Air Conditioning (HVAC) and Water Heating (WH)

- **Subtopic A: Components R&D for Residential and Commercial HVAC/WH Air-Source Heat Pumps**
  This subtopic will focus on advancing Residential and Commercial HVAC/WH air-source heat pump components R&D that relies on a vapor compression cycle. These refrigerants include both natural refrigerants and fluorinated gases (F-gases) equipment. The four basic components of a heat pump system will be the focus of this subtopic: compressors, heat exchangers (evaporator and condenser), expansion and reversing valves. The target outcomes are lower cost and higher performing air source heat pumps and heat pump water heaters that surpasses ENERGY STAR levels by at least 10% while having payback periods less than or equal to 5 years. BTO is also addressing concerns over refrigerant leaks with R&D focusing on refrigerant leak detection and sensor development. Reducing refrigerant leaks for HVAC and water heating equipment has the potential to increase lifetime equipment operating efficiency, address safety issues, decrease equipment and operating cost, and most importantly supports hydrofluorocarbon (HFC) phasedown and greenhouse gas reduction goals.
- **Subtopic B: HVAC/WH Cost Compression Solutions**
  This subtopic will focus on reducing the costs (product and installation) to address more equitable heat pump and heat pump water heater solutions to increase market penetration, especially in cold, very cold regions, multifamily applications, and low-income neighborhoods. Solutions are expected to use a refrigerant with less than 750 global warming potential (GWP). The target outcomes are lower-installed cost heat pumps and heat pump water heaters. Heat pumps shall meet Department of Energy

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minimum efficiency standards and have a demonstrated installation time of less than 3-hours for a typical residential system swap-out. Heat pump water heaters shall meet Uniform Energy Factor (UEF) of 3.5 and have a demonstrated installation time of fewer than 2 hours when replacing tankless or tank fossil fuel-based water heaters less than 150 gallons. For systems that are not explicitly addressed (e.g., unitized systems, integrated systems, mechanical system pods, etc.), applicants shall justify relevant performance and installation time metrics as compared to conventional systems.

- **Subtopic C: Commercial Low GWP Cold Climate Rooftop Heat Pump**
  The goal of this subtopic is to develop a commercial Low-GWP rooftop unit (RTU) for cold climates that uses a refrigerant with a global warming potential (GWP) less than 150. A clear commercialization plan that engages an industrial partner would be ideal in commercializing the RTU and early market entry. A cold climate rooftop heat pump capable of operation to -15F using a refrigerant with a GWP of less than 150. This would enable the US to meet future HFC target reductions of 85% and ensure US competitiveness in the global market.
- **Subtopic D: Commercial Heat Pump Water Heater Development and Demonstration**
  This subtopic seeks to fund the development and demonstration of heat pump technologies that provide central water heating solutions in commercial buildings. Residential Heat Pump Water Heaters used in a commercial application are not eligible for this subtopic. Preferred proposals will include near commercial and emerging heat pump technologies that provide central water heating for commercial or large multifamily buildings, or solutions that are ready for demonstration in occupied and operational buildings and display a high potential to significantly reduce greenhouse gas emissions across the U.S. building stock. Development projects may include but are not limited to storage sizes, reducing piping losses, and other system implementation issues. Commercial Heat Pump Hot Water Heaters funded under this proposal shall have an efficiency equivalent to EnergyStar or higher.

Area of Interest: Thermal Energy Storage (TES)

Plug-and-Play Modular Thermal Energy Storage Systems Development

This topic seeks the development and validation of next generation plug-and-play modular thermal energy storage (TES) systems for combined heating and cooling applications with improved cost and performance and ease of installation that can easily connect with the HVAC equipment, easily scale to the appropriate size for the application, and shift 30-50% of HVAC loads over 4 hours. The modular TES device should be designed and engineered to maximize efficiency, power delivery, and utilization at high discharge rates using advanced heat exchangers, state of charge (SOC) measurement, and predictive controls. TES ready connection points should be designed and engineered into the HVAC equipment to facilitate easier integration and performance of the overall TES-HVAC system. Modifications to provide these TES-ready connectors to the HVAC equipment should not exceed 2-5% of original equipment manufacturer (OEM) costs. The target outcomes are lower cost and higher performing modular

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TES systems that can be easily connected to HVAC equipment through universal plug and play connectors and able to discharge in 4 hours utilizing at least 95% of its stored capacity at a capital cost of under $40/kWh thermal at scale.

Area of Interest: Battery Energy Storage Systems (BESS)

- **Subtopic A: Innovative BESS Integration and Coordination Strategies**
  This topic seeks product innovations that reduce cost, increase building resilience, or improve grid integration of BESS in residential and commercial buildings. Innovations should provide either (1) easier integration with buildings or (2) improved coordination of charging behavior across BESS or between BESS and the electrical grid. Proposals to this topic may target either benefit or (ideally) both. The BESS can either be centralized in a building or distributed among or within end uses. Both stationary and non-stationary home battery systems are eligible under this subtopic. Vehicle-to-building or vehicle-to-grid battery systems are not eligible. BTO strongly encourages proposals to this topic that improve the viability of whole-building electrification retrofits through load management and peak shaving.
- **Subtopic B: Net-zero Emissions BESS Validation and Analysis**
  This topic seeks validation and analysis activities that align the economic and resiliency benefits of BESS in residential and commercial buildings with emissions reduction. The goal of this topic is to advance understanding of the complexity and tradeoffs between resilience, electricity bill savings, and emissions reduction through realistic demonstrations that support in-depth technoeconomic and lifecycle analyses. Validation measures should include an accounting of avoided emissions in real time based on charging and discharging times and grid mix, ideally with no impact on performance or building occupants. Analysis should accompany validation activities, with thoughtful application of lifecycle carbon impacts, geographic diversity, and technoeconomic feasibility for net-zero (or better) BESS operation. Both stationary and non-stationary home battery systems are eligible for this topic, including bidirectional electric vehicle charging applications.

