# FINANCIAL ASSISTANCE
# FUNDING OPPORTUNITY ANNOUNCEMENT

## U. S. Department of Energy

## Office of Fossil Energy

## National Energy Technology Laboratory

## Funding Opportunity Number: DE-FOA-0001715

*Support of Fossil Energy Research at U.S. Colleges and Universities Including University Coal Research (UCR) and Research by Historically Black Colleges and Universities and Other Minority Institutions (HBCU/OMI)*

**Announcement Type: Initial**

**CFDA Number: 81.089 Fossil Energy Research and Development**

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|---|---|
| **Issue Date:** | **12/19/2016** |
| **Letter of Intent Due Date:** | **Not Applicable** |
| **Pre-Application Due Date:** | **Not Applicable** |
| **Application Due Date:** | **2/17/2017 at 11:59:59 PM Eastern Time** |

**NOTE: REGISTRATION/SUBMISSION REQUIREMENTS**

***Registration Requirements***

There are several one-time actions you must complete in order to submit an application in response to this Announcement (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the System for Award Management (SAM), and register with Grants.gov). Applicants who are not registered with SAM and Grants.gov, should allow at least 44 days to complete these requirements. It is suggested that the process be started as soon as possible.

**Applicants must obtain a DUNS number. DUNS website: http://fedgov.dnb.com/webform.**

**Applicants must register with the SAM. SAM website: http://www.sam.gov/. If you had an active registration in CCR, you should have an active registration in SAM. More information about SAM registration for applicants is found at: https://www.sam.gov/sam/transcript/Quick_Guide_for_Grants_Registrations_v1.7.pdf.**

**Applicants must register with Grants.gov. There are 3 steps to this process.**

1) **The Authorized Organizational Representative (AOR) must register at: https://apply07.grants.gov/apply/OrcRegister .**

2) **An email is sent to the E-Business (E-Biz) POC listed in SAM. The E-Biz POC must approve the AOR registration using their MPIN from their SAM registration.**

3) **AOR verifies that registration was completed at: http://www.grants.gov/web/grants/applicants/organization-registration/step-5-track-aor-status.html**

**More information about the above steps is provided at: http://www.grants.gov/web/grants/applicants/organization-registration.html**

**Applicants must register with FedConnect to submit questions. FedConnect website: www.fedconnect.net.**

***Questions***

Questions relating to the registration process, **system requirements, or how an application form works** must be directed to Grants.gov at 1-800-518-4726 or **support@grants.gov**.

Questions regarding the **content** of the announcement must be submitted through the FedConnect portal. You must register with FedConnect to respond as an interested party to submit questions and to view responses to questions. It is recommended that you register as soon after release of the FOA as possible to have the benefit of all responses. DOE/NNSA will try to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website.

***Application Preparation and Submission***

**Applicants must download the application package, application forms and instructions, from Grants.gov. Grants.gov website: http://www.grants.gov/**
(Additional instructions are provided in Section IV.A of this FOA.)

**Where to Submit**
Applications must be submitted through Grants.gov to be considered for award. You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements carefully and start the process immediately. Remember you have to update your SAM registration

annually. If you have any questions about your registration, you should contact the Grants.gov Helpdesk at 1-800-518-4726 to verify that you are still registered in Grants.gov.

**IMPORTANT NOTICE TO POTENTIAL APPLICANTS:** When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e. Grants.gov registration).

## Section I - FUNDING OPPORTUNITY DESCRIPTION

### BACKGROUND

This funding opportunity will encompass two separate University programs, each with its own requirements and each with restricted eligibility. The two programs are the University Coal Research (UCR) Program and the Historically Black Colleges and Universities and Other Minority Institutions (HBCU/OMI) Program. Each section of this document will be subdivided into a UCR section and an HBCU/OMI section to clearly address the requirements for each program.

### UCR

Through this proposed Funding Opportunity Announcement (FOA), the University Coal Research (UCR) Program supports the Department of Energy's (DOE) Office of Fossil Energy and the National Energy Technology Laboratory (NETL) mission by supporting long-term, high-risk meritorious fundamental research that advances the science of coal technologies at U.S. colleges and universities. Since its inception in FY1979, the UCR Program has maintained three objectives, to be achieved simultaneously, which are: (1) sustain a national university program of research in energy and environmental science and engineering related to coal through innovative and fundamental investigations pertinent to coal conversion and utilization; (2) to maintain and upgrade the coal research capabilities and facilities of U.S. colleges and universities; and (3) to support the education and training of our next generation of scientists and engineers.

The FOA will offer areas of research that address specific problems for overcoming barriers in technology development for Fossil Energy's Crosscutting Research Program in an environmentally acceptable manner. Applications submitted in response to the FOA will be evaluated by reviewers from differing backgrounds (e.g., industry and DOE) with the most meritorious applications selected for award.

Historically, the involvement of professors and students has been an essential element in the success of the UCR Program. The participation of students is valuable because it serves to promote the influx of fresh ideas, and it ensures continued training of future scientists and engineers. This emphasis on U.S. College and University professors and students will be continued in FY2017 for all applications.

To develop and sustain a national program of university research that advances the previous stated objectives, the DOE is interested in innovative and fundamental research pertinent to coal conversion and utilization.

### HBCU/OMI

To sustain a healthy economy and remain competitive internationally, the United States will need a highly-skilled workforce, which includes competent and dedicated scientists, engineers, and managers in technical fields. It will need not only advanced technology markets, but also knowledge of and sensitivity for culturally diverse customers and business partners. This theme is consistent with the Department of Energy Science Education Enhancement Act (42 U.S.C. § 7381) as amended by Sections 1102 and 1105 of the Energy Policy Act of 2005, which provides the statutory authority for U.S. Department of Energy's (DOEs) HBCU/OMI Research and Development Program (HBCU/OMI Program). Implementation of the HBCU/OMI Program is also supported by DOE's Strategic Plan and Strategic Plan for Minority Education Programs, both of which promote the DOE's collaboration with HBCU/OMI. The HBCU/OMI Program is, thus, structured to support the mission of DOE.

The annual Funding Opportunity Announcement (FOA) for fiscal year (FY) 2017 activity coincides with the Annual Procurement Plan. The process for supporting critical key research areas in fossil energy will be continued through this FOA. This program supports the Department of Energy's (DOE) Office of Fossil Energy and the National Energy Technology Laboratory (NETL) mission by supporting long-term, high-risk meritorious fundamental research that advances the science of coal technologies at eligible U.S. colleges and universities. Work conducted in this program enables segments of the college population, not typically tapped for educational research in these subject areas, to advance technical skills and provide a

meaningful contribution to the Fossil Energy Program in Crosscutting Research. Thus, grants awarded under this program are intended to maintain and upgrade educational, training, and research capabilities of HBCUs/OMIs in the fields of science and technology related to fossil energy resources. The key purpose of this program is to involve professors and students. Essential to the success of this program are (1) the collaborative involvement of HBCU/OMI professors and students along with the commercial sector; and (2) the establishment of linkages between the HBCU/OMI and private sector fossil energy community in the development and execution of fresh new research ideas.

## OBJECTIVES

### UCR

The objective of the proposed activity is to issue the afore-mentioned FOA with restricted elibility among the University community, receive and review the applications, select the top-rated applications for award, negotiate with the selected applicants and complete the award process by issuing grants. Applications submitted in response to the FOA will be evaluated by reviewers from differing backgrounds (e.g., industry and DOE) with the most meritorious applications selected for award.

### UCR Areas of Interest 1 (AOI 1):

The targeted Areas of Interest (AOI) for the FY2017 announcement are the following:

### AOI 1-1: Real-Time Modeling for Cyber-Physical Systems

DOE NETL has ongoing R&D that is focused on developing advanced controls algorithms to meet the performance challenges of hybrid power systems that feature multiple energy components and assets [1]. The NETL cyber-physical system (CPS) merges physical hardware and processes with virtual components for the realization of fully integrated networks. DOE NETL has supported extensive R&D in the areas of advanced controls, system identification, and real-time modeling, using a specialized CPS, known as the Hybrid Performance (HYPER) Facility, which features a solid oxide fuel cell (SOFC) and gas turbine hybrid energy system [2-4]. Inherent in the operation of CPS is the need for models that can respond to external stimuli (including physical, virtual, and combinations therein), sensors, actuators, and also contend with system behavior such as software scheduling and communication delays [5]. A compounding factor on top of this high-level complexity is the need for models that operate at fast time scales approaching real time, for which existing methodologies are lacking.

Proposal applications are sought that create advanced numerical methods for the purpose of performing real-time modeling of energy components for cyber-physical systems. Relevant time-scales of operation for models in response to system dynamics are 5 milliseconds or faster. Energy components of interest include (but not limited to) power electronics, solid oxide fuel cells, gas turbines, supercritical $CO_2$-based power cycles, and other transformational energy technologies currently under development.

(See Appendices/Reference Material for AOI 1-1 background.)

### AOI 1-2: General Framework for Radiative Heat Transfer in Gas-Solids Flows

Radiative heat transfer is the dominant mode of heat transfer in a variety of conventional and renewable energy conversion technologies based on gas-solid reacting flows, including coal combustion, gasification, and solar thermochemical conversions. The design and optimization of these devices is increasingly dependent on predictive simulations to shorten the design cycle. As a result, it is necessary for researchers and engineers to have access to an assortment of efficient, high-fidelity radiation models so that they can choose an appropriate radiation model for the given application. Therefore, applications are sought to improve the gas/gas-solid radiative heat transfer models in the open source code Multiphase Flow with Interface eXchanges (MFIX) Two-Fluid Model (MFIX-TFM) and/or the MFIX Discrete Element Model (MFIX-DEM) as described in Cai and Modest [1]. To be successful applicants must address the following objectives: (1) Develop and implement a general framework to support the integration of modern gas

radiation models for gas-solid reacting flows; (2) Implement a methodology for developing new multiphase radiation models with accuracy and efficiency commensurate to the different importance in a variety of energy related applications; (3) Reduce the computational cost of existing high-fidelity models via systematic optimizations; (4) Demonstrate the accuracy and efficiency of the radiation models under typical gas-solids reacting flow conditions. Applicants should discuss how they plan to coordinate the documentation and integration of new capabilities over the course of the award period with the MFIX development team.

Applications targeting model development for software packages other than MFIX-TFM and/or MFIX-DEM (e.g., commercial, open source, or in-house codes) will be considered non-responsive.

(See Appendices/Reference Material for AOI 1-2 background.)

