

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



**RECIPIENT:** University of Southern California

**STATE:** CA

**PROJECT TITLE :** H2 Gas Turbine Thermal Barrier Coating Durability and Process Enhancement with Revolutionary Probabilistic Machine Learning (H2ThERMaL)

<b>Funding Opportunity Announcement Number</b>	<b>Procurement Instrument Number</b>	<b>NEPA Control Number</b>	<b>CID Number</b>
DE-FOA-0002553	DE-EE0010213	GFO-0010213-001	GO10213

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 the University of Southern California (USC) to develop and demonstrate enhancement of thermal barrier coating (TBC) durability and spray process for components used in harsh conditions such as in hydrogen (H<sub>2</sub>) gas turbine combustion. The proposed approach would utilize probabilistic machine learning (ML) methods to improve component life and withstand H<sub>2</sub> impacts on materials. The TBC application process would be demonstrated on a representative combustor liner. The project would be completed over two Budget Periods (BPs) with a Go/No-Go decision point between each BP. This NEPA determination is applicable to both BPs.

An optimized spray TBC application process would be developed and laboratory-scale tests of nickel alloy coupon samples in H<sub>2</sub>-bearing atmospheres would be conducted. The extent of damage from exposure in various H<sub>2</sub>-rich environments would be evaluated. ML methods would be used to transfer knowledge from coupon-level testing to full-scale components. Once the improved TBC is developed, it would be applied to a plate representing a combustor liner and installed in a high-pressure combustion rig for testing. Materials to be tested would be vendor-provided alloys and alloy/coating systems, both with approximate sample dimensions of 1 inch x ½ inch x ¼ inch. Approximately 150 samples would be tested.

Proposed project activities by location are listed below:

University of Southern California – Los Angeles, CA

- Computational modeling, machine learning, and probabilistic modeling

General Electric Research – Niskayuna, NY

- Analytical and AI modeling using in-house capabilities and demonstrating the proposed approach on a combustion component in high-pressure test rig

University of Virginia, Department of Materials Science and Engineering – Charlottesville, VA

- Modeling for simulation of thermochemical reactions of materials in combustion environments

- Coupon testing and coupon-level demonstration of spray TBC

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 substances and work with materials under high temperature and pressure. Any associated risks would be mitigated through adherence to established health and safety policies and procedures, including personnel training, the use of personal protective equipment, and engineering controls. All waste products would be disposed of by licensed waste management service providers. USC and its project partners would observe all applicable federal, state, and local health, safety, and environmental regulations.

## NEPA PROVISION

DOE has made a final NEPA determination.

Notes:

Advanced Manufacturing Office  
Review completed by Shaina Aguilar on 8/19/22.

## 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: 8/22/2022

## 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: \_\_\_\_\_