



U.S. NATIONAL SCIENCE FOUNDATION
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ALEXANDRIA, VIRGINIA 22314

NSF 24-045

Dear Colleague Letter: Funding Opportunities for Engineering Research to Achieve Net-Zero Climate Goals by 2050

December 28, 2023

Dear Colleagues:

With this Dear Colleague Letter, the U.S. National Science Foundation (NSF) Directorate for Engineering (ENG) encourages the submission of research and education proposals related to Net-Zero Climate Goals, including innovations to create a **Circular Economy**.

Bold and decisive actions taking multiple approaches are needed to reach Net-Zero Climate Goals by 2050, as described in [The Long-Term Strategy of the United States, Pathways to Net-Zero Greenhouse Gas Emissions by 2050](#), including advances in clean energy technologies, climate change mitigation and adaptation strategies, circular economy pathways, and innovations to reduce, capture and reuse greenhouse gas emissions. NSF-funded workshops on topics ranging from electrochemical energy storage¹ to a zero-carbon power grid² have identified new research directions that can help meet this global challenge. NSF supports the creation and acceleration of new pathways from exploratory concepts to technological solutions.

The grand challenges of enabling a carbon-neutral energy system can only be met through scientific, engineering, and technological advances. To achieve a carbon-neutral, equitable, and sustainable economy, clean energy must increasingly dominate energy sources. Critical technological advances are needed to maximize access and utilization of renewable energy, enable grid security and storage, and electrify manufacturing, transportation, and chemical processing. Industrial and manufacturing processes in particular are difficult to decarbonize, and their transition is key to meeting net-zero goals while expanding economic prosperity.

NSF and the Engineering Directorate invest in research and education activities toward net-zero goals that align with the needs of the nation and support the CHIPS and Science Act of 2022, White House strategies (such as the [Net-Zero Game Changers Initiative](#)), and other policy directives and reports (such as [U.S. Innovation to Meet 2050 Climate Goals](#)).

ENGINEERING DIRECTORATE INTERESTS

The Directorate for Engineering encourages the submission of all types of research and education proposals related to net-zero goals, including proposals in the following areas:

Industrial products and fuels for a net-zero, circular economy: Technologies and practices for industrial manufacturing of steel, aluminum, cement, concrete, engineered timber, chemicals, semiconductor materials and systems, multifunctional infrastructure (construction) materials, electrofuels, clean water, and other products with net-zero greenhouse gas emissions. Examples include, but are not limited to, design for circularity, novel industrial process efficiency, net-zero feedstock utilization, net-zero industrial heat, and net-zero carbon conversion technologies.

Net-zero building heating and cooling: Technologies and practices for affordable and comfortable building space conditioning with net-zero operational greenhouse gas emissions for either new systems or retrofits. Examples include, but are not limited to, multifunctional building envelopes, next-generation heat pumps, advanced insulation materials and coatings for thermal and moisture control, efficient indoor air quality and heat management, grid- and building-optimized HVAC controls and sensors, energy storage and management, integration of solar energy, and very low or no global warming refrigerants.

Net-zero power grid and electrification: Grid technologies and practices that support increasing levels of carbon-free power generation and demand while maintaining and improving security, affordability, reliability, stability, and resilience. Examples include, but are not limited to, intelligent real-time sensing, communications and controls for integration of distributed energy resources, demand-response systems for power distribution and energy storage, power electronic devices for high- and medium-voltage systems, advanced transformers and distribution equipment, and cyber and physical security.

Net-zero aviation: Technologies and practices enable aviation operations management and services with net-zero greenhouse gas emissions and/or climate impacts. Examples include, but are not limited to, sustainable aviation fuel, highly efficient aircraft and engine technology, hydrogen or electric powered aircraft, innovative route design, scheduling and operational procedures to optimize energy consumption, and solutions for warming contrails.

Net-zero mobility: Technologies and practices that enable net-zero emission in public transportation and personalized mobility services. Examples include, but are not limited to, net-zero vehicle production and operation; universal mobility payment systems; dynamic on-demand scheduling and routing; vehicle sensing, communication, and control hardware and software; robotics and autonomy for transportation and logistics; net-zero public transportation delivery; and net-zero shared mobility options for diverse travelers, especially people with limited mobility choices.

Greenhouse gas modeling and information systems to support net-zero goals: Tracking progress toward emissions targets and net-zero goals requires effective measurement, modeling, and data management for greenhouse gases. Research is needed to refine data assimilation capabilities, model scaling, and development of data products to support management and decision-making.