**AOI 1-3: Sensors for Continuous Water Quality Monitoring of Contaminants in Impaired Water**

One of the drivers in effectively managing water use is the need for reliable, real-time, measurement-based data [1]. This is especially important as steam electric power generating facilities are being required to adhere to the new effluent limitations guidelines (ELGs) [2]. The development of sensors that are inexpensive, self-powered, wireless, rapidly deployable, and robust would facilitate the requisite data collection while also providing real-time data rather than dependence on periodic, manual grab samples that must be analyzed in a lab. Data results related to the grab samples could take days or weeks. Since little to no actual data are collected in real-time, predictions and estimates are made regarding water management (such as treatment steps or amounts). The present and growing emphasis on reducing or maintaining the water-use footprint, while not polluting the environment, in the energy sector should not move forward based on projections and estimates alone but from tangible, collected data. If these data are able to address—continuously—contaminants that are of concern to the EPA, other agencies, and the public, utilities will have the knowledge and opportunity to control their water streams to more closely meet regulations by addressing under-/over- treatment or other areas of concern which would lead to potential cost savings and/or avoidance of potential violations.

Impaired sources of water are increasingly being used as makeup water in thermoelectric power plants. These can include, but are not limited to, municipal effluent wastewaters, reused FGD (flue gas desulfurization) wastewaters, ash handling waters, and blowdown from cooling towers. These sensor packages may be placed in water intake or wastewater discharge streams. Continuous measurements of one or more contaminants of concern and water quality indicators at once from a single sensor package would aid treatment systems and, potentially, aid in leak detection or sourcing of problems and could provide valuable feedback control to operators.

Grant applications are sought for the development of a water sensor package that is rapidly-deployable, ultimately capable of operating in a wireless and self-powered mode, while making and relaying real-time, in situ concentration measurements of one or more contaminants such as bromide, nitrites/nitrates, boron, ammonia, phosphorus, selenium, arsenic, mercury, or other toxic pollutants from impaired water sources (justification of contaminant selection is encouraged). Integrated sensor packages that also make measurements of common indicators of water quality such as, but not limited to, temperature, TSS (total suspended solids), flow, pH, TDS (total dissolved solids), and dissolved oxygen are useful, but are not required. Preference will be given to sensor packages that make multiple contaminant measurements for the lowest cost.

Applications must justify their proposed concentration detection limits and how they relate to current guidelines (e.g., ELGs, state regulations, etc.) so that false positives can be minimized. Successful applicant(s) will be required to show how integration of their sensor(s) will benefit power plants.

(See Appendices/Reference Material for AOI 1-3 background.)

**AOI 1-4: Rapid Experimental Screening Techniques for Development of Advanced Creep Resistant Alloys for High Temperature Fossil Energy (FE) Applications**

Despite significant advances in computational based design tools and microstructure analysis instruments, experimental methods and equipment used for creep testing during the initial research phase on new alloys are still very similar to the methods used 20 years ago. Strain measurement sensitivity of creep test instruments has also changed little in the past 20 years. A number of attempts have been made to develop faster and more efficient creep testing methods (e.g., small punch testing and creep relaxation tests) but none of these methods have provided sufficient early indications of long term creep behavior (long term being >100,000 hours of operating life) that would enable go/no decisions on continuing research of a specific alloy composition. Applications are sought for new experimental methods, instruments and testing strategies that will result in up to a factor of two (2) reduction in the time and cost to perform the initial testing and screening of new alloys for high temperature, long service life fossil energy (FE) applications.

**HBCU/OMI**

The objective of the proposed activity is to issue the afore-mentioned FOA with restricted elibility among the HBCU/OMI community, receive and review the applications, select the top-rated applications for award, negotiate with the selected applicants and complete the award process by issuing grants. Applications submitted in response to the FOA will be evaluated by reviewers from differing backgrounds (e.g., industry and DOE) with the most meritorious applications selected for award.

**HBCU/OMI Areas of Interest 2 (AOI 2):**

The targeted Areas of Interest (AOI) for the FY2017 announcement are the following:

**AOI 2-1: Improved Ab Initio Models of High Performance Structural Alloys for Existing and Advanced Technologies Fossil Energy (FE) Power Plants**

Computational design of new structural components for FE power plant components often starts with ab initio density functional theory modeling to identify potential strengthening phases within a large compositional space of elements. However, the calculations are normally done at zero Kelvin (0 K) despite the fact the intended use temperature of new alloys is well above 600 K. Thus, phases that might exist at high temperature but not zero Kelvin, and the converse will not be determined by conventional zero Kelvin ab initio computations. Some advances have made in performing ab initio calculations of multi-component alloy compositions, but such computations still require supercomputer capabilities. Applications are sought for breakthrough approaches to enabling high throughput ab initio computations of multi-component alloy compositions at elevated temperatures. Proposals should aim for at least a 50% reduction in computational time needed by current state of the art methods.

**AOI 2-2: Improved Water Usage at Existing Power Generation Facilities**

The Department of Energy (DOE) has a large emphasis on the interaction between water and energy and has prepared a Water Energy Nexus Report [1]. The largest use of water in the US is thermoelectric power plant cooling water [2], and NETL has had an extensive program looking into more efficient water use at power plants [3]. Previous research has been conducted to improve water usage at power plants and many potential water saving techniques have been developed [4]. A large quantity of cooling water is necessary for condensing steam after the turbine outlet, in both coal fired power plants and natural gas combined cycle plants, and results in waste heat. If this waste heat can utilized for beneficial use rather than for evaporating water in a cooling tower, less water will be needed for power generation. One example of the successful use of waste heat is drying coal prior to combustion [5, 6]. Power plants are also potential sources of water for reuse, especially from the cooling tower and flue gas. This water can be captured by several methods, including condensing heat exchangers, membranes, or desiccants. The SPX ClearSky Plume Abatement Cooling Tower is an example of a commercially successful application of this [7]. Reutilization of power plant water such as blowdown from cooling towers, flue gas desulfurization wastewater, and ash handling waters is also becoming more common and necessary. Waste heat can be used to assist in this treatment of these effluent streams [8].

Applications are sought for research and development projects that lower the overall water usage and/or impact on water quality from power plants. Responsive projects may include paper-based systems studies, bench-scale testing of new concepts, and/or improvements to existing plants such as increasing the thermal efficiency of condensers. Successful applicant(s) will be required to show how integration of their proposed technology/process will benefit power plants.

(See Appendices/Reference Material for AOI 2-2 background.)

## Section II - AWARD INFORMATION

### A. TYPE OF AWARD INSTRUMENT

DOE anticipates awarding grants under this funding opportunity announcement.

### B. ESTIMATED FUNDING

**AOI 1** Approximately $1,800,000 of DOE funding is available for awards in FY 2017.
**AOI 2** Approximately $900,000 of DOE funding is available for awards in FY 2017.

**Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress for the purpose of these programs and the availability of future-year budget authority.**

### C. MAXIMUM AND MINIMUM AWARD SIZE

Ceiling (i.e., the maximum amount for an individual award made under this announcement):

| AOI 1 | AOI 2 |
|---|---|
| $400,000 DOE Funding | $250,000 DOE Funding |

Floor (i.e., the minimum amount for an individual award made under this announcement):

| AOI 1 | AOI 2 |
|---|---|
| $1 DOE Funding | $1 DOE Funding |

### D. EXPECTED NUMBER OF AWARDS

It is anticipated that seven (7) to nine (9) awards will be made under this FOA, depending on the size of the awards. Awards are expected to be distributed between the two Areas of Interest as follows:

**AOI 1 (inclusive of AOI 1-1 through AOI 1-4)** - University Coal Research - 4 to 5 awards

**AOI 2 (inclusive of AOI 2-1 and AOI 2-2)** - Historically Black Colleges and Universities and Other Minority Institutions – 3 to 4 awards

The Government reserves the right to fund the proposed Government share, in whole or in part, on any, all, or none of the applications submitted in response to this Announcement and will award that number of financial assistance instruments which serves the public purpose and is in the best interest of the Government.

### E. ANTICIPATED AWARD SIZE

DOE anticipates that awards will be up to the $250,000 to $400,000 range for the total project period not including cost share.

### F. PERIOD OF PERFORMANCE

DOE anticipates making awards ranging up to 36 months in duration under this FOA. Go/No Go decision points which coincide with the Continuation Application review process at the end of each budget period may be utilized to decide whether sufficient progress has been made to continue into the next budget period. The number of Budget Periods will be determined on a project-by-project basis.

### G. TYPE OF APPLICATION

DOE will accept only new applications under this announcement.

## Section III - ELIGIBILITY INFORMATION

### A. ELIGIBLE APPLICANTS

**AOI 1 (inclusive of AOI 1-1 through AOI 1-4) - University Coal Research -**

In accordance with 2 CFR 200.203(c), the eligibility of recipients under the UCR portion of this FOA is limited to U.S. colleges, universities, and university-affiliated research institutions. Grants awarded through the UCR Program are for maintaining and upgrading the educational, training, and research capabilities of U.S. universities and colleges in the fields of science, environment, energy, and technology related to coal.

The Principal Investigator or a Co-Principal Investigator listed in the application must be a teaching professor at the submitting university. If this condition is met, other participants, Co-Principal Investigators or research staff, who do not hold teaching or student positions may be included as part of the research team.

Applications from university-affiliated research institutions must be submitted through the college or university with which they are affiliated.

At least one student registered at the applicant university is to perform research for the duration of the project period.

The scope of work to be performed by subcontractors may not be more significant than the scope of work to be performed by the applicant.

**AOI 2 (inclusive of AOI 2-1 and AOI 2-2) - Historically Black Colleges and Universities and Other Minority Institutions**

Eligibility for participation in this program is restricted to HBCU/OMIs recognized by the Office for Civil Rights (OCR), U.S. Department of Education, and identified on OCR's U.S.-accredited postsecondary minority institutions list in effect on the closing date of this FOA.
(http://www.ed.gov/about/offices/list/ocr/edlite-minorityinst.html)

Alternatively, institutions may produce certification from their administrations that (a) at least 50 percent of enrolled students are minorities or (b) they are HBCUs included in the White House's list of institutions (http://www.ed.gov/edblogs/whhbcu/one-hundred-and-five-historically-black-colleges-and-universities/).

Applications must be submitted through Grants.gov by a qualified HBCU/OMI authorized representative. Applicants must be an HBCU/OMI as defined above.

Applications from university-affiliated research institutions must be submitted through the college or university with which they are affiliated.

At least one student registered at the applicant university is to perform research for the duration of the project period.

The scope of work to be performed by subcontractors may not be more significant than the scope of work to be performed by the applicant.

### B. COST SHARING

Cost sharing is not required. However, realizing the benefit of university/industry collaboration, it is acceptable. Note, however, that private industry must be a participant and not a proposer.

