U.S. Department of Energy
Categorical Exclusion Determination Form

Submit by E-mail

Proposed Action Title: The Design Intelligence for Formidable Energy Reduction Engendering Numerous Totally Impactful Advanced Technology Enhancements (DIFFERENTIATE)

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Location(s) (City/County/State): CA; CO; CT; GA; IA; IL; IN; MA; MD; MI; NH; NJ; NY; PA; TN; TX; WA

Proposed Action Description:

Projects funded under the DIFFERENTIATE Program seek to enhance energy innovation by incorporating artificial intelligence and machine learning into energy technology development. These projects will adopt and utilize a simplified engineering design process framework to identify six general mathematical optimization problems that are common to many engineering design processes. The teams will then conceptualize several machine learning tools that could help engineers execute and solve these problems in a manner that dramatically accelerates the pace of energy innovation. If successful, the Program will support the development of machine learning tools that enhance (1) the creativity of the hypothesis generation, (2) efficiency of the high-fidelity evaluation process, and (3) ultimately reduce design iteration.

The DIFFERENTIATE Program is composed of 23 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This Determination covers all of the 23 projects (listed in Attachment A). All 23 projects fit within the class of actions identified under the DOE Categorical Exclusion identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the projects. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements.

Categorical Exclusion(s) Applied:

A9 - Information gathering, analysis, and dissemination

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.15 - Small-scale indoor research and development projects using nanoscale materials

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of 10 CFR Part 1021.

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

☑ The proposal 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 proposal that may affect the significance of the environmental effects of the proposal.

☑ The proposal 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.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: [signature] Date Determined: 02/28/2020

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Attachment A: Projects in the DIFFERENTIATE (FOA No. DE-FOA-0002107) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
United Technologies Research Center 2107-1502	Learning Enabled Network Synthesis (LENS) (P.300.0694)	A9
United Technologies Research Center 2107-1503	MULTI-source Learning-Accelerated Design of high-Efficiency multi-stage compRessor (MULTI-LEADER) (P.100.0979)	A9
Los Alamos National Laboratory 2107-1504	Machine learning based well design to enhance unconventional energy production	A9
General Electric Company, Ge Research 2107-1521	IMPACT: Design of Integrated Multi-physics, Producible Additive Components for Turbomachinery	A9; B3.6
General Electric Company, Ge Research 2107-1522	Probabalistic Machine Learning for Inverse Design of Aerodynamic Systems (Pro-ML IDeAS)	A9
National Renewable Energy Laboratory 2107-1532	End-To-End Optimization For Battery Materials And Molecules By Combining Graph Neural Networks And Reinforcement Learning	A9
National Renewable Energy Laboratory 2107-1535	INTEGRATE – Inverse Network Transformations for Efficient Generation of Robust Airfoil and Turbine Enhancements	A9
Lawrence Berkeley National Laboratory 2107-1539	Deep Learning and Natural Language Processing for Accelerated Inverse Design of Optical Metamaterials	A9; B3.6; B3.15
University Of Texas At Austin 2107-1541	Learning Optimal Aerodynamic Designs	A9
Northwestern University 2107-1543	Adaptive Discovery and Mixed-Variable Optimization of Next Generation Synthesizable Microelectronic Materials	A9
IBM Research 2107-1544	Model-based Reinforcement Learning with Active Learning for Efficient Electrical Power Converter Design	A9
Carnegie Mellon University 2107-1548	High-fidelity Accelerated Design of High-performance Electrochemical Systems	A9; B3.6; B3.15

Attachment A: Projects in the DIFFERENTIATE (FOA No. DE-FOA-0002107) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Stanford University 2107-1569	Energy efficient integrated photonic systems based on inverse design	A9; B3.6; B3.15
University Of Missouri: Columbia 2107-1570	Deep Learning Prediction of Protein Complex Structures	A9
Princeton University 2107-1577	MLSPICE: Machine Learning based SPICE Modeling Platform for Power Magnetics	A9; B3.6
Iowa State University 2107-1585	Context-Aware Learning for Inverse Design in Photovoltaics	A9
University Of Maryland: College Park 2107-1608	Invertible Design Manifolds for Heat Transfer Surfaces (INVERT)	A9
Pacific Northwest National Laboratory 2107-1625	Machine learning for natural gas to electric power system design	A9
Massachusetts Institute Of Technology 2107-1630	Machine learning assisted models for understanding and optimizing boiling heat transfer on scalable random surfaces	A9; B3.6
University Of Michigan: Dearborn 2107-1631	ML-ACCEPT: Machine-Learning-enhanced Automated Circuit Configuration and Evaluation of Power Converters	A9
Massachusetts Institute Of Technology 2107-1634	Global optimization of multicomponent oxide catalysts for OER/ORR	A9; B3.6; B3.15
Carnegie Mellon University 2107-1641	Predicting Catalyst Surface Stability Under Reaction Conditions Using Deep Reinforcement Learning and Machine Learning Potentials	B3.6; B3.15
Julia Computing, Inc. 2107-1656	Accelerating Coupled HVAC/Building Simulation with a Neural Component Architecture	A9