

PMC-ND

(1.08.09.13)

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

**RECIPIENT: RICE UNIVERSITY****STATE: TX**

**PROJECT TITLE:** HIGHLY EFFICIENT SOLAR WATER-SPLITTING USING 3D/2D HYDROPHOBIC PEROVSKITES WITH CORROSION RESISTANT BARRIERS

<b>Funding Opportunity Announcement Number</b>	<b>Procurement Instrument Number</b>	<b>NEPA Control Number</b>	<b>CID Number</b>
DE-FOA-0002022	DE-EE0008843	GFO-0008843-001	

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 Rice University to design and develop a halide hybrid perovskite-based photoelectrochemical cell (HaP-PEC). The technology would incorporate a novel type of 3D/2D heterostructure perovskite solar cell, which would be developed to be water resistant and have a higher performance efficiency (e.g. solar-to-hydrogen (STH) conversion efficiency), as compared to current technologies. The project would be completed over three Budget Periods, with a Go/No-Go Decision Point in between each BP.

BP1 would focus on the design/development of HaP materials and their integration into the solar cell structures. Proposed activities under this period would include material selection (e.g. photo-absorbing HaP materials), material synthesis (e.g. thin film synthesis), cell design/fabrication, and material analysis (e.g. X-ray diffraction, spectroscopy). BP2 would center on research into corrosion mechanisms and applications to counteract cell corrosion. Task work would include optimization of HaP-PEC subcomponents (e.g. photocathodes and photoanodes), performance testing, and anti-corrosion barrier development. BP3 would focus on HaP-PEC performance optimization and addressing scale-up of the HaP-PEC active area. Specifically, the HaP-PEC active area would be scaled up to a 5x5 square inch module, for which a proof-of-concept module would be developed. A techno-economic cost analysis would also be completed during this period.

All project activities would be coordinated by Rice University. Laboratory work would be performed at existing, purpose-built facilities. Design, testing, characterization, and fabrication activities would be performed at Rice University's campus in Houston, TX. Testing activities and additional characterization work would be performed at a DOE Energy Materials Network (EMN) laboratory (likely at the Lawrence Berkeley National Laboratory (Berkeley, CA), National Renewable Energy Laboratory (Golden, CO), or Lawrence Livermore National Laboratory (Livermore, CA)). No physical modification 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 of industrial chemicals and solvents. Photoabsorbers would contain background concentrations of lead salts. Fabrication of the photoabsorbers would be performed in sealed glove boxes in order to prevent users from directly accessing the materials. All lead-containing materials would then be disposed in accordance with established hazardous waste disposal guidelines. Rice 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:

Fuel Cell Technologies Office

This NEPA determination does not require a tailored NEPA Provision.

NEPA review completed by Jonathan Hartman, 12/10/2019

## 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:



Casey Strickland

NEPA Compliance Officer

Date: 12/11/2019

## 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: