

PMC-ND
(1.08.09.13)

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



RECIPIENT: Colorado State University

STATE: CO

PROJECT TITLE: Electro-Enhanced Conversion of Wet Waste to Products Beyond Methane

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0002029	DE-EE0008923	GFO-0008923-001	G08923

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 Colorado State University (CSU) to develop a process to convert wet waste (e.g. food waste and cattle manure) into biofuels. The process would incorporate anaerobic digestion (AD) to convert the initial inputs into volatile fatty acids (VFAs), chemical extraction/electrodialysis to separate the VFAs, and bioelectrosynthesis to upgrade the VFAs to alcohols.

The project would be completed through an iterated approach over three Budget Periods (BPs), with each BP building on the results of the previous BP. Project activities would be performed repeatedly throughout the project, with adjustments made to the methodologies based on previous outcomes. Throughout the project, experimental testing would focus on the development of methodologies for wet waste conversion and VFA upgrading, defining optimal operating conditions for conversion processes, and sub-system optimization.

Specific activities to be performed are described below:

Task 1 - Enhancement of Volatile Fatty Acids Production in AD: AD would be performed. The process would be developed through multiple iterations to enhance VFA production and increase feedstock conversion. Variables of interest (e.g. microbial communities, redox profiles) would be modified in order to assess the impacts to the process outputs. VFA extraction and microbial community development would also be performed as part of this task.

AD would be performed in small and pilot-scale batches (2 – 30 L and 2,000 L batches, respectively). Various iterations would be performed at small scales (2 – 30 L) to gather data on preferred methodologies. Small scale batches would be performed at established laboratory facilities operated by CSU and its project partners (discussed further below) that are designed to perform work similar in nature to that included in this project.

Approximately 1 – 2 of the best performing processes would be selected for testing at pilot-scale (2,000 L batch). Pilot-scale experiments would be performed using an existing reactor located at South Dakota School of Mines & Technology's (SDSM&T) campus in Rapid City, SD. The primary components of the reactor consist of a 2,000 L tank, slurry grinders, and a solid-liquid separator. All components are housed within a shipping container measuring 18' x 7.5' x 7.5'. The shipping container is located at an outdoor location on campus which has been designated for its use. The reactor is outfitted with all required utility connections.

Pilot-scale testing would consist of continuous digestion campaigns of 1 – 2 weeks. Food waste/manure (7 lb/h), water (1 gal/min) and sodium carbonate (1 lb/h) would be used as inputs. VFAs (3.5 lb/h), biogas (0.7 ft³/min), undigested solids (1.3 lb/h) and water (1 gal/min) would be produced as outputs. All waste materials and wastewater generated by the project would be disposed of properly, in accordance with local regulations. SDSM&T would adhere to established protocols to ensure that biochemical oxygen demand (BOD) levels do not exceed allowable concentrations.

Task 2 - Capturing and upgrading AD gaseous and liquid product streams: Carbon dioxide (CO₂) produced through AD in the previous task would be reduced to acetate and ethanol through microbial electrosynthesis (MES). These products, along with VFAs would be upgraded to higher value products (e.g. organic acids, alcohols). Electro-bioreactors would be used for the conversion process. Several 120 ml bioreactors are currently installed at the National Renewable Energy Laboratory (NREL). Additional bioreactors measuring between 120 and 500 ml (approximately 8) would be installed to supplement these. The bioreactors would be fabricated using existing equipment at NREL's machine shop. The bioreactors would consist of small plastic vessels connected with electrodes, plastic headplates, and Nafion membranes. The bioreactors, once connected, would be small enough to rest on a desktop. No facility modifications would be required for the installation of this equipment.

Task 3 - System Evaluation and Optimization to Assess Economic Viability: This task would consist of engineering process modeling and techno-economic analysis.

Task 4 - Integrate Education with Research: This task would consist of activities intended to integrate students into the research activities at the universities participating in the project. This would include the development of internship programs, outreach programs, and forums to discuss research.

All project activities would be coordinated by CSU. CSU and NREL would perform small-scale (< 30 L) AD experiments. SDSM&T would perform small (< 20 L) and pilot-scale (2,000 L) AD experiments. University of California, Irvine (UCI) and NREL would perform electro-dialysis and bioelectrosynthesis at bench scale (< 20L). No physical modifications to existing facilities, construction of new facilities, ground disturbing activities, or changes to the use, mission, or operation of existing facilities would be required. Likewise, no additional permits or authorizations would be needed for the completion of project activities.

Project activities would involve the use and handling of industrial solvents and microbial strains. All such handling would be performed in controlled laboratory environments. Risks associated with the performance of project work would be mitigated through adherence to established corporate health and safety policies and procedures. Protocols would include employee training, the use of personal protective equipment, engineering controls, monitoring, and internal assessments. Microbial strains used would be limited to those within the Risk Group 1 (RG1) category, per the classification system of the National Institutes of Health (NIH). Laboratories utilizing these species would be equipped to meet RG1 requirements for handling, storage, and disposal. Genetic engineering would be conducted on some microbial strains at the laboratory facilities of NREL and UCI. This would be performed in accordance with established biosafety protocols. All microbial strains that have been engineered would be autoclaved prior to disposal. At SDSM&T's sites, larger scale AD would be performed. This would involve the use of heavy mechanical equipment. The digestion process would also yield flammable methane. SDSM&T regularly conducts work similar in nature to that which would be performed as part of this project. The AD equipment that would be used underwent a safety review prior to commissioning. Methane produced would be vented through an existing air handling system. All personnel would receive training in proper operation of the equipment and handling of microbial species.

CSU 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:

Bioenergy Technologies Office
This NEPA determination does not require a tailored NEPA provision.
Review completed by Jonathan Hartman, 07/29/2020

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: **Roak Parker**
NEPA Compliance Officer

Date: 7/29/2020

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: _____

Field Office Manager

Date: _____