Circular bioeconomy: Research that facilitates sustainable societal use of food, energy, water, nitrogen, phosphorus, and materials, with the reduction and eventual elimination of fossil fuel combustion without carbon capture. Additionally, research on material flows that reduce or eliminate waste, with an emphasis on closed-loop or “circular” processing.

PROGRAMS AND CONTACTS

The Engineering Directorate encourages the submission of Net-Zero-related proposals to the ENG core programs listed below, and to other relevant programs. To determine which program best fits a project idea, Principal Investigators are encouraged to read the program descriptions and reach out to program contacts with questions.

- **Advanced Manufacturing:** AdvancedManufacturing@nsf.gov
- **Catalysis:** Robert McCabe, rmccabe@nsf.gov
- **Civil Infrastructure Systems:** Siqian Shen, siqshen@nsf.gov
- **Combustion and Fire Systems:** Harsha Chelliah, hchellia@nsf.gov
- **Dynamics, Control, and Systems Diagnostics:** Jordan Berg, jberg@nsf.gov
- **Electrochemical Systems:** Carole Read, cread@nsf.gov
- **Energy, Power, Control and Networks:** Eyad H. Abed, eabed@nsf.gov
- **Engineering Design and Systems Engineering:** Kathryn Jablokow, kjabloko@nsf.gov
- **Engineering for Civil Infrastructure:** Giovanna Biscontin, gibiscon@nsf.gov
- **Environmental Engineering:** Mamadou Diallo, mdiallo@nsf.gov; Karl Rockne, krockne@nsf.gov
- **Environmental Sustainability:** Bruce K. Hamilton, bhamilto@nsf.gov
- **Fluid Dynamics:** Ronald D. Joslin, rjoslin@nsf.gov
- **Foundational Research in Robotics:** Jordan Berg, jberg@nsf.gov
- **Interfacial Engineering:** Christy Payne, cpayne@nsf.gov
- **Mechanics of Materials and Structures:** moms@nsf.gov
- **Particulate and Multiphase Processes:** Shahab Shojaei-Zadeh, sshojaei@nsf.gov
- **Process Systems, Reaction Engineering, and Molecular Thermodynamics:** Raymond A. Adomaitis, radomait@nsf.gov
- **Thermal Transport Processes:** Sumanta Acharya, sacharya@nsf.gov

The Engineering Directorate also encourages proposals for research centers, which tackle grand challenges and spur industrial innovation, and for workforce development, which provides experiential learning opportunities and opens new career paths.

- **Engineering Research Centers (ERC)**: nsferc@nsf.gov
- **Industry–University Cooperative Research Centers (IUCRC)**: Prakash Balan, pbalan@nsf.gov
- **Non-Academic Research Internships for Graduate Students (INTERN)**: Prakash Balan, pbalan@nsf.gov
- **Research Experiences for Teachers (RET)**: Amelia Greer, agreer@nsf.gov
- **Research Experiences for Undergraduates (REU)**: reu.eng@nsf.gov (REU for ERCs: reu.eng.erc@nsf.gov)

SUBMISSION GUIDANCE

Proposals submitted in response to this DCL should focus on scientific research and education relevant to net-zero climate goals and a circular economy. Proposal titles should begin with “**ENG-NETZERO:**” followed by any other relevant prefixes and the project name.

For consideration during fiscal year 2024, proposals to programs without deadlines should be submitted by April 30, 2024; proposals submitted later will be considered for fiscal year 2025.

NSF welcomes proposals that broaden geographic and demographic participation to engage the full spectrum of diverse talent in STEM. Proposals from minority-serving institutions, emerging research institutions, primarily undergraduate institutions, two-year colleges, and institutions in EPSCoR-eligible jurisdictions, along with collaborations between these institutions and those in non-EPSCoR jurisdictions, are encouraged.

This DCL does not constitute a new competition or program. Proposals submitted in response to this DCL should be prepared and submitted in accordance with guidelines in the [NSF Proposal & Award Policies & Procedures Guide](#) (PAPPG) and instructions found in relevant program descriptions.

Sincerely,

Susan Margulies
Assistant Director, Engineering

REFERENCES

- 1 [NSF Award Search: Award # 1942226 - CBET Energy Storage Workshop: Frontiers of Materials, Architectures and Techniques](#)
- 2 [NSF Award Search: Award # 2218933 - US-European Workshop: Grid at the Edge-towards the zero-carbon power grid with improved visibility, safety and reliability at Split, Croatia on May 23-24, 2022](#)