



U.S. Department of Energy Categorical Exclusion Determination Form

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Proposed Action Title: Cooling Operations Optimized for Leaps in Energy, Reliability, and Carbon Hyperefficiency for Information Processing Systems Program -- COOLERCHIPS and COOLERCHIPS SBIR/STTR (FOA Nos. DE-FOA-0002851 and DE-FOA-0002852)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): AR, CA, CO, CT, DC, FL, GA, IL, IN, MA, MD, MI, MO, NC, NM, NY, OH, PA, TN, TX, VA, WI

Proposed Action Description:

SECOND AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original and First Amended Determination, dated August 11, 2023 and September 6, 2023, respectively.) The COOLERCHIPS program seeks to develop highly efficient, and reliable cooling technologies for data centers. If successful, COOLERCHIPS technologies could reduce total cooling energy expenditure to less than 5% of a typical data center's IT load at any time and at any U.S. location for a high-density compute system, thereby reducing the operational CO2 footprint of data center operations. The COOLERCHIPS Program is composed of 15 small-scale research and development projects that will be conducted by universities, non-profit, and for-profit entities, small businesses, and federal laboratories. This Second Amended Determination adds 4 projects (Jetcool Technologies, Inc.; University of California, Davis [UC Davis]; National Renewable Energy Laboratory; and HRL Laboratories, LLC; see Attachment for all 12 projects covered by this and prior Determinations). These projects fit within the class of actions identified under the DOE Categorical Exclusions identified below. 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. UC Davis may require permits and approvals for their proposed actions, and is prohibited from commencing applicable project work until those permits are obtained. UC Davis has certified that they will update ARPA-E on any permit requirements, at which time ARPA-E will determine whether an amended NEPA Determination, is required prior to the conduct of applicable project work.



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: Approved via email

Date Determined: September 19, 2023



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Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): AR, CA, CO, CT, DC, FL, GA, IL, IN, MD, MI, MO, NY, OH, PA, TN, TX, VA, WI

Proposed Action Description:

FIRST AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original Programmatic Determination, dated August 11, 2023.) The Cooling Operations Optimized for Leaps in Energy, Reliability, and Carbon Hyperefficiency for Information Processing Systems Program (COOLERCHIPS) seeks to develop highly efficient, and reliable cooling technologies for data centers. Specifically, the COOLERCHIPS program will fund the development of: (1) secondary cooling loop components, (2) cooling systems for modular/EDGE data centers (3) innovative data center cooling system software, and (4) support facilities for testing new technologies developed under the program. If successful, COOLERCHIPS technologies could reduce total cooling energy expenditure to less than 5% of a typical data center's IT load at any time and at any U.S. location for a high-density compute system, thereby reducing the operational CO2 footprint of data center operations. The COOLERCHIPS Program is composed of 15 small-scale research and development projects that will be conducted by universities, non-profit and for-profit entities, small businesses, and federal laboratories. This First Amended Determination adds 4 projects (University of Florida, Raytheon Technologies/RTX, Flexnode, Inc., and University of Missouri) to the Determination signed on August 11, 2023 (see Attachment for all 8 projects covered by this and the prior Determination). These projects fit within the class of actions identified under the DOE Categorical Exclusions identified below. 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: Approved via email

Date Determined: September 6, 2023



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Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): AR, CA, CO, FL, IL, IN, MD, NY, PA, TN, TX, WI

Proposed Action Description:

The Cooling Operations Optimized for Leaps in Energy, Reliability, and Carbon Hyperefficiency for Information Processing Systems Program (COOLERCHIPS) seeks to develop highly efficient, and reliable cooling technologies for data centers. Specifically, the COOLERCHIPS program will fund the development of: (1) secondary cooling loop components, (2) cooling systems for modular/EDGE data centers (3) innovative data center cooling system software, and (4) support facilities for testing new technologies developed under the program. If successful, COOLERCHIPS technologies could reduce total cooling energy expenditure to less than 5% of a typical data center's IT load at any time and at any U.S. location for a high-density compute system, thereby reducing the operational CO2 footprint of data center operations. The COOLERCHIPS Program is composed of 15 small-scale research and development projects that will be conducted by universities, non-profit and for-profit entities, small businesses, and federal laboratories. This Determination covers 4 of the 15 projects (listed in Attachment A). All 4 projects fit within the class of actions identified under the DOE Categorical Exclusions identified below. 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. The University of Texas, Arlington has not obtained all necessary permits and approvals applicable to their proposed actions, and is prohibited from commencing applicable project work until those permits are obtained. Per the terms of the award, a permits certification and, if necessary, an amended NEPA Determination, are required prior to the conduct of applicable project work.

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: **Approved via email**

Date Determined: **August 11, 2023**

**Attachment A: Projects in the COOLERCHIPS (FOA No. DE-FOA-0002851 and DE-FOA-0002852)
Program**

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Jetcool Technologies, Inc. (2852-1525)	Sub-One PUE through Silicon Cooling Efficiency	A9, B3.6
University of California, Davis (2851-1566)	Holistic Modular Energy-efficient Directed Cooling Solutions (HoMEDiCS) for Edge Computing	A9, B3.6
National Renewable Energy Laboratory (2851-1524)	COOLERCHIPS Technical Evaluation Team	A9, B3.6
HRL Laboratories, LLC (2851-1528)	Aligned Graphite Microchannel Cooling (AGMC) System with Additively Manufactured Manifolds	A9, B3.6, B3.15
Flexnode, Inc. (2852-1522)	Prefab Modular Liquid-cooled Micro Data Center	A9, B3.6
Raytheon Technologies Research Center/RTX (2851-1502)	EXTRACT: Extra Efficient Data Centers Using Avionics Cooling Technology	A9, B3.6
University of Florida (2851-1533)	Hyperefficient Data Centers for Deep Decarbonization of Large-scale Computing	A9, B3.6
University of Missouri (2851-1516)	Dual-mode Hybrid Two-phase Loop for Data Center Cooling	A9, B3.6
Purdue University (2851-1537)	Confined Direct Two-phase Jet Impingement Cooling with Topology Optimized Surface Engineering and Phase Separation Using Additive Manufacturing	A9, B3.6
University of Illinois at Urbana – Champaign (2851-1600)	Holistic Rack-to-Processor Power and Thermal Co-Design for Future Servers	A9, B3.6
University of Maryland (2851-1529)	Multi-Objective Optimization Software for COOLERCHIPS	A9
University of Texas, Arlington (2851-1571)	Holistic Co-Design of Novel Hybrid Cooling Technology for the Data Center of the Future	A9, B3.6, B3.15

Bold text indicates the four projects included in the Second Amended CX.