Area of Interest: Plug Loads/Lighting

Integrating Connected Lighting with Plug Load Control to Support Building Electrification

This topic seeks to make data and interfaces associated with connected lighting systems (CLS) available and actionable for plug loads in buildings with minimal cost and complexity. Rather than targeting whole-building automation systems, which are generally more costly and complex to specify and maintain than CLS, this approach aims to incorporate plug loads and lighting into a shared control environment with similar functionality to a standalone CLS. Solutions to this topic area should be minimally invasive and only marginally more expensive or complex compared to current CLS products, both in terms of installation and operation. The

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control solution should ideally address devices that are already networked without additional hardware, taking advantage of relevant communication and interoperability protocols. Data obtained from CLS sensors should inform plug load behavior, either by turning off devices or ensuring they are in a low-power state whenever feasible. User interfaces should extend best practices for lighting controls to plug loads, with design for ease of use and clarity. Software tools developed under this topic should ideally be open-source and accessible to a broad user base "out of the box." Applications should target commercial buildings, and applicants should provide estimates of energy savings potential specific to the building sector their proposal targets.

Area of Interest: Opaque Building Envelope

- **Subtopic A: R5+ Insulated Cladding for Residential Field Applied Applications**
  This topic seeks the development and validation of cost-effective insulated cladding solutions for typical siding products (e.g., vinyl, wood, fiber cement, engineered wood), in the same form factor as commercially available products. The designs should focus on at least R5 performance with effective rain screen and be easy to install with consideration of interfaces (windows, roof to wall, wall to foundation, construction penetrations). The goal is to develop and commercialize an R5+ drop-in replacement for uninsulated, finish only siding with a maximum installed thickness of 1-1/2" (ideally 1-1/8") and Installed product cost premium (including addition of an air control layer) of $1 per square foot.
- **Subtopic B: Cost Compression Solutions for Building Insulation Retrofit Technologies**
  This topic seeks demonstrated process or technology solutions to lower the costs of (a) field applied continuous insulation retrofits and (b) panelized insulation retrofits and address barriers to equitable uptake of envelope energy efficiency improvements, especially in multifamily and low-income housing. Solutions should be developed and validated in a lab or field environment and capable of addressing building irregularities, especially out-of-square or out-of-plane components. The goal is to validate solutions to lower the cost of wall retrofits, including the air, water, and thermal control layers, cladding, and integration details with the following cost and performance targets.
    A. Field Applied Continuous Insulation Retrofits: <$5/sqft for R-15+ (at scale)
    B. Panelized Retrofits: <$10/sqft for R-25+ (at scale)
- **Subtopic C: Air Leakage Diagnostic and Air Sealing Technologies**
  Air leakage in the U.S. accounts for about 4 Quads of energy annually, costing approximately $10 billion per year. This topic seeks the development and validation of (a) higher fidelity, portable air leakage diagnostic technologies that can be used to identify the location and quantify the extent of infiltration/exfiltration in occupied buildings regardless of outdoor weather conditions at a speed of 1 second per square foot envelope area and per test cost of $100 or less and (b) advanced air-sealing technologies designed specifically for use in existing, occupied buildings at the following cost and performance targets for residential and commercial buildings, respectively.

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Residential buildings: 1 ACH @ $1.22/ft2 envelope area and commercial buildings: 0.2 CFM75/ft2 @ $0.53/ft2 envelope area.

EERE envisions awarding multiple financial assistance awards in the form of cooperative agreements. The estimated period of performance for each award will be approximately 2-3 years.

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 December 2022 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 register for any open EERE FOAs that are currently in EERE 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.**

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- 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.

Teaming List

BTO is compiling a "teaming" partner list to facilitate widespread participation in this FOA. This list allows organizations with expertise in the topics to express their interest to potential applicants and to explore potential partnerships. The Teaming Partner List is available on https://eere-Exchange.energy.gov under this NOI (DE-FOA-0002787) until a potential FOA is posted. Any organization that would like to be included on this list should submit the following information to the FOA email box (BENEFIT22@ee.doe.gov) with the subject line *"BENEFIT 2022 FOA: Teaming Partner Information":*

- Organization Name
- Contact Name
- Contact Email
- Contact Phone #
- Contact Website/Social Media
- Organization Type
- FOA Topic Area(s) of Interest
- Area of Technical Expertise (bulleted list)
- Brief Description of Capabilities and/or Demonstration/Field Validation Site Offering (can optionally include diversity, equity, and inclusion (DEI) strengths and best practices). If offering a Demonstration/Field Validation Site, please include the below information:
  - Quantity of Properties
  - Location of Properties
  - Property Type
  - Climate Zone(s)
  - Any Additional Notes

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- Description of Need in a Teaming Partner and/or Demonstration/Field Validation Site

By submitting a request to be included on the Teaming Partner List, the requesting organization consents to the publication of the above-referenced information. Each organization should provide a generic point of contact e-mail address to receive queries. If a direct personal e-mail address is provided, the requesting organization consents to its publication. 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.

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