

PMC-ND

(1.08.09.13)

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



**RECIPIENT:** University of Louisiana at Lafayette

**STATE:** LA

**PROJECT TITLE:** Modular Reactors for the Capture and Electro-conversion of CO<sub>2</sub> in Various Industrial Processes to Value-Added Chemicals

<b>Funding Opportunity Announcement Number</b>	<b>Procurement Instrument Number</b>	<b>NEPA Control Number</b>	<b>CID Number</b>
DE-FOA-0002252	DE-EE0009421	GFO-0009421-001	G09421

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.)

**B3.15 Small-scale indoor research and development projects using nanoscale materials** Siting, construction, modification, operation, and decommissioning of facilities for indoor small-scale research and development projects and small-scale pilot projects using nanoscale materials in accordance with applicable requirements (such as engineering, worker safety, procedural, and administrative regulations) necessary to ensure the containment of any hazardous materials. Construction and modification activities would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible).

**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 the University of Louisiana at Lafayette to develop co-located modular reactors for the capture and subsequent conversion of carbon dioxide (CO<sub>2</sub>) to value-added ethylene (C<sub>2</sub>H<sub>4</sub>). Two modular reactors would be created: one for carbon capture that would include a fuel cell that enables diffusion and one for carbon utilization that would include an anion exchange membrane (AEM) for the electro-conversion of CO<sub>2</sub>. In addition, an auxiliary unit would be created to provide fuel for the fuel cell reactor. All three units are electrochemical membrane reactors but have different membranes and would be operated at different conditions. Each unit would be built as a smaller model then scaled-up. The project would be completed over three Budget Periods (BPs) with a Go/No-Go Decision Point between each BP. This NEPA review applies to all three BPs.

Single electrochemical cell reactors for CO<sub>2</sub> capture and sequestration would be fabricated, demonstrated, and tested for baseline performance. A modular electrolysis cell that converts CO<sub>2</sub> to ethylene would be designed, manufactured, and demonstrated. This would integrate the AEM, tandem cathode electrode, and oxide anode electrode into a single cell. An auxiliary reactor unit would be designed, optimized, and scaled up from one single cell to a stack. The CO<sub>2</sub> capture reactor, the CO<sub>2</sub> utilization reactor that converts CO<sub>2</sub>, and the auxiliary unit would be integrated into a single system to increase energy efficiency of the overall process and provide a reliable and convenient CO<sub>2</sub> source that is typically representative of industrial CO<sub>2</sub> sources. Tasks would be performed as the module reactors are designed, optimized for performance, and scaled up from the baselines to evaluate stack stability.

Proposed project activities by location are listed below:

University of Louisiana at Lafayette – Lafayette, LA

- Assist in development of carbon capture modular reactor and carbon utilization modular reactor.
- Develop and fabricate cells and stacks for the auxiliary unit.

Idaho National Laboratory – Idaho Falls, ID

- Develop baseline modular electrochemical membrane reactor (EMR) for CO<sub>2</sub> capture. This would include performing fundamental studies for material properties and compatibilities for components, engineering cell structures, and fabricating EMRs.
- Technology scale-up of modularized EMR stack and demonstrate efficient CO<sub>2</sub> capture using modularized reactor.
- Manufacture multiple single cells, assemble, and test at existing testing manifold for a typical stack.

University of Cincinnati – Cincinnati, OH

- Design, synthesize, fabricate, characterize, and test catalyst and tandem gas diffusion electrodes, and analyze data.

Giner, Inc – Newton, MA

- Design, manufacture, and testing of electrolyzer cells.
- Develop and fabricate catalyst using standard wet chemistry techniques including electrodeposition, ink formulation, and electro spraying.
- Fabricate electrodes and membranes.
- Use these materials to design and assemble electrolyzer cells and stacks. Test electrolyzers for CO<sub>2</sub> and carbon monoxide (CO) conversion followed by CO<sub>2</sub>/CO to C<sub>2</sub>H<sub>4</sub> conversion and analyze data.

Project activities would involve the handling of chemical solvents, flammable gases, and compressed gas cylinders. Any risks associated with the handling of these materials would be mitigated through adherence to established health and safety policies and procedures. Protocols would include personnel training, the use of personal protective equipment, monitoring, internal assessment, and engineering controls. Nanoscale particles would be used for catalyst fabrication. Personal protection equipment and vent hoods would be used during fabrication and processing of these materials. All waste products would be disposed of by licensed waste management service providers. The University of Louisiana at Lafayette and its project partners would observe all applicable Federal, state, and local health, safety, and environmental regulations. No modifications, new permits, or change in the use, mission, or operation of any facility would be required.

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 5/5/21.

## 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: 5/5/2021  
NEPA Compliance Officer

**FIELD OFFICE MANAGER DETERMINATION**

- 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