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# U.S. DEPARTMENT OF ENERGY
# OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
# NEPA DETERMINATION

**RECIPIENT:** Clemson University **STATE:** SC

**PROJECT TITLE:** Megawatt Scale, Multi-Source Heat Recovery System with a Flexible Grid Interconnect

| Funding Opportunity Announcement Number | Procurement Instrument Number | NEPA Control Number | CID Number |
|---|---|---|---|
| DE-FOA-0002252 | DE-EE0009423 | GFO-0009423-001 | GO9423 |

**Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Policy 451.1), I have made the following determination:**

**CX, EA, EIS APPENDIX AND NUMBER:**
Description:

| | |
|---|---|
| **A9 Information gathering, analysis, and dissemination** | Information gathering (including, but not limited to, literature surveys, inventories, site visits, and audits), data analysis (including, but not limited to, computer modeling), document preparation (including, but not limited to, conceptual design, feasibility studies, and analytical energy supply and demand studies), and information dissemination (including, but not limited to, document publication and distribution, and classroom training and informational programs), but not including site characterization or environmental monitoring. (See also B3.1 of appendix B to this subpart.) |
| **B3.6 Small-scale research and development, laboratory operations, and pilot projects** | Siting, construction, modification, operation, and decommissioning of facilities for smallscale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment. |

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to Clemson University to design, develop, and demonstrate a megawatt scale, multi-source heat recovery system with a flexible grid interconnection utilizing physics-based modeling and simulations of the Organic Rankine Cycle. This system would produce energy from multiple heat sources (thermal, mechanical, and electrical) and combine them into a single heat recovery stream. Design and development of the system would involve computer simulations, controller hardware-in-the-loop experiments, and bench-top testing. The project would be completed over three Budget Periods (BPs) with a Go/No-Go decision point between each BP. This NEPA determination is applicable to all three BPs.

Models and analysis tools would be created to understand system requirements and to analyze behavior under various grid-connected scenarios. Algorithms, cost functions, and hardware would be designed to manage the dynamic performance of the system. Engineering design and analysis would be completed for system components, which would include heat exchangers for district heating, evaporators for each heat source and condensers, the working fluid characteristics and pumping requirements, expansion tank sizing, turbo expander design and operating envelopes, and control valving and sensing. The proposed system would be validated by merging simulation models with physical control hardware to create a hardware-in-the-loop environment. Demonstration equipment would be installed and commissioned in Clemson University's Energy Innovation Center (EIC) to demonstrate efficacy and viability of this technology. Equipment would include the heat recovery system and controllable laboratory equipment. A full scale 1-megawatt electric, multi-source heat recovery system demonstration would take place in Clemson's controlled laboratory environment.

Proposed project activities by location are listed below:

Clemson University, EIC – North Charleston, SC

- Controller hardware-in-the-loop setups, modeling, and computer simulations.
- Full scale prototype assembly and demonstration of the full-scale prototype system.

Clemson University, Carroll Campbell Graduate Education Center – Greenville, SC

- Computer simulations, component modeling, and controls development.

• Small scale bench-top experiments with multiple heat source controls.

TECO Westinghouse Motor Company – Round Rock, TX

• Control system development, manufacturing and assembly of system components, and initial bench-top testing of system components.

National Renewable Energy Laboratory – Golden, CO

• Computer modeling, simulations, and economic analysis.

No changes in the use, mission, or operation of existing facilities would be required as part of this project and no additional permits would be required in order to conduct any of the work activities.

Project activities would involve the use and handling of hazardous materials including refrigerant, solvents, and oils. Any risks associated with the handling of these materials would be mitigated through adherence to established health and safety policies and procedures outlined in the Cornell EIC Safety Manual. The EIC is located within the 100-year floodplain. Proposed activities would not require any construction or modification to EIC buildings. Although the university stores 50-60 thousand liters of oil at the EIC, it has a Spill Prevention, Control, and Countermeasure Plan and measures from this plan would be followed to mitigate impacts from a spill. All waste products would be disposed of by licensed waste management service providers. Clemson University and its project partners would observe all applicable Federal, state, and local health, safety, and environmental regulations.

Any work proposed to be conducted at a federal facility may be subject to additional NEPA review by the cognizant federal official and must meet the applicable health and safety requirements of the facility.

**NEPA PROVISION**

DOE has made a final NEPA determination.

Notes:

Advanced Manufacturing Office
This NEPA determination does not require a tailored NEPA provision.
Review completed by Shaina Aguilar on 7/26/21.

**FOR CATEGORICAL EXCLUSION DETERMINATIONS**

The proposed action (or the part of the proposal defined in the Rationale above) fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D. To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects of the proposal.

The proposed action has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

The proposed action is categorically excluded from further NEPA review.

**SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.**

NEPA Compliance Officer Signature: Electronically Signed By: Casey Strickland Date: 7/28/2021

NEPA Compliance Officer

**FIELD OFFICE MANAGER DETERMINATION**

- [x] Field Office Manager review not required
- [ ] Field Office Manager review required

**BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :**

Field Office Manager's Signature: _____ Date: _____

Field Office Manager