

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



**RECIPIENT:** University of Michigan, Ann Arbor

**STATE:** MI

**PROJECT TITLE :** Integrated biochemical and electrochemical technologies (IBET) to convert organic waste to biopower via North American research and educational partnerships

<b>Funding Opportunity Announcement Number</b>	<b>Procurement Instrument Number</b>	<b>NEPA Control Number</b>	<b>CID Number</b>
DE-FOA-0002203	DE-EE0009284	GFO-0009284-001	GO9284

**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 federal funding to the University of Michigan, Ann Arbor (University of Michigan) to develop and test novel biomethane production technologies. As part of the project, laboratory and pilot-scale anaerobic digestion reactors would be fabricated and tested in laboratory settings and at an existing water resource recovery facility.

Project activities would include conceptual design work, data analysis, computer modeling, anaerobic digestion reactor assembly, operational testing, and material characterization. Each of these activities will be discussed in more detail below.

Conceptual design work, data analysis, and computer modeling would be performed throughout the project. University of Michigan, Argonne National Laboratory (ANL), Northwestern University, and inCTRL Solutions Corporation (inCTRL) would all participate in conceptual design work, which would include development of biomethane and hydrogen processing methods, as well as the development of the bioreactor device specifications. inCTRL's participation in the project would occur at an existing office location in Toronto, Ontario, Canada. All inCTRL work would be limited to computer modeling and simulations of bioreactor processes. No physical experimentation would be performed by inCTRL.

Anaerobic digestion reactor assembly would consist of both laboratory and pilot-scale device assembly. Both systems would consist of similar component parts, with the primary difference between the two being that of scale. Each system would include two bioreactor modules to produce biogas as part of a two-phase approach, an electrochemical reactor to produce carbon dioxide and hydrogen from the biogas, and a gas phase methanogenic (GAME) bioreactor, which would utilize the produced hydrogen as an input. The two bioreactor modules would also be connected to a feed-delivery system.

For laboratory-scale bioreactor development, University of Michigan, ANL, and Northwestern University would each independently develop and test the components discussed above. The components would then be assembled into an integrated system at ANL's facilities in Lemont, IL. University of Michigan would assemble and test the two-phase bioreactor modules at laboratory facilities at its campus in Ann Arbor, MI. ANL would develop and assemble the electrochemical reactor at its laboratory facilities in Lemont, IL. Northwestern University would assemble and test the GAME bioreactor at laboratory facilities at its campus in Evanston, IL. For system integration at ANL, the modules

would be connected via a series of tubes, pumps, and valves, and would also be connected to monitoring and control devices. Assembly and installation of the components and integrated system would not require any physical modifications to existing facilities, ground disturbance, or changes to the use, mission, or operation of existing facilities. No additional permits or authorizations would be required.

Operational testing would consist of feeding the above-mentioned devices and the integrated system with input materials (e.g., food/municipal solid waste samples and water) to produce the target output materials (e.g., methane gas, carbon dioxide). At all of the project locations, operational testing of the individual devices and the integrated system would be performed at laboratory-scale (i.e., tens of liters of biomethane produced per day).

Pilot-scale device assembly (TRL-5) would be performed at the Great Lakes Water Authority Water Resource Recovery Facility in Detroit, MI. The pilot-scale integrated system would have a processing capacity of 100-L. The integrated system would be deployed at the facility utilizing a trailer, which would be parked next to existing sewage sludge tanks. The system would be fully contained within the trailer and would not be directly connected to any facility infrastructure. Sewage sludge from the facility would be collected and fed into the system manually. Assembly and installation of the integrated system would not require any physical modifications to existing facilities, ground disturbance, or changes to the use, mission, or operation of existing facilities. No additional permits or authorizations would be required.

Material characterization would be performed throughout the project, both in the laboratory settings where laboratory-scale device testing would occur, and at the Great Lakes Water Authority Water Resource Recovery Facility. Material characterization would include analysis of the microbial communities existing in the input materials fed into the bioreactors. This would be performed by the project team utilizing standardized DNA sequencing techniques. No biological strains would be artificially introduced and all work to be performed would be limited to biosafety level 1 requirements, which would be met by the project team.

Project work would involve the use and handling of industrial chemicals, heavy metals, flammable gases, and municipal waste. All such handling would be performed in controlled laboratory environments and industrial waste treatment facilities that work with these materials as part of their regular course of business. To mitigate potential hazards, University of Michigan and its project partners would adhere to established institutional health and safety policies and procedures. Protocols would include employee training, the use of personal protective equipment, engineering controls, monitoring, and internal/external assessments. All waste materials produced would be handled and disposed of properly, in accordance with established institutional waste management policies. Biomass samples would be bleached or autoclaved prior to disposal. All emissions produced by the project would be filtered through fume hoods.

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:

Bioenergy Technologies Office

This NEPA determination does not require a tailored NEPA provision.

Review completed by Jonathan Hartman, 06/28/2021

Review updated by Corrin MacLuckie, 03/19/2024

## **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.

DOE has determined that work to be carried out outside of the United States, its territories and possessions is exempt from further review pursuant to Section 5.1.1 of the DOE Final Guidelines for Implementation of Executive Order 12114; "Environmental Effects Abroad of Major Federal Actions."

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: **6/29/2021**  
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