Although cost sharing is not required under this FOA, applicants proposing industrial collaboration cost share of any of the following types will be considered appropriate for the UCR or HBCU/OMI program:

1. Cash cost-sharing received by the university awardee from participant(s). NOTE: Cost-sharing is not required for either program; and

2. Subcontracting by university awardee with the industrial participant(s) to provide consultation and experimental data and/or equipment not available at the university; and

3. In-kind collaboration with the industrial participant(s) agreeing to consult with the Principle Investigator, and to share non-proprietary information that will assist in improving the experimental plan and/or assist in analyzing data obtained by the Principal Investigator. In-kind use of industrial experimental facilities not available at the university is included in this kid of collaboration.

DOE views the UCR and HBCU/OMI Programs as assistance programs and, as such, will not permit payment of any fees to industrial participants.

## C. OTHER ELIGIBILITY REQUIREMENTS

**FFRDC/National Laboratories**

Federally Funded Research and Development Center (FFRDC) Contractors. FFRDC contractors may be proposed as a team member on another entity's application subject to the following guidelines:

Authorization for non-DOE/NNSA FFRDCs. The Federal agency sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of a FFRDC contractor must be consistent with the contractor's authority under its award and must not place the FFRDC contractor in direct competition with the private sector.

Authorization for DOE/NNSA FFRDCs. The cognizant contracting officer for the FFRDC must authorize in writing the use of a DOE/NNSA FFRDC contractor on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization.

"Authorization is granted for the [*Name*] Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complimentary to the missions of the laboratory, will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory, and will not place the laboratory in direct competition with the domestic private sector."

Value/Funding. The value of, and funding for, the FFRDC contractor portion of the work will not normally be included in the award to a successful applicant. Usually, DOE/NNSA will fund a DOE/NNSA FFRDC contractor through the DOE field work proposal system and other FFRDC contractors through an interagency agreement with the sponsoring agency.

FFRDC Contractor Effort:

1. The scope of work to be performed by the FFRDC contractor may not be more significant than the scope of work to be performed by the applicant.
2. The FFRDC contractor effort, in aggregate, shall not exceed 25% of the total estimated cost of the project, including the applicant's and the FFRDC contractor's portions of the effort.

Responsibility: The applicant, if successful, will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and the FFRDC contractor.

**NOTE: NETL may not be proposed as a team member on another entity's application. An**

**application that includes NETL as a team member will be considered nonresponsive to this FOA.**

## D. PERFORMANCE OF WORK IN UNITED STATES

The Applicant agrees that at least **75%** of the direct labor cost for the project (including subrecipient labor) shall be incurred in the United States, unless the Applicant can demonstrate to the satisfaction of the Department of Energy that the United States economic interest will be better served through a greater percentage of the work being performed outside of the United States.

Applicants and prime recipients may request a waiver of this requirement. Applicants must include a written waiver request in the Full Application. Prime recipients must submit any waiver requests in writing to the DOE Contracting Officer for this FOA. The DOE Contracting Officer has discretion to waive this requirement if he/she determines that it will further the purposes of this FOA and is otherwise in the best interest of the Government. If you would like to request a waiver see Section VIII.

## Section IV - APPLICATION AND SUBMISSION INFORMATION

### A. ADDRESS TO REQUEST APPLICATION PACKAGE

Application forms and instructions are available at Grants.gov. To access these materials, go to http://www.grants.gov, select "Apply for Grants," and then select "Download Application Package." Enter the CFDA and/or the funding opportunity number located on the cover of this announcement, and then follow the prompts to download the application package.

### B. LETTER OF INTENT AND PRE-APPLICATION

Letters of Intent and Pre-applications are not required.

### C. CONTENT AND APPLICATION FORMS

You must complete the mandatory forms and any applicable optional forms (e.g., Disclosure of Lobbying Activities [SF-LLL]) in accordance with the instructions on the forms and the additional instructions below. Files that are attached to the forms must be in Adobe Portable Document Format (PDF) unless otherwise specified in this announcement.

#### 1. SF 424 (R&R)

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. The list of certifications and assurances referenced in Field 17 can be found on the DOE Financial Assistance Forms Page at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Certifications and Assurances.

**NOTE: Applicants must identify both the Program (UCR or HBCU/OMI), as well as the Area of Interest (AOI) subtopic (X, where X is the subtopic number) under that program that they are applying for (i.e., AOI 1-X or AOI 2-X). The required format for the project title is: "(Program), (AOI 1-X or AOI 2-X), (Project Title)"**

#### 2. RESEARCH AND RELATED OTHER PROJECT INFORMATION

Complete questions 1 through 6 and attach files. The files must comply with the following instructions:

**Project Summary/Abstract (Field 7 on the Form):**

The Project Summary/Abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the Area of Interest toward which the application is submitted, the project title (maximum of 140 characters due to system limitations), the project director/principal investigator(s), and overall project objectives. It must also include a summary description of the approach, methods to be employed, major participants (for collaborative projects), and expected outcomes of the proposed project.

The last paragraph of the Summary/Abstract must contain a project BENEFITS STATEMENT that clearly (a) identifies the methodology, tools, or technology being developed or studied (b) provides a brief statement of how the technology or approach being studied will improve or advance the current state of the art methodologies or technologies, and (c) explains the relevance of the effort to the objectives listed in SECTION I of the FOA.

This document must not include any proprietary or sensitive business information as the Department may make it available to the public after awards are made. The project summary must not exceed one (1) page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right), single spaced,

with font not smaller than 11 point. To attach a Project Summary/Abstract to Field 7, click "Add Attachment."

**Project Narrative (Field 8 on the Form):**

The Project Narrative must not exceed twenty-five (25) double-spaced pages when printed, using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point, excluding the Cover Page, Table of Contents, and Appendices (see below for descriptions of the Cover Page, Table of Contents, and Appendices), but including charts, graphs, maps, photographs, tables, and other pictorial presentations. PAGES IN EXCESS OF THOSE STIPULATED ABOVE WILL NOT BE REVIEWED.

The Project Narrative should provide the bulk of the technical content related to the project being proposed. Evaluation of the Project Narrative will be the most important component of the evaluation of the application.

Do not include in the Project Narrative any Internet addresses (URLs) that provide information necessary to review the application, because the information contained in these sites will not be reviewed.

See Part VIII.D of this FOA for instructions on how to mark proprietary application information.

To attach a Project Narrative, click "Add Attachment." All sections of the Project Narrative (including Cover Sheet, Table of Contents, and Project Narrative Appendices) should be included in a single file named "NARRATIVE.pdf" and attached in Field 8.

**Project Narrative – Cover Page** [Maximum of 1 page, excluded from the Project Narrative page limitation]

The cover page shall include the following:

- Funding Opportunity Announcement Number
- Title of proposed project (maximum of 140 characters due to system limitations)
- Area of Interest toward which the application is submitted, to be included in the Title
- Name and address of the Applicant's organization
- Technical and business points of contact, including their telephone/FAX numbers and e-mail addresses
- Date of Application

**Project Narrative – Table of Contents** [Maximum of 1 page, excluded from the Project Narrative page limitation]

**Project Narrative – Structure and Content**

The Project Narrative must address:

- **Project Objectives:** This section should provide a clear, concise statement of the specific objectives/aims of the proposed project. (This section will count toward the Project Narrative page limitation.)
- **Merit Review Criterion Discussion:** The section should be formatted to address each of the merit review criterion and sub-criterion listed in Part V.A. Provide sufficient information so that reviewers will be able to evaluate the application in accordance with these merit review criterion. DOE WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH OF THE MERIT REVIEW CRITERION AND SUB-CRITERION. (This section will count toward the Project Narrative page limitation.)
- **Relevance and Outcomes/Impacts:** This section should explain the relevance of the effort to the

objectives in the program announcement and the expected outcomes and/or impacts. (This section will count toward the Project Narrative page limitation.)

- **Project Organization and Structure:** Provide the following information in this section:
  - Roles & Responsibilities of Participants: Provide a discussion of the collaborative nature of the proposed research, key project team members, and the capacity in which each team member will assist in achieving the overall objective(s) of the proposed project. For multi-organizational or multi-investigator projects, describe the roles to be performed by each participant/investigator within the context of the Task/Subtask structure contained in the Statement of Project Objectives (SOPO). Include descriptions of any business agreements or intellectual property issues between the applicant and other members of the project team, and how these agreements will be integrated and managed. Although not required, a complete organizational chart(s), accompanied by a discussion of how the organizational structure will facilitate the performance of the Tasks and achievement of the objectives described in the SOPO within the timeframe specified in the application, may be helpful.
  - Decision-making and Communication Strategy: Provide a discussion of how communication and decision-making will occur within the context of the organizational structure, with particular emphasis on scientific/technical direction and mechanisms for controlling project scope, cost, and schedule. Include a discussion of how the project team will communicate with DOE and external stakeholders during the performance of the project.
  - Management Capabilities: Provide information relevant to the capabilities and experience of the PI and project team in managing technical projects of similar nature and complexity. If applicable, include examples that demonstrate the ability to successfully meet research objectives within scope, budget, and schedule.

  (This section will count toward the Project Narrative page limitation.)
- **Multiple Principal Investigators:** The Applicant, whether a single organization or team/partnership/consortium, must indicate if the project will include multiple PIs. This decision is solely the responsibility of the Applicant. If multiple PIs will be designated, the application must identify the Contact PI/Project Coordinator and provide a "Coordination and Management Plan" that describes the organization structure of the project as it pertains to the designation of multiple PIs. This plan should, at a minimum, include:
  - process for making decisions on scientific/technical direction;
  - publications;
  - intellectual property issues;
  - communication plans;
  - procedures for resolving conflicts; and
  - PIs' roles and administrative, technical, and scientific responsibilities for the project.

  [NOTE: Co-PIs are considered "multiple PIs".] (This section will count toward the Project Narrative page limitation.)
- **Facilities & Other Resources:** This information is used to assess the capability of the organizational resources, including subrecipient resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical, and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. This section, on its own, must provide a complete, but concise, summary of the Facilities & Other Resources available.* (This section will count toward the Project Narrative page limitation.)
- **Equipment:** List important items of equipment already available for this project, including subrecipient resources, and, if appropriate, note the location and pertinent capabilities of each. If you are proposing to acquire equipment, describe comparable equipment, if any, already at your organization and explain why it cannot be used. This section, on its own, must provide a complete, but concise, summary of the Equipment available.* (This section will count toward the Project Narrative page limitation.)
- **Bibliography & References:** See "Bibliography & References Cited Appendix" below in the

"Project Narrative Appendices" Section. (This section will be excluded from the Project Narrative page limitation.)

