NATIONAL SCIENCE FOUNDATION
2415 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22314

NSF 23-109

Dear Colleague Letter: Clean Energy Technology RAISE or EAGER Proposals

May 17, 2023

Dear Colleagues:

As energy use in the United States continues to grow, the use of clean, sustainable energy sources must increase to meet demand. These sources include energy from biomass, geothermal, wind, hydropower, tidal power, and solar sources. For the purposes of this Dear Colleague Letter (DCL), clean energy represents new efficient technology based on novel fundamental concepts, the energy saved through increased energy efficiency and conservation measures for existing technologies, as well as energy derived from renewable sources.

With this DCL, the National Science Foundation (NSF) invites interdisciplinary groups of Principal Investigators (PIs) to develop potentially transformative, convergent, fundamental research proposals in the area of clean energy technologies. Two kinds of proposals will be considered: Research Advanced by Interdisciplinary Science and Engineering (RAISE) and Early-concept Grants for Exploratory Research (EAGER).

NSF's Directorates for Engineering (ENG); Mathematical and Physical Sciences (MPS); Biological Sciences (BIO); Computer and Information Science and Engineering (CISE); Geosciences (GEO); Social, Behavioral and Economic Sciences (SBE); STEM Education (EDU); and Technology, Innovation and Partnerships (TIP) seek to support new research that advances Clean Energy Technologies and increases the use of clean energy sources to benefit all sectors of the economy, to ensure social justice, and to contribute to the public good. Advances in custom-designing and producing materials for energy-efficient technologies, electrification of the U.S. economy including the transportation sector and the chemical industry, as well as developing new approaches to harnessing energy from renewable sources in green and sustainable ways, are critical for developing practical approaches to achieving a carbon-neutral and equitable economy.

Proposals that address barriers and opportunities for technology adoption, economic and

societal impacts of technology development, social justice considerations, or social and environmental sustainability of clean energy technologies are strongly encouraged.

RAISE and EAGER proposals require the submission of a Concept Outline that describes the research and how it will benefit clean energy technology as defined above. Concept outlines must focus on one or more of the following areas:

a. **Hydrogen, fusion, and/or geothermal technologies:** Example topics that enable science and technology discovery and development include: resource discovery and characterization; new materials, chemical conversion technologies: process systems research aimed at fundamental understanding of underlying phenomena that govern overall efficiency, performance, and scalability; plasma, laser, materials, and power management technologies for fusion energy; new bio-inspired or bio-mimetic materials, biological platforms and circuitry to support the bioconversion of chemical energy to electric power; geothermal resource and geothermal hydrogen operation/extraction; understanding of limits of maximum capacity and scale-up; understanding of integration with other energy systems and grid infrastructure; and computing systems and infrastructure for these technologies.
b. **Industrial heat and/or energy efficiency technologies:** Example topics that enable science and technology discovery and development include: fundamental research aimed at substituting clean energy sources for fossil fuels to provide industrial process heat, understanding underlying phenomena that govern overall efficiency and maximum scale for methods by which heat is used to transform chemicals and materials into useful products; fundamental understanding of optimization and control of the built environment; investigations of impacts to the integration with larger energy systems and the grid; energy-efficient power electronics and systems – distribution and consumption; energy efficient micro-electronics; integration of energy systems and the grid with other infrastructure systems such as transportation; new device, circuit, and systems technologies and processes to harness energy from heat generated by advanced computing; and reducing power consumption in data centers.
c. **Fundamental challenges of enabling offshore wind/wave technologies:** Example topics include fundamental research on materials and structures under extreme conditions, fundamental research aimed at understanding underlying phenomena that control overall efficiency and maximum scale; fundamental understanding of impacts to local and regional environment; computing systems and infrastructure for resilient renewable energy; understanding the integration with larger energy systems and the grid; fundamental understanding of resource prediction for intermittent renewable resources like wind; LIDAR (Light Detection and Ranging) for improved wind detection in wind turbines; fundamental understanding of effective utilization of these resources; and fundamental understanding of corrosion and structural issues in the ocean environment.

d. **Critical materials for clean energy technologies - their recovery, reuse, and recycling:** Example topics that enable science and technology discovery and development include new approaches to materials recovery and recycling; deposit discovery and characterization; fundamental research on advanced manufacturing to allow simpler recovery at end-of-use; and advancing the fundamental understanding of challenges and potential solutions to enable reuse of critical materials.
e. **Net-zero fuels and bioenergy:** Example topics that enable science and technology discovery and development include new chemicals and multifunctional materials, chemical conversion, and/or process systems research aimed at fundamental understanding of underlying phenomena that control overall efficiency and performance, including quantum mechanics principles in biology such as coherence for efficient energy transfer or tunneling in enzyme efficiency for energy capture, transfer, or storage; new biological platforms and circuitry to support the bioconversion of chemical energy to electric power; discovering value in CO2 through new bio-based systems, such as bio-electrochemical reduction to make fuels and chemicals; understanding of limits of maximum capacity and scale-up; and understanding of integration with other energy/process systems and/or grid infrastructure.
f. **Education and workforce development efforts:** Example topics include understanding of workforce education and training needs; broadening participation opportunities; and new pedagogical approaches in order to advance and strengthen the U.S. competitiveness in the research areas listed above. A project's scope may span from preK-12 through graduate school and career levels. Example efforts across different career and education levels include, but are not limited to, developing new curricula or teaching materials in clean energy, building partnerships with stakeholders to share data or software tools aiming to improve learning of clean energy concepts, partnerships with the private sector or government research institutions to create new training opportunities, involving undergraduate students in research, offering faculty or professional development workshops for experiential learning of clean energy concepts and applications, designing novel approaches to helping researchers and graduate students to understand lab-to-market processes, or building transfer pathways from community colleges to 4-year colleges.