- **Statement of Project Objectives (SOPO):** The Project Narrative must contain a single, detailed Statement of Project Objectives (SOPO) that addresses how the project objectives will be met. The Statement of Project Objectives must contain a clear, concise description of all activities to be completed during project performance and follow the structure discussed below. The Statement of Project Objectives may be released to the public by DOE, in whole or in part, after award. Therefore, the SOPO provided in this section must not contain proprietary or confidential business information. The Statement of Project Objectives is generally less than ten (10) pages in total for the proposed work. (This section will count toward the Project Narrative page limitation.)

Applicants shall prepare the Statement of Project Objectives in the following format:

(BEGINNING OF SOPO FORMAT)

STATEMENT OF PROJECT OBJECTIVES

TITLE OF WORK TO BE PERFORMED

[Specify AOI 1-X or AOI 2-X] Insert the title of work to be performed. Be concise and descriptive.

A. OBJECTIVES

Include one paragraph on the overall objective(s) of the work. If the project is divided into Phases, include specific objective(s) for each Phase.

B. SCOPE OF WORK

This section should not exceed one-half page. It should summarize the work effort and approach to achieve the project objective(s) and clearly define the overall boundaries of the work to be performed. All Tasks and Subtasks described in Section C of the SOPO must fall clearly within the boundaries established by the Scope of Work.

C. TASKS TO BE PERFORMED

Tasks and Subtasks (if applicable) should be concisely written, provided in a logical sequence and apportioned across the project Phases (if applicable), as appropriate. Tasks must be numbered consecutively and continuously throughout the entire duration of the project, starting with Task 1.0 as outlined below. If the project has been divided into Phases, do not re-number the Tasks at the beginning of each Phase. Where appropriate, and at the Applicant's discretion, place go/no go decision point(s) in the SOPO to allow the DOE to review and determine continuance of the remaining Phases and/or Tasks.

Task 1.0 – Project Management and Planning

**(THIS TASK IS MANDATORY AND MUST ADDRESS THE FOLLOWING. APPLICANT INSERT THE LANGUAGE PROVIDED BELOW IN QUOTES)**

"This Task shall include the necessary activities to ensure coordination and planning of the project with DOE/NETL and other project participants. These activities shall include, but are not limited to, the monitoring and controlling of project scope, cost, schedule, and risk and the submission and approval of required National Environmental Policy Act (NEPA) documentation".

[NOTE: The project is restricted from taking any action using Federal funds which would have an adverse effect on the environment or limits the choice of reasonable alternatives prior to DOE providing final NEPA decision regarding this project.]

"This Task shall include all work elements required to maintain and revise the Project Management Plan and to manage and report on activities in accordance with the plan. In addition, this Task should also include all work elements required to maintain and revise the Data Management Plan."

[NOTE: Successful Applicants shall revise the version of the Project Management Plan that is submitted with their applications by including details from the negotiation process and through consultation with the Federal Project Officer. This Project Management Plan will be updated by the Applicant as the project progresses, and the Applicant must use this plan to report schedule and budget variances.]

[APPLICANT continue with tasks/sub-tasks as necessary]

Task 2.0 – (Title)

(Description)

Subtask 2.1 – (Title)

(Description)

Subtask 2.2 – (Title)

(Description)

Task 3.0 – (Title)

(Description)

Subtask 3.1 – (Title)

(Description)

Subtask 3.2 – (Title)

(Description)

D. DELIVERABLES **(THIS TASK IS MANDATORY. APPLICANT INSERT THE LANGUAGE PROVIDED BELOW IN QUOTES)**

"The periodic, topical, and final reports shall be submitted in accordance with the Federal Assistance Reporting Checklist attached to the negotiated Financial Assistance Award and the instructions accompanying the checklist.

In addition to the reports specified in the "Federal Assistance Reporting Checklist", the Recipient must provide the following to the DOE Project Officer (identified in Block 15 of the Assistance Agreement as the Program Manager):

[NOTE: Do <u>not</u> include routine progress reports as Deliverables, because these reports will be already required via the Federal Assistance Reporting Checklist.]

(1) <u>Task 1.0 –</u> <u>Project Management Plan (PMP)</u> PMP should be updated thirty days after

award and be updated as necessary throughout the project as requested by the Project Officer.

(2) Task 1.0 – Data Management Plan (DMP) DMP should be updated as necessary throughout the project as requested by the Project Officer."

**Applicants may continue to list the deliverables other than those identified on the "Federal Assistance Reporting Checklist" that will be delivered. These reports shall also be identified within the text of the Statement of Project Objectives.**

Deliverables such as highly-focused technical reports, hardware and software items, video or audio recordings, etc. shall also be listed in Section D. All Deliverables shall be linked to specific Tasks or subtasks identified within the Statement of Project Objectives. See the following example:

(3) Task 2.0 – (Report Description)

(4) Task 3.1 – (Report Description)

E. BRIEFINGS/TECHNICAL PRESENTATIONS **(THIS TASK IS MANDATORY. APPLICANT INSERT THE LANGUAGE PROVIDED BELOW IN QUOTES)**

"The Recipient shall prepare detailed briefings for presentation to the Project Officer at the Project Officer's facility located in Pittsburgh, PA or Morgantown, WV. The Recipient shall make a presentation to the NETL Project Officer/Manager at a project kick-off meeting held within ninety (90) days of the project start date. At a minimum, annual briefings shall also be given by the Recipient to explain the plans, progress, and results of the technical effort and a final project briefing at the close of the project shall also be given."

At the Applicant's discretion, other briefings/presentations may be added to Section E of the SOPO. If the application is selected for award, DOE may require the Recipient to include additional briefings/presentations, provided that such briefings/presentations are consistent with the budget, schedule, and scope of the project.

(END OF SOPO FORMAT)

*Note to Applicants: For sections "Facilities & Other Resources" and "Equipment", please do not provide a simple statement declaring that "See Project Narrative Appendices for this information" or its equivalent. Merit Reviewers will be instructed to interpret this as a Major Weakness, which is likely to adversely affect the rating assigned to Merit Review Criteria 3 (MRC 3). Although not required to do so, Merit Reviewers may, at their discretion, compare the summary information in the Project Narrative (sections "Facilities & Other Resources" and "Equipment") to the more detailed information contained in the Project Narrative Appendices. Any disagreement between the sources of information may be cited as a weakness by Merit Reviewers and may adversely affect the rating assigned to MRC 3. All such discrepancies must be completely resolved if the Application is selected for award.

**Project Narrative Appendices**

The following appendices shall be included in the Project Narrative file, if applicable.

- **Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers Appendix:** This Identification of Potential Conflicts of Interest Appendix will be excluded from the Project Narrative page limitation. Provide the following information in this section:

  - Collaborators and Co-editors: List in alphabetical order all persons, including their

current organizational affiliation, who are, or who have been, collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this application. Also, list any individuals who are currently, or have been, co-editors with you on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this application. If there are no collaborators or co-editors to report, state "None."

- Graduate and Postdoctoral Advisors and Advisees: List the names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s) during the last 5 years. Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates.

- **Facilities & Other Resources Appendix:** This information is used to assess the capability of the organizational resources, including subrecipient resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical, and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. This Appendix should provide more detail, if necessary, than the "Facilities & Other Resources" Section in the Project Narrative. In order to reduce the number of files attached to your application, please provide the Facility and Other Resource information as an appendix to your Project Narrative. Do not attach a file in Field 9. This Facilities & Other Resources Appendix will be excluded from the Project Narrative page limitation.

- **Equipment Appendix:** List major items of equipment already available for this project, including subrecipient resources, and, if appropriate identify location and pertinent capabilities. If you are proposing to acquire equipment, describe comparable equipment, if any, already at your organization and explain why it cannot be used. This Appendix should provide more detail, if necessary, than the "Equipment" Section in the Project Narrative. In order to reduce the number of files attached to your application, please provide the Equipment information as an appendix to your Project Narrative. Do not attach a file in Field 10. This Equipment Appendix will be excluded from the Project Narrative page limitation.

- **Bibliography & References Cited Appendix:** Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. In order to reduce the number of files attached to your application, please provide the Bibliography & References Cited information as an appendix to your Project Narrative. Do not attach a file in Field 11. This Bibliography & References Cited Appendix will be excluded from the Project Narrative page limitation.

**(End of Project Narrative)**

**Other Attachments (Field 12 on the form):**

If you need to elaborate on your responses to questions 1-6 on the "Other Project Information" document, attach a file in field 12.

Also, attach the following files:

**Project Management Plan (PMP)**

The Applicant must provide a stand-alone Project Management Plan (PMP). The PMP serves the following purposes:

- Contains a thorough discussion of project risks and how these risks will be minimized and/or mitigated
- Establishes baselines for execution and linkage of project tasks, labor effort (types, amounts, etc.), and project costs
- Identifies key milestones and decision points
- Defines the criteria which will determine whether the project is or is not successful

The PMP is generally about 6-8 pages single spaced, including graphs and tables. (This section will be excluded from the Project Narrative page limitation.).

The PMP, on its own, must provide all the information needed by Merit Reviewers to assign strengths, weaknesses, and ratings to Criterion 2, based on the PMP factors (sub-criterion (c) and (d)) listed in Section V.A.2. of this FOA. DOE recognizes that other required elements of the Application package will contain additional information to support various sections of the PMP, such as:

- Project Narrative Appendix – Facilities and Equipment
- Commitment Letters from Third Parties Contributing to Cost Sharing (Section IV.C.2, Other Attachments to Field 12)
- Budget for DOE Federally Funded Research and Development Center (FFRDC) Contractor (Section IV.C.2, Other Attachments to Field 12)
- Environmental Questionnaire (Section IV.C.2, Other Attachments to Field 12)
- Biographical Sketches (Section IV.C.3)
- Budget Forms and Budget Justification (Section IV.C.4)
- Budgets for Subawardees, other than DOE FFRDC Contractors (Section IV.C.5)

However, the Merit Reviewers will not be required to consult these other elements of the Application package when performing their evaluations under MRC 2 (sub-criterion (c) and (d)).* The PMP must provide, in the appropriate sections, complete but concise synopses of the more detailed information contained in the other required elements of the Application package. Applicants must ensure that the information contained in the PMP is entirely consistent with the information contained in the other required elements of the Application package.

*Note to Applicants: Although not required to do so, Merit Reviewers may, at their discretion, compare the summary information in the PMP to the more detailed information contained in the other required elements of the Application package. Any disagreement between the two sources of information may be cited as a weakness by Merit Reviewers and may adversely affect the rating assigned to MRC 2. All such discrepancies must be completely resolved if the Application is selected for award.

Applicants are encouraged not to include any proprietary or confidential business information in the PMP.

The format below must be used for the PMP:

(BEGINNING OF PMP)
(Begin PMP Title Page)

**PROJECT MANAGEMENT PLAN**
**for** {specify AOI 1-X or AOI 2-X} **{insert project title}**
{Date Prepared}

**SUBMITTED UNDER FUNDING OPPORTUNITY ANNOUNCEMENT**

DE-FOA-0001715

**SUBMITTED BY**

{Organization Name}
{Organization Address}
{City, State, Zip Code}

**PRINCIPAL INVESTIGATOR**

{Name}
{Phone Number}
{E-mail}

**SUBMITTED TO**

U.S. Department of Energy
National Energy Technology Laboratory

(End PMP Title Page)

## A. EXECUTIVE SUMMARY

Provide a description of the project that summarizes its objectives, goals, approach, and expected results. For consistency within this Application, the information provided in the Project Summary/Abstract (Field 7) should simply be copied to this document for completeness.

## B. RISK MANAGEMENT

Project risk events are uncertain future events that, if realized, will adversely affect the success of the project. Provide a summary description of the proposed approach to identify, analyze, and respond to potential risks associated with the project.* At a minimum, include the initial identification of significant risks that have the potential to impede project progress, such as: (a) technical difficulties; (b) resource availability; (c) environmental, health, or safety issues; (d) site access issues for field work (if applicable), and (e) management issues. For all identified risks, provide clear strategies to minimize and/or mitigate any adverse impacts that may occur.

*Note to Applicants: For this section, please do not provide a simple statement declaring that "No significant project risks have been identified" or its equivalent. Merit Reviewers will be instructed to interpret this as a Major Weakness, which is likely to adversely affect the rating assigned to Criterion 2.

## C. MILESTONE LOG

Within the context of the PMP, a milestone is defined as a singular key event that marks the completion of a significant element of work as defined in the SOPO. An important decision, the derivation of a critical piece of information, or completion of a technical report that outlines or affects the future of a project may also be viewed as a Milestone. Conversely, periodic, mandatory progress reports are not considered to be Milestones.

Milestones provided in the PMP are presumed to lie on the critical path of the project, i.e., unless all milestones are achieved, the Objectives as defined in the SOPO cannot be met completely. Applicants must provide at least two milestones per calendar year throughout the course of the project. Milestones should be quantitative and show progress toward budget period and/or project goals.

[NOTE: During project performance, the Recipient will report the Milestone Status as part of the required quarterly Progress Report as prescribed under Attachment 3, Federal Assistance Reporting Checklist. The

Milestone Status will present actual performance in comparison with Milestone Log, and include:

(1) the actual status and progress of the project,
(2) specific progress made toward achieving the project's milestones, and
(3) any proposed changes in the project's schedule required to complete milestones.]

Each milestone should be linked to a specific Task or Subtask in the SOPO and include a milestone number, title, planned completion date, and the method/measure used to verify completion of the milestone, as shown in the example below.

| Milestone | Task/ Subtask | Milestone Title | Planned Completion Date | Verification method |
|---|---|---|---|---|
| M1 | 2.2 | Complete evaluation of historical and academic data on the material testing method(s) to date | 06/30/18 | Summary report on evaluation of historical and academic data |
| M2 | 4.3 | Complete laboratory testing of first proposed new alloy | 03/31/19 | Alloy test results provided to DOE |

D. **FUNDING AND COSTING PROFILE**

The Applicant should provide a complete, but concise, table summary (the Project Funding Profile) that shows, by budget period, the amount of government funding going to each project team member. The Applicant should also provide a table summary (the Project Costing Profile) that projects, by month, the expenditure of government funds for the first budget period, at a minimum. Information in these summaries must be entirely consistent with the information contained in the other required elements of the Application package. Include the following information:

- Project Funding Profile: The Applicant should provide complete, but concise, summaries (via tables or other means) of the funding requirements associated with the project. Information in this section (e.g., length of Budget Periods, cost-sharing sources, and associated dollar amounts) must be entirely consistent with the information provided in the separate "RESEARCH AND RELATED BUDGET" forms submitted under IV.C.4 of this FOA. Include the following profiles:

  - By Budget Period: Specify the DOE funding and non-Federal cost share, if applicable, funding required to complete the work scheduled during each Budget Period of the project.
  - By Recipient Organization: Amount of funding (DOE and non-Federal cost-share, if applicable) to be **received by** the Applicant's organization and by all major subrecipients and FFRDCs during each Budget Period. For the purposes of this section, major subrecipients would be those anticipated to perform work estimated to be more than $100,000 or 50 percent of the total work effort (whichever is less).

**Example of Project Funding Profile by Recipient Organization and Budget Period**

| Recipient Organization | Budget Period 1 | | Budget Period 2 | | Budget Period 3 | | Total | |
|---|---|---|---|---|---|---|---|---|
| | DOE Funds | Non-Federal Cost Share | DOE Funds | Non-Federal Cost Share | DOE Funds | Non-Federal Cost Share | DOE Funds | Non-Federal Cost Share |
| **Applicant** | | | | | | | | |
| **Subrecipient A** | | | | | | | | |
| **Subrecipient B** | | | | | | | | |
| **FFRDC** | | | | | | | | |
| **Total ($)** | | | | | | | | |

- DOE Funding by Government Fiscal Year Quarter: In order to allow DOE to allocate Government funds most effectively, Applicants must provide quarterly and monthly DOE funding requirements for all (Government) Fiscal Years associated with the first Budget Period of the project. (Note that the beginning or end of a given Budget Period may not coincide with the beginning or end of a FY Quarter.) If possible, the Applicant should estimate the Quarterly funding requirements for all (Government) Fiscal Years across all Budget Periods during which the project will be active. Cost share, if applicable, should also be included.

**Example of Project Costing Profile Requirements by Government FY Quarter**

| Fiscal Year | Fiscal Quarter | Month | Federal Funding Monthly Total ($) | Non-Federal Funding (Cost Share) Monthly Total ($) | Total ($) |
|---|---|---|---|---|---|
| 2017 | Q4 | August | | | |
| | | September | | | |
| 2018 | Q1 | October | | | |
| | | November | | | |
| | | December | | | |
| | Q2 | January | | | |
| | | February | | | |
| | | March | | | |
| | Q3 | April | | | |
| | | May | | | |
| | | June | | | |
| | Q4 | July | | | |
| | | August | | | |
| | | September | | | |
| 2019 … | Q1 | October | | | |
| | | November | | | |
| | | December | | | |
| | … | … | | | |
| | | … | | | |
| | | **Total ($)** | | | |

E. **PROJECT TIMELINE**

The Applicant should provide a visual representation of the schedule of project activities (Gantt chart or equivalent), broken down by Phase (if applicable) and by Task/Subtask as identified in the SOPO. The schedule/timeline should indicate a start and an end date for each Phase, Task, and Subtask. The schedule should show interdependencies between tasks and include the milestones identified in the Project Milestones section of the PMP (Section C above). It may be necessary to support the visual schedule with a brief narrative to explain key elements of the schedule and interrelationships among tasks.

F. **DECISION POINTS AND SUCCESS CRITERIA**

A 'decision point' can be viewed as a critical juncture at which the results of the project determine which direction the project should take. At some points, called go/no-go decision points, a decision must be made as to or whether or not the project should continue at all. The Applicant should identify and list all decision points, including go/no-go decision points, associated with the project and discuss the circumstances that are likely to affect the decision. In addition, the Applicant should clearly define the criteria that will determine whether the project has been "successful" at each decision point. These success criteria should be objective and stated in terms of specific, measurable, and repeatable data or project accomplishments. Usually, the success criteria pertain to desirable outcomes, results, and observations from the project. Success criteria are often used by DOE to determine if specific goals and objectives were met at the end of a project Phase or Budget Period.

Decision Points may coincide with milestones (PMP Section C) in that they both lie on the project's critical path; however, there are important distinctions between the two. Unlike milestones, decision points do not always pertain to a singular event or project-related accomplishment; likewise, not all milestones require decisions to be made. Also, decision points (particularly go/no-go decision points) typically occur at the end of a specific project Phase or Budget Period whereas milestones may occur at any time during a project.

The inclusion of decision points is up to the Applicant. Success Criteria should be identified regardless of the Applicant's decision to include decision point(s).

(END OF PMP FORMAT)

[NOTE: As the first task in the Statement of Project Objectives, successful applicants will revise the version of the Project Management Plan that is submitted with their applications by including details from the negotiation process. This Project Management Plan will be updated by the Recipient as the project progresses, and the Recipient must use this plan to report schedule and budget variances.]

Save this plan in a single file named "PMP.pdf," and click on "Add Attachments" in Field 12 to attach.

**Commitment Letters from Third Parties Contributing to Cost Sharing (if applicable)**

If a third party, (i.e., a party other than the organization submitting the application) proposes to provide cost sharing, the applicant must include a letter from the third party stating that it is committed to providing a specific minimum dollar amount of cost sharing. The letter should also identify the proposed cost sharing (e.g., cash, services, and/or property) to be contributed. Letters must be signed by the person authorized to commit the expenditure of funds by the entity and be provided in a PDF format. Save this information in a single file named "CLTP.pdf" and click on "Add Attachments" in Field 12 to attach.

**Budget for DOE/NNSA Federally Funded Research and Development Center (FFRDC) Contractor (if applicable)**

If a DOE/NNSA FFRDC contractor is to perform a portion of the work, you must provide a DOE Field Work Proposal in accordance with the requirements in DOE Order 412.1 Work Authorization System. This order and the DOE Field Work Proposal form are available at https://www.directives.doe.gov/directives-documents/0412.1-BOrder-A-admchg1. Use the FFRDC name as the file name (up to 10 letters) and click on "Add Attachments" in Field 12 to attach.

**Environmental Questionnaire (EQ)**

Applicants must complete the Environmental Questionnaire (EQ) at http://www.netl.doe.gov/File%20Library/Business/forms/451_1-1-3.pdf for each performance site. Save the questionnaire(s) in a single file named "Env.pdf" and click on "Add Attachments" in Field 12 to attach.

**Data Management Plan (DMP)**

- **Data Management Plan (SEPT 2015) (ALT 1)**
  Applicants are required to submit a Data Management Plan as part of their full application. The Data Management Plan is a document that outlines the proposed plan for data sharing or preservation. Submission of this plan is required with the full application, and failure to submit the plan may result in rejection of the applicant's application without further consideration. Guidance for preparing a Data Management Plan is provided in Appendix B of the FOA. Save this plan in a single file named "DMP.pdf," and click on "Add Attachment" in Field 12 to attach.

- **General DMP Guidance**
  The Data Management Plan must not exceed 6 pages when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right), single spaced, with font not smaller than 11 point. EVALUATORS WILL REVIEW ONLY THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. Do not include any Internet addresses (URLs) that provide information necessary to review the application. See Part VIII.D for instructions on how to mark proprietary application information.