Research related to computational, simulation, and data-science tools that can lead to new insights in clean energy technology development is also encouraged.

A RAISE or EAGER proposal may only be submitted after consideration of the Concept Outline by an NSF Program Officer. A minimum of one PI and one co-PI must be associated with a concept outline for both RAISEs and EAGERs. Concept outlines are strictly limited in length to 3 pages plus a half-page justification of the estimated budget, for a total of 4 pages, including references. All correspondence, inquiries, and concept outlines for EAGERS must be submitted to CET_DCL_EAGER@nsf.gov. All correspondence, inquiries,

and concept outlines for RAISES must be submitted to CET_DCL_Raises@nsf.gov. **An individual may appear as PI, co-PI, Senior Personnel, or Consultant on no more than one RAISE or EAGER proposal submitted in response to this DCL**. EAGERS will be internally reviewed. RAISES will be externally reviewed. Proposals that fail to address concepts described in this DCL will be returned without review.

For an EAGER submission:

The research topic (a-f) along with at least one relevant NSF core program must be indicated in the first paragraph of the concept outline. The concept outline must describe the research idea with a clear explanation of why it is innovative, potentially transformative, or otherwise potentially impactful. Reasons why this project is appropriate for EAGER funding must be provided in a separate paragraph, e.g., it involves radically different approaches, applies new expertise, or engages novel interdisciplinary perspectives; in short, it is an interdisciplinary high-risk, high-reward project that is unsuitable for submission as a “regular” proposal. New collaborations with researchers at Federally Funded Research and Development Centers (FFRDCs) and/or industry are welcomed. Funding of these FFRDC collaborators in general is not allowed as part of this DCL.

Concept outlines for EAGER proposals responsive to this DCL must be received by 5 p.m. submitter's local time on 06/14/2023. The correspondence permitting submission of an EAGER proposal can be expected approximately 3 weeks after submission of the concept outline. This correspondence will include a proposal due date of August 16, 2023 by 5 p.m. submitter’s local time. All EAGER proposals must be submitted via Research.gov to the coordinating program Electrochemical Systems (PD 23-7644) in the Chemical, Bioengineering, Environmental, and Transport System Division (CBET) of NSF's Directorate for Engineering (ENG). EAGER proposals submitted without prior submission of a corresponding concept outline and subsequent correspondence email will be returned without review. The email from an NSF Program Officer serves as documentation of approval for submittal and must be uploaded by the prospective PI in the “Program Officer Concurrence Email” section of Research.gov. The concept outline and proposal titles must begin with "EAGER: CET:". An individual may be included in only one concept outline and subsequent EAGER proposal submission pursuant to this DCL. Complete guidance on submitting a EAGER proposal may be found in Chapter II.F.3 of the NSF Proposal and Award Policies and Procedures Guide 23-1.

For a RAISE submission:

The research topic (a-f) along with at least two relevant NSF core programs must be indicated in the first paragraph of the concept outline. The concept outline must describe the research idea with a clear explanation of why it is innovative, potentially transformative, or otherwise potentially impactful. Reasons why this project is appropriate for RAISE funding

must be provided in a separate paragraph, e.g., it involves scientific advances that lie for the most part outside the scope of a single program or discipline, such that substantial funding support from more than one program or discipline is necessary; that the lines of research promise transformational advances; and that prospective discoveries reside at the interfaces of disciplinary boundaries that may not be recognized through traditional review or co-review. New collaborations with researchers at Federally Funded Research and Development Centers (FFRDCs) and/or industry are welcomed. Funding of these FFRDC collaborators in general is not allowed as part of this DCL.

Concept outlines responsive to this DCL must be received by 5 p.m. submitter's local time on 07/12/2023. The correspondence permitting submission of a RAISE proposal can be expected approximately 3 weeks after submission of the concept outline. This correspondence will include a proposal due date of October 3, 2023 by 5 p.m. submitter's local time. All RAISE proposals must be submitted via Research.gov to the coordinating program Electrochemical Systems (PD 23-7644) in the Chemical, Bioengineering, Environmental, and Transport System Division (CBET) of NSF's Directorate for Engineering (ENG). The submitter must confirm with at least two program officers of different core programs in any of the participating NSF Directorates that the project bridges the scope of their programs. These programs must be identified in the first paragraph of the concept outline for the RAISE proposal. The email correspondence permitting submission of the RAISE proposal from an NSF Program Officer serves as documentation of approval for submittal and must be uploaded by the prospective PI in the "Program Officer Concurrence Email" section of Research.gov. The concept outline and proposal titles must begin with "RAISE: CET:". An individual may be included in only one concept outline and subsequent RAISE proposal submission pursuant to this DCL. RAISE proposals submitted without prior submission of a corresponding concept and subsequent correspondence email will be returned without review.

For an invited RAISE proposal, NSF will not accept separately submitted collaborative proposals from multiple organizations. A proposal involving more than one organization must be submitted as a single proposal from one organization, with the collaborators identified as subawardee organizations. Complete guidance on submitting a RAISE proposal may be found in Chapter II.F.4 of the NSF Proposal and Award Policies and Procedures Guide 23-1.

All correspondence, inquiries, and concept outlines for EAGERS must be submitted to CET_DCL_EAGER@nsf.gov. All correspondence, inquiries, and concept outlines for RAISES must be submitted to CET_DCL_Raises@nsf.gov.

Sincerely,

Susan S. Margulies, Assistant Director
Directorate for Engineering (ENG)

Sean L. Jones, Assistant Director
Directorate for Mathematical and Physical Sciences (MPS)

Simon Malcomber, Acting Assistant Director
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