  In addition to the guidelines set forth in Appendix B, the Data Management Plan should include: (1) a description of the types of data that will be generated under this project, (2) a description of the types of data that will be made publically available, and (3) a description of any restrictions that will be placed on the data. If software is anticipated to be developed under the Award, the Data Management Plan should also include a plan for its distribution (e.g., open source or commercial licensing).

**3. RESEARCH AND RELATED SENIOR/KEY PERSON**

Complete this form before the Budget form to populate data on the Budget form. Beginning with the Project Director/Principal Investigator (PD/PI), provide a profile for each senior/key person proposed. A senior/key person is any individual who contributes in a substantive, measurable way to the scientific/technical development or execution of the project, whether or not a salary is proposed for this individual. Subrecipients and consultants must be included if they meet this definition. For each senior/key person provide:

**Biographical Sketch:**

Complete a biographical sketch for each senior/key person and attach to the "Attach Biographical Sketch" field in each profile. The biographical information for each person must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must include:

- Education and Training: Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree, and year.

- Research and Professional Experience: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

- Publications: Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically.

- Patents, copyrights, and software systems developed may be provided in addition to or substituted for publications.

- Synergistic Activities: List no more than 5 professional and scholarly activities related to the effort proposed.

**Current and Pending Support:**

Provide a list of all current and pending support (both Federal and non-Federal) for the PD/PI and senior/key persons, including subrecipients, for ongoing projects and pending applications. For each organization providing support, show the total award amount for the entire award period (including indirect costs) and the number of person-months per year to be devoted to the project by the senior/key person. Concurrent submission of an application to other organizations for simultaneous consideration will not prejudice its review. Save the information in a separate file and attach to the "Attach Current and Pending Support" field in each profile.

**4. RESEARCH AND RELATED BUDGET (TOTAL FED + NON-FED)**

Complete the Research and Related Budget (Total Fed & Non-Fed) form in accordance with the instructions on the form and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for being allowable under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement (See Section IV.G).

**Budget Justification (Field K on the form):**

Provide the required supporting information for the following costs (See R&R instructions): equipment; domestic and foreign travel; participant/trainees; material and supplies; publication; consultant services; ADP/computer services; subaward/consortium/contractual; equipment or facility rental/user fees; alterations and renovations; and indirect cost type. Provide any other information you wish to submit to justify your budget request. If cost sharing is required, provide an explanation of the source, nature, amount, and availability of any proposed cost sharing. Attach a single budget justification file for the entire project period in Field K. The file automatically carries over to each budget year.

Applicants shall use the Detailed Budget Justification form (OMB Number 1910-5162) embedded below. Save the information in a single file named “RecipientBudgetJustification.xls or xlsx” and click on “Add Attachments” in Field K to attach.

Detailed_Budget_Justification.xlsx

**5. R&R SUBAWARD BUDGET (TOTAL FED + NON-FED) ATTACHMENT(S) FORM**

Budgets for Subrecipients, other than DOE FFRDC Contractors. Applicants must provide a separate cumulative R&R budget and budget justification for each subrecipient that is expected to perform work estimated to be more than $100,000 or 50 percent of the total work effort (whichever is less). Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET (Total Fed + Non-Fed) FORM and e-mail it to each subrecipient required to submit a separate budget. In addition, send each subrecipient the detailed budget justification (OMB Number 1910-5162) file embedded below. After the Subrecipient has e-mailed its completed budget and budget justification back to you, please upload the files to your application package either by attaching the files in the subaward R&R budget form or in Field 12 (click on "add attachment" to attach). The subrecipient files "subrecipientbudget.pdf" and "subrecipientbudget justification.xls or .xlsx" can be uploaded separately to maintain the integrity of the file format or saved in a

single Adobe file, "subrecipient budget and justification.pdf".

Detailed_Budget_Justification.xlsx

**6. PROJECT/PERFORMANCE SITE LOCATION(S)**

Indicate the primary site where the work will be performed. If a portion of the project will be performed at any other site(s), identify the site location(s) in the blocks provided.

Note that the Project/Performance Site Congressional District is entered in the format of the 2 digit state code followed by a dash and a 3 digit Congressional district code, for example VA-001. Hover over this field for additional instructions.

Use the Next Site button to expand the form to add additional Project/Performance Site Locations.

Note to Applicants: An Environmental Questionnaire (see Section IV.C.2, Other Attachments to Field 12) should be completed for each project/performance site indicated.

**7. DISCLOSURE OF LOBBYING ACTIVITIES (SF-LLL)**

If applicable, complete SF- LLL. Applicability: If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying."

**Summary of Required Forms and Files**:

Your application must include the following documents:

| Name of Document | Format | Attach to |
|---|---|---|
| **SF 424 (R&R)** | Form | N/A |
| **RESEARCH AND RELATED OTHER PROJECT INFORMATION** | Form | N/A |
| Project Summary/Abstract | PDF | Field 7 |
| Project Narrative, including appendices | PDF | Field 8 |
| Project Management Plan | PDF | Field 12 |
| Commitment Letters from Third Parties (if applicable) | PDF | Field 12 |
| Budget for DOE FFRDC (if applicable) | PDF | Field 12 |
| Environmental Questionnaire(s) | PDF | Field 12 |
| Data Management Plan | PDF | Field 12 |
| **RESEARCH & RELATED SENIOR/KEY PERSON** | Form | N/A |
| Biographical Sketch | PDF | Attach to appropriate block |
| Current and Pending Support | PDF | Attach to appropriate block |
| **RESEARCH AND RELATED BUDGET (TOTAL FED + NON-FED)** | Form | N/A |
| Budget Justification | Excel | Field K |
| **R&R SUBAWARD BUDGET (TOTAL FED + NON-FED) ATTACHMENT(S) FORM (**if applicable) | Form | N/A |
| Budget Justification | Excel | Attach to appropriate block |

| | | |
|---|---|---|
| **PROJECT/PERFORMANCE SITE LOCATION(S)** | Form | N/A |
| **SF-LLL Disclosure of Lobbying Activities (**if applicable) | Form | N/A |

**D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS**

If selected for award, DOE/NNSA reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment Letter from Third Parties Contributing to Cost Sharing, if applicable
- Data Management Plan

**E. SUBMISSION DATES AND TIMES**

Applications must be received by **February 17, 2017** not later than **11:59:59 PM Eastern Time**. You are encouraged to transmit your application well before the deadline. The Grants.gov Helpdesk is available for extended periods; please check their website for the Helpdesk hours of operation.

**APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

**F. INTERGOVERNMENTAL REVIEW**

This program is not subject to Executive Order 12372 - Intergovernmental Review of Federal Programs.

**G. FUNDING RESTRICTIONS (DECEMBER 2014)**

Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority.

Cost Principles. Costs must be allowable, allocable and reasonable in accordance with the applicable Federal cost principles referenced in 2 CFR part 200 as amended by 2 CFR part 910 [DOE Financial Assistance Regulation]. The cost principles for commercial organizations are in FAR Part 31.

Pre-award Costs. Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 2 CFR part 200 as amended by 2 CFR part 910 [DOE Financial Assistance Regulation]. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

**H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS**

**1. Where to Submit**

**APPLICATIONS MUST BE SUBMITTED THROUGH GRANTS.GOV TO BE CONSIDERED FOR AWARD.**

Submit electronic applications through the "Apply for Grants" function at http://www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@grants.gov.

**2. Registration Process**

**One Time Registration Process**

You must COMPLETE the one-time registration process (all steps) before you can submit your first application through Grants.gov (See http://www.grants.gov/web/grants/applicants/organization-registration.html). We recommend that you start this process at least six weeks before the application due date. It may take 44 days or more to complete the entire process. See the Grants.gov web page for Registering as an Organization at http://www.grants.gov/web/grants/applicants/organization-registration.html to guide you through the process. [IMPORTANT: During the SAM registration process, you will be asked to designate an E-Business Point of Contact (EBIZ POC). The EBIZ POC must obtain a special password called "Marketing Partner Identification Number" (MPIN). The EBIZ POC will need the MPIN to complete the Grants.gov registration process.] When you have completed the Grants.gov registration process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step.

**3. Application Receipt Notices**

After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of four e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to two (2) business days from application submission to receipt of email Number 2. The titles of the four e-mails are:

Number 1 - Grants.gov Submission Receipt Number
Number 2 - Grants.gov Submission Validation Receipt for Application Number
Number 3 - Grants.gov Grantor Agency Retrieval Receipt for Application Number
Number 4 - Grants.gov Agency Tracking Number Assignment for Application Number

## Section V - APPLICATION REVIEW INFORMATION

### A. CRITERIA

### 1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 CFR 605.10(b) to determine that (1) the applicant is eligible for an award; (2) the information required by the funding opportunity announcement has been submitted; and (3) the proposed project is responsive to the objectives of the funding opportunity announcement. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

### 2. Merit Review Criteria

Applications submitted in response to either program area in this funding opportunity will be evaluated and scored in accordance with the Merit Review Criteria (MRC) and the corresponding weights listed with each. The MRC delineated below parallels sections MRC 1, MRC 2, and MRC 3 of the Project Narrative. DOE will consider and evaluate only those applications that address these three (3) MRC separately in the Project Narrative section and the stand-alone Project Management Plan (PMP). Each Project Narrative section is to contain a thorough discussion of the respective sub-criteria.

Applications that avoid substantial discussion of the requested information by utilization of references to other publications, Project Narrative Appendices, and/or attachments outside the Project Narrative (except the PMP) will be judged non-responsive to the criterion. Referenced publications, Project Narrative Appendices, and attachments are to be supplied to validate the discussion.

**NOTE: The following Merit Review Criterion apply to all applications submitted, regardless of program area. In addition, applications will only be scored/ranked against other applications from that specific program area (Example: UCR applications will only be ranked against other UCR applications).**

**MRC 1. Scientific and Technical Merit (45%)**

The application will be evaluated to determine the overall technical merit and quality of the proposed concept, including the following:

a) The degree to which development of the proposed technology can be expected to contribute to a developmental breakthrough for the challenges described in the topic area.
b) The thoroughness and relevance of the scientific, engineering, and technical information and data provided to support readiness of the proposed technology.
c) The degree to which the proposed work is based on sound scientific and engineering principles.

**MRC 2. Technical Approach and Understanding (40%)**

The application will be evaluated to determine the overall quality, soundness, and reasonableness of the applicant's technical approach to fulfill the requirements of the proposed work, including the following:

a) The likelihood that the overall approach will result in successful achievement of the objectives and deliverables described in the applicable topic area, including the extent to which the proposed Statement of Project Objectives (SOPO) is organized, logical, and complete, with appropriate technical decision points.
b) The extent to which the proposed approach satisfies the requirements, goals, and objectives of the applicable topic area.
c) Adequacy and completeness of the Project Management Plan (PMP) in establishing the technical scope, budget, and schedule baselines, in identifying key milestones and decision points, in controlling project performance relative to these baselines and decision points, and in defining the

actions that will be taken when these baselines must be revised.

d) Adequacy and completeness of the identification of, and mitigation strategies for, project risks, including technical, organizational, cost share support and other risks affecting the potential for success.

**MRC 3. Applicant/Team Capabilities, Facilities and Equipment, and Adherence to FOA Requirements (15%)**

The application will be evaluated in terms of the qualifications and experience of key personnel assigned to the project (including subcontractors and consultants, if considered key personnel), the qualifications of the participating organizations, the proposed management of the effort, the facilities and equipment, and adherence to FOA-specified requirements as outlined according to the following factors:

a) Ability and commitment of key personnel and subcontractors to support successful completion of the project including: scientific mastery of the described technology, pertinent systems operations and analysis experience, project management experience, and demonstrated R&D experience and capabilities relevant to the proposed work.
b) The extent of prior experience in managing projects of similar type, size, and complexity and in successfully completing similar R&D projects.
c) The project organization, showing responsibilities and lines of authority (both technical and administrative, including participating organizations and key subcontractors), is clearly described and optimized to assure successful project execution.
d) The appropriateness and availability of facilities, equipment, and their relevance to technology development and/or commercial applications, as applicable.
e) The extent to which the applicant has adhered to FOA-specified requirements such as abiding by document formatting requirements and including required sections or files (such as table of contents, EQ [Environmental Questionnaire], Data Management Plan, etc.).

### 3. Other Selection Factors

**REPORTING OF MATTERS RELATED TO RECIPIENT INTEGRITY AND PERFORMANCE (DECEMBER 2015)**

DOE, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 U.S.C. 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.205 - Federal awarding agency review of risk posed by applicants.

## B. REVIEW AND SELECTION PROCESS

### 1. Merit Review

**Applications Subject to Merit Review**

Applications that pass the initial review will be subjected to a merit review in accordance with the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance." This guide is

available at http://energy.gov/management/office-management/operational-management/financial-assistance under Financial Assistance Policy and Guidance.

**2. Selection**

The Selection Official will consider the merit review recommendation, program policy factors, and the amount of funds available.

**Program Policy Factors**

The selection official will consider the following program policy factors in the selection process:

- It may be desirable to select for award a group of projects, which represents a diversity of technical approaches and methods.
- It may be desirable to support complementary and/or duplicative efforts or projects, which, when taken together, will best achieve the research goals and objectives.
- It may be desirable, because of the type of projects envisioned, or limitations of past efforts, to select for award a group of projects with a broad or specific geographic distribution.
- It may be desirable to select a project for award of less technical merit than another project(s), if such a selection will optimize use of available funds by allowing more projects to be supported while not being detrimental to the overall objectives of the program.
- It may be desirable to select a project for award which reduces Federal investment and maximizes corporate commitment, as demonstrated by cost share levels or other resource leveraging (e.g., in-kind contributions).
- It may be desirable to select a project for award which presents lesser schedule, budget, technical concerns, and/or environmental risks.

**3. Discussions and Award**

The Government may enter into discussions with a selected applicant for any reason deemed necessary, including but not limited to: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 2 CFR part 200 as amended by 2 CFR part 910 (DOE Financial Assistance Regulation); and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

**C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES**

DOE anticipates notifying applicants selected for award by the end of May 2017 and making awards by the end of June 2017.

## Section VI - AWARD ADMINISTRATION INFORMATION

### A. AWARD NOTICES

#### 1. Notice of Selection

**Selected Applicants Notification**

DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Section IV.G with respect to the allowability of pre-award costs.)

**Non-selected Notification**

Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

#### 2. Notice of Award

An Assistance Agreement issued by the contracting officer is the authorizing award document. It normally includes either as an attachment or by reference: (1) Special Terms and Conditions; (2) Applicable program regulations, if any; (3) Application as approved by DOE; (4) 2 CFR part 200 as amended by 2 CFR part 910 (DOE Financial Assistance Regulation); (5) National Policy Assurances To Be Incorporated As Award Terms; (6) Budget Summary; and (7) Federal Assistance Reporting Checklist, which identifies the reporting requirements.

For grants and cooperative agreements made to universities, non-profits and other entities subject to Title 2 CFR, awards made under this funding opportunity should include the government-wide Research Terms and Conditions. A new version of the Terms and Conditions based on the changes to 2 CFR 200 is not yet available. Once the Terms and Conditions become available, they will be located at http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp. If an award is made under this funding opportunity before the Terms and Conditions are posted, alternative Terms and Conditions may be included in the award.

### B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

#### 1. Administrative Requirements (DECEMBER 2014)

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR part 200 as amended by 2 CFR part 910 (DOE Financial Assistance Regulation) (See: http://www.eCFR.gov). For grants and cooperative agreements made to universities, non-profits and other entities subject to Title 2 CFR, awards made under this funding opportunity will include the government-wide Research Terms and Conditions. A new version of these Terms and Conditions based on the changes to 2 CFR 200 is not yet available. Once they become available, they will be located at http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp.

If an award is made under this funding opportunity before the Terms and Conditions are posted, alternative Terms and Conditions may be included in the award.

**DUNS AND SAM REQUIREMENTS**

Additional administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR, Part 25 (See: http://www.eCFR.gov). Prime awardees must keep their data at the System for Award Management (SAM) current at http://www.sam.gov current SAM is the government-wide system that replaced the CCR. If you had an active registration in the CCR, you have an active registration in SAM. Subawardees at all tiers must obtain DUNS numbers and provide the DUNS to the prime awardee before

the subaward can be issued.

**SUBAWARD AND EXECUTIVE REPORTING**

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR, Part 170. (See: http://www.eCFR.gov). Prime awardees must register with the new FSRS database and report the required data on their first tier subawardees. Prime awardees must report the executive compensation for their own executives as part of their registration profile in the System for Award Management (SAM).

**2. Special Terms and Conditions and National Policy Requirements (DECEMBER 2014)**

The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Award Terms.

The National Policy Assurances to Be Incorporated as Award Terms are located at http://www.nsf.gov/bfa/dias/policy/rtc/appc.pdf

Intellectual Property Provisions. The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at: http://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards

Lobbying Restrictions. By accepting funds under this award, you agree that none of the funds obligated on the award shall be expended, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

**FOREIGN NATIONAL INVOLVEMENT**

All applicants selected for an award resulting from this FOA may be required to provide information to the Department of Energy (DOE) in order to facilitate our responsibilities associated with foreign national access to DOE sites, information, technologies, equipment, programs or personnel. 'Foreign national' is defined as any person who was born outside the jurisdiction of the United States, is a citizen of a foreign government, and has not been naturalized under U.S. law. If the selected applicant, including subrecipients/contractors, anticipates utilizing a foreign national in the performance of an award, the selected applicant may be responsible for providing to the DOE specific information about the foreign national(s) to ensure compliance with all of the requirements for access approval. Access approval for individuals from countries identified on the U.S. Department of State list of State Sponsors of Terrorism must receive final approval authority from the Secretary of Energy before they can commence work.

**CORPORATE FELONY CONVICTION AND FEDERAL TAX LIABILITY REPRESENTATIONS (MARCH 2014)**

In submitting an application in response to this FOA the Applicant represents that:

(1) It is not a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months; and

(2) It is not a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definition applies:
A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District

of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

**NONDISCLOSURE AND CONFIDENTIALITY AGREEMENTS REPRESENTATIONS (JUNE 2015)**

In submitting an application in response to this FOA the Applicant represents that:

(1) It does not and will not require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contactors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.

(2) It does not and will not use any Federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:

a. "These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling."

b. The limitation above shall not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

Notwithstanding provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the United States Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States Government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

## C. REPORTING

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The checklist is available at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Award Forms.

## Section VII - QUESTIONS/AGENCY CONTACTS

### A. QUESTIONS

Questions regarding the content of the announcement must be submitted through the FedConnect portal. You must register with FedConnect to respond as an interested party to submit questions and to view responses to questions. It is recommended that you register as soon after release of the FOA as possible to have the benefit of all responses. DOE/NNSA will try to respond to a question within 3 business days unless a similar question and answer have already been posted on the website.

Questions and comments concerning this FOA shall be submitted not later than 7 calendar days prior to the application due date. Questions submitted after that date may not allow the Government sufficient time to respond.

Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. DOE/NNSA cannot answer these questions.

### B. AGENCY CONTACT

| | |
|---|---|
| Name: | Lucas Payne |
| E-mail: | lucas.payne@netl.doe.gov |

## Section VIII - OTHER INFORMATION

### A. MODIFICATIONS/AMENDMENTS

Notices of any modifications/amendments to this announcement will be posted on Grants.gov and the FedConnect portal. You can receive an email when a modification/amendment or an announcement message is posted by registering with FedConnect as an interested party for this FOA. It is recommended that you register as soon after release of the FOA as possible to ensure you receive timely notice of any modifications/amendments or other announcements.

### B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

DOE reserves the right, without qualification, to reject any or all applications received in response to this announcement and to select any application, in whole or in part, as a basis for negotiation and/or award.

### C. COMMITMENT OF PUBLIC FUNDS

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority.

### D. PROPRIETARY APPLICATION INFORMATION

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the Project Narrative and specifies the pages of the application which are to be restricted:

> "The data contained in pages [*Insert pages*] of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

> "The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation."

### E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

### F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM

Patent Rights. The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See "Notice of Right to Request Patent Waiver" in paragraph G below.)

Rights in Technical Data. Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to insure the commercialization of technology developed under a DOE agreement.

## G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784 see http://www.energy.gov/gc/services/technology-transfer-and-procurement/office-assistant-general-counsel-technology-transf-1 for further information. Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

## H. CONFERENCE SPENDING (FEBRUARY 2015)

The Recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States Government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States Government would otherwise exceed $20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such conference.

## I. PERFORMANCE OF WORK IN THE UNITED STATES WAIVER

As set forth in Section III, at least **75%** of the direct labor cost for the project (including subrecipient labor) shall be incurred in the United States, unless the Recipient can demonstrate to the satisfaction of the Department of Energy that the United States economic interest will be better served through a greater percentage of the work being performed outside of the United States.

To request a waiver for this requirement, the Applicant must submit a waiver request in the Full Application, which includes the following information: entity name, description of work to be performed outside the United States and the location where the work will be performed. Waiver requests should explain how the waiver would further the purposes of this FOA and otherwise serve the interests of the Department of Energy. The Contracting Officer may require additional information before considering the waiver request. Save the Waiver Request(s) in a single filed titled: "PerformanceofWork_Waiver.pdf"

## J. NOTICE REGARDING ELIBIBLE/INELIGIBLE ACTIVITIES

Eligible activities under this program include those which describe and promote the understanding of

scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

## K. FOREIGN ENTITY WAIVER REQUEST

As set forth in Section III.A.3, all prime recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. If a foreign entity applies for funding as a prime recipient, it must designate a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a State or territory of the United States to be the prime recipient.

To request a waiver for this requirement, the Applicant must submit a waiver request in the Full Application, which includes the following information: entity name, country (or state) of incorporation, description of the work to be performed by that entity, and the location where the work will be performed. If the applicant is seeking a waiver to have a foreign entity serve as the prime recipient, the applicant must explain why it is necessary to have a foreign entity serve as the prime recipient. Waiver requests should explain how the waiver would further the purposes of this FOA and otherwise serve the interests of the Department of Energy. The Contracting Officer may require additional information before considering the waiver request. Save the Waiver Request(s) in a single filed titled: "LeadOrganization_Waiver.pdf"

## Section IX - APPENDICES/REFERENCE MATERIAL

### APPENDIX A - REFERENCE MATERIAL

**References for AOI 1-1:**

[1] National Energy Technology Laboratory, (April 2016). Crosscutting Research & Analysis Program Sensors and Controls Project Portfolio. http://www.netl.doe.gov/File%20Library/Research/Coal/cross-cutting%20research/CCR-Sensors-and-Controls-2016.pdf (last accessed, December 1, 2016).

[2] Tucker, D., Zaccaria, V., Harun, F. "Real-time model of a fuel manifold in a solid oxide fuel cell stack for fuel flexibility studies," Proceedings of the ASME 2016 Power and Energy Conference, PowerEnergy2016-59429. Accepted.

[3] Zaccaria, V., Tucker, D., Traverso, A., "A distributed real-time model of degradation in a solid oxide fuel cell, Part I: Model Characterization," Journal of Power Sources. 311, 175-181. DOI:10.1016/j.jpowsour.2016.02.040.

[4] Zhou, N., Yang, C. Tucker, D., Pezzini, P., Traverso, A., "Transfer function development for control of fuel cell turbine hybrid systems," International Journal of Hydrogen Energy, 40:1967-1979 (2015): doi:10.1016/j.ijhydene.2014.11.107.

[5] Derler, Patricia, Edward A. Lee, and Alberto L. Sangiovanni-Vincentelli. Addressing modeling challenges in cyber-physical systems. No. UCB/EECS-2011-17. University of California Berkeley Department of Electrical Engineering and Computer Science, 2011.

**References for AOI 1-2:**

[1] Jian Cai and Michael Modest, "Radiation modeling in fluidized-bed coal combustion," 50th AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition Nashville, Tennessee, January 09-12, 2012.

**References for AOI 1-3:**

[1] “The Water-Energy Nexus: Challenges and Opportunities,” U.S. DOE. July 2014 (http://www.energy.gov/sites/prod/files/2014/07/f17/Water%20Energy%20Nexus%20Full%20Report%20July%202014.pdf).

[2] “Steam Electric Power Generating Effluent Guidelines and Standards,” 40 CFR Part 423, U.S. EPA, 2015.

**References for AOI 2-2:**

[1] “The Water-Energy Nexus: Challenges and Opportunities,” U.S. DOE. July 2014 (http://www.energy.gov/sites/prod/files/2014/07/f17/Water%20Energy%20Nexus%20Full%20Report%20July%202014.pdf).

[2] Maupin, M.A., Kenny, J.F., Hutson, S.S., Lovelace, J.K., Barber, N.L., and Linsey, K.S., 2014, Estimated use of water in the United States in 2010: U.S. Geological Survey Circular 1405, 56 p., http://dx.doi.org/10.3133/cir1405.

[3] Carney, B. and Shuster, E., “Exploring the Possibilities: The NETL Power Plant Water Program” Cornerstone Magazine, April 2014. http://cornerstonemag.net/exploring-the-possibilities-the-netl-power-plant-water-program/.

[4] Bushart, S. and Shi, J., “Advanced Cooling and Water Treatment Technology Concepts for Power Plants,” Power Magazine, April 2014. http://www.powermag.com/advanced-cooling-and-water-treatment-technology-concepts-for-power-plants/.

[5] Dotson, B., “Cleantech: innovative Lab Partnership Reduces Emissions from Coal,” U.S. DOE, January 2014. http://energy.gov/articles/cleantech-innovative-lab-partnership-reduces-emissions-coal.

[6] Sarunac, S. Ness, M., and Bullinger, C., “Improve plant Efficiency and Reduce CO2 Emissions When Firing High-Moisture Coals,” Power Magazine, November 2014. http://www.powermag.com/improve-plant-efficiency-and-reduce-co2-emissions-when-firing-high-moisture-coals/.

[7] Lindahl, P. “Plume Abatement,” Power Engineering, November 2009. http://www.power-eng.com/articles/print/volume-113/issue-11/departments/what-works/plume-abatement.html.

[8] Gingerich, D.B. and Mauter, M.S., “Quantity, Quality, and Availability of Waste Heat from United States Thermal Power Generation" Environmental Science & Technology 2015 49 (14), 8297-8306. DOI: 10.1021/es5060989.

**APPENDIX B - DATA MANAGEMENT PLAN**

A Data Management Plan (DMP) explains how data generated in the course of the work performed under this award will be shared and preserved or, when justified, explains why data sharing or preservation is not possible or scientifically appropriate.

**DMP Requirements**

In order for a DMP to be considered acceptable, the DMP must address the following:

At a minimum, the DMP must describe how data sharing and preservation will enable validation of the results from the proposed work, or how results could be validated if data are not shared or preserved.

The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital research data used to generate the displayed data should be made as accessible as possible in accordance with the principles stated above. This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.

The DMP should consult and reference available information about data management resources to be used in the course of the proposed work. In particular, a DMP that explicitly or implicitly commits data management resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management at DOE User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other DOE facilities can be found in the additional guidance from the sponsoring program.

The DMP must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security (e.g., protected critical infrastructure information -- PCII); recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise be consistent with all laws (e.g., export control laws), and DOE regulations, orders, and policies.

**Data Determination for a DMP**

The Principal Investigators from the Prime Recipient Organization and the Sub-Recipient Organizations should determine which data should be the subject of the DMP and, in the DMP, propose which data should be shared and/or preserved in accordance with the DMP Requirements noted above.

For data that will be generated through the course of the proposed work, the Principal Investigator should indicate what types of data should be protected from immediate public disclosure by DOE (referred to as "protected data") and what types of data that DOE should be able to release immediately (referred to as "unlimited rights data"). Similarly, for proprietary data developed outside of the proposed work at private expense that will be used in the course of the proposed work (referred to as "limited rights data"), the Principal Investigator should indicate whether that type of data will be subject to public release or kept confidential. Any use of limited rights data or labeling of data as "protected data" must be consistent with the DMP Requirements noted above.

**Suggested Elements for a DMP**

The following list of elements for a DMP provides suggestions regarding the data management planning process and the structure of the DMP:

- Data Types and Sources: A brief, high-level description of the data to be generated or used through the course of the proposed work and which of these are considered digital

research data necessary to validate the research findings or results.

- Content and Format: A statement of plans for data and metadata content and format including, where applicable, a description of documentation plans, annotation of relevant software, and the rationale for the selection of appropriate standards. Existing, accepted community standards should be used where possible. Where community standards are missing or inadequate, the DMP could propose alternate strategies for facilitating sharing, and should advise the sponsoring program of any need to develop or generalize standards.

- Sharing and Preservation: A description of the plans for data sharing and preservation. This should include, when appropriate: the anticipated means for sharing and the rationale for any restrictions on who may access the data and under what conditions; a timeline for sharing and preservation that addresses both the minimum length of time the data will be available and any anticipated delay to data access after research findings are published; any special requirements for data sharing, for example, proprietary software needed to access or interpret data, applicable policies, provisions, and licenses for re-use and re-distribution, and for the production of derivatives, including guidance for how data and data products should be cited; any resources and capabilities (equipment, connections, systems, software, expertise, etc.) requested in the research proposal that are needed to meet the stated goals for sharing and preservation (this could reference the relevant section of the associated research proposal and budget request); and whether/where the data will be preserved after direct project funding ends and any plans for the transfer of responsibilities for sharing and preservation.

- Protection: A statement of plans, where appropriate and necessary, to protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; and avoid significant negative impact on innovation, and U.S. competitiveness.

- Rationale: A discussion of the rationale or justification for the proposed data management plan including, for example, the potential impact of the data within the immediate field and in other fields, and any broader societal impact.

**Additional Guidance**

In determining which data should be shared and preserved, researchers must consider the data needed to validate research findings as described in the Requirements, and are encouraged to consider the potential benefits of their data to their own fields of research, fields other than their own, and society at large.

DMPs should reflect relevant standards and community best practices and make use of community accepted repositories whenever practicable.

Costs associated with the scope of work and resources articulated in a DMP may be included in the proposed research budget as permitted by the applicable cost principles.

To improve the discoverability of and attribution for datasets created and used in the course of research, DOE encourages the citation of publicly available datasets within the reference section of publications, and the identification of datasets with persistent identifiers such as Digital Object Identifiers (DOIs). In most cases, DOE can provide DOIs free of charge for data resulting from DOE-funded research through its Office of Scientific and Technical Information (OSTI) DataID Service.

**Definitions**

Data Preservation: Data preservation means providing for the usability of data beyond the lifetime of the research activity that generated them.

Data Sharing: Data sharing means making data available to people other than those who have generated them. Examples of data sharing range from bilateral communications with colleagues, to providing free, unrestricted access to anyone through, for example, a web-based platform.

Digital Research Data: The term digital data encompasses a wide variety of information stored in digital form including: experimental, observational, and simulation data; codes, software and algorithms; text; numeric information; images; video; audio; and associated metadata. It also encompasses information in a variety of different forms including raw, processed, and analyzed data, published and archived data.

Research Data: The recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues. This 'recorded' material excludes physical objects (e.g., laboratory samples).

Research data also do not include:

a) Trade secrets, commercial information, materials necessary to be held confidential by a researcher until they are published, or similar information which is protected under law; and

b) Personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy, such as information that could be used to identify a particular person in a research study.

Validate: In the context of DMPs, validate means to support, corroborate, verify, or otherwise determine the legitimacy of the research findings. Validation of research findings could be accomplished by reproducing the original experiment or analyses; comparing and contrasting the results against those of a new experiment or analyses; or by some other means.