WIND FORECASTING IMPROVEMENT PROJECT IN COMPLEX TERRAIN

Funding Opportunity Announcement (FOA) Number: [DE-FOA-0000984]
FOA Type: Modification No. 0001
CFDA Number: 81.087

FOA Issue Date:	4/4/2014
Informational Webinar	4/21/2014 3:00-5:00pm ET
Submission Deadline for Concept Papers:	5/5/2014 5:00pm ET
Submission Deadline for Full Applications:	6/5/2014 5:00pm ET
Submission Deadline for Replies to Reviewer Comments:	7/10/2014
Expected Date for EERE Selection Notifications:	8/22/2014
Expected Timeframe for Award Negotiations	60 days

- Applicants must submit a Concept Paper by the due date listed above to be eligible to submit a Full Application.

- To apply to this FOA, Applicants must register with and submit application materials through EERE Exchange at https://eere-Exchange.energy.gov, EERE's online application portal. Frequently asked questions for this FOA and the EERE Application process can be found at https://eere-exchange.energy.gov/FAQ.aspx.

- Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the Applicant/Selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancellation of further award negotiations and rescission of the Selection.

MODIFICATIONS

All modifications to the Funding Opportunity Announcement are highlighted in yellow in the body of the FOA.

Mod. No.	Date	Description of Modifications
0001	4/22/2014	Information presented during the Information Webinar on the support roles of DOE National Laboratories and NOAA with respect to the FOA research areas is included as Appendix G. Applicant Replies to Reviewer Comments extended from two business days to three business days (refer to Section IV.F).

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EXECUTIVE SUMMARY

Means of Submission	Concept Papers, Full Applications, and Replies to Reviewer Comments must be submitted through EERE Exchange at https://eere-Exchange.energy.gov, EERE's online application portal. EERE will not review or consider applications submitted through other means. The Users' Guide for Applying to the Department of Energy EERE Funding Opportunity Announcements is found at https://eere-Exchange.energy.gov/Manuals.aspx.
Total Amount to be Awarded	$2,500,000
Average Award Amount	EERE anticipates making one award up to $2,500,000.
Types of Funding Agreements	Cooperative Agreements
Period of Performance	Up to 39 months which includes: • Up to 9 months for planning integration and acquiring land easements • Up to 18 months to conduct a field campaign, including deployment of instrumentation, with representative data for each season • 12 months for data analysis and model improvement or development
Eligible Applicants	Individuals, Domestic Entities, Foreign Entities, Incorporated Consortia, Unincorporated Consortia, subject to the definitions in Section III.A. Federally Funded Research and Development Centers (FFRDC) and Government-owned, government-operated (GOGO) facilities are ineligible to apply as either prime or subrecipients to this FOA.
Cost Share Requirement	20% of Total Project Costs Pursuant to the authority in Section 988(b)(3) of the Energy Policy Act of 2005, the Office is reducing the cost share for certain entities to 10% for this FOA. Accordingly, the following entities require a 10% (not 20%) cost share for allowable costs under this FOA: domestic institutions of higher education; domestic nonprofit entities; or U.S. State, local or tribal Governments. To obtain this cost share reduction, the entity must also be a Prime Recipient of the FOA award and must perform more than 50 percent of the project work, as measured by the Total Project Cost.
Submission of Multiple Applications	Applicants may only submit one Concept Paper and one Full Application for consideration under this FOA. If an applicant submits more than one Concept Paper or Full Application, EERE will only consider the last timely submission for evaluation. Any other submissions received listing the same applicant will be considered non-compliant and not eligible for further consideration. This limitation does not prohibit an applicant from collaborating on other applications (e.g., as a potential Subrecipient or partner) so long as the entity is only listed as the Prime Applicant on one Concept Paper and Full Application submitted under this FOA.
Application Forms	Required forms and templates for Full Applications are available on EERE Exchange at https://eere-Exchange.energy.gov.

FOA Summary	This Funding Opportunity Announcement (FOA) is aimed at improving the physical understanding of atmospheric processes which directly impact the wind industry forecasts and incorporate the new understanding into the foundational weather forecasting models. The awardee, in partnership with Department of Energy (DOE), National Oceanic and Atmospheric Administration (NOAA), and a Balancing Authority (BA), will conduct a field campaign in an area of complex terrain to assess how physical processes alter wind speeds at hub heights. From this research, the team will work to develop physical modeling schemes or atmospheric theories that can be incorporated in foundational weather models to improve wind forecasting. Specific objectives of this FOA include: • Working with project partners and available resources described in this FOA, design and implement an observational field campaign in an area, nominally 800 by 800 kilometers in scale, of complex terrain. • Improve the understanding of physical phenomena, processes, and the atmospheric properties that occur in these regions and impact wind speeds and direction at turbine hub heights. • Develop new or improved WRF model schemes or atmospheric modeling theories in conjunction with NOAA and the DOE National Labs identified under this FOA. These schemes or theories should better represent physical processes and increase accuracy of predicted wind changes in the 0 to 15 hour forecasts, with positive implications for day-ahead forecasts, in foundational weather models. • Develop decision support tools which could include probabilistic forecast information, uncertainty quantification and forecast reliability for system operations. • Disseminate results that contribute to improvements in the state-of-the-art of short-term forecasting methods as well as any unintended discoveries that benefit the meteorological and/or wind community.

I. FUNDING OPPORTUNITY DESCRIPTION

A. DESCRIPTION/BACKGROUND

The Wind and Water Power Technologies Office (WWPTO)
The WWPTO is within the Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE). EERE supports research and development projects such as this FOA that increase the viability and deployment of renewable energy technologies

The WWPTO's mission is to enable rapid expansion of clean, affordable, reliable, and domestic wind and water power to promote national security, economic vitality and environmental quality. To find more information, please visit the Wind Power Program (www.energy.gov/eere/renewables/wind) and Water Power Program (www.energy.gov/eere/renewables/water) websites.

The Wind Program's activities accelerate the deployment of wind power technologies through improved performance and reliability, lowered costs, and reduced market barriers. The Wind Program works with national laboratories, industry, universities, and other federal agencies to conduct research and development activities through competitively selected, directly funded, and cost-shared projects. The Wind Program's efforts target both land-based and offshore wind power to fully support a national clean energy economy.

This FOA is issued under the statutory authority granted by EPACT 2005, Section 931(a)(2)(B)(iii) which states, "The Secretary shall conduct a program of research, development, demonstration, and commercial application for wind energy, including testing and verification (including construction and operation of a research and testing facility capable of testing wind turbines)."

Funding Opportunity Description
This FOA supports the research of physical phenomena, processes and atmospheric properties in areas of complex terrain that drive changes in wind speeds within the planetary boundary layer (PBL) of the atmosphere as well as the development of new or improved Weather Research and Forecasting (WRF)-based schemes or basic modeling theories used in foundational forecasting models. Each of these activities are part of the overall FOA goal to improve the short-term (0-15 hour) wind forecasts, with possible positive implications for day-ahead, by improving foundational weather models.

Accuracy of commercial wind energy forecasting services is limited to a large degree by foundational weather models available from the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service. These foundational models currently have limited ability to predict wind speed changes and ramp events at turbine heights, constraining commercial wind forecast models in predicting these events for optimum system operations. As wind deployment continues to contribute to the nation's energy mix, the ability for system

operators to anticipate wind speed changes and ramp events is critical to ensuring integration of wind power and grid reliability.

In a 2009 National Renewable Energy Laboratory (NREL) study in which a 14% wind energy penetration in the U.S. was assumed, savings of $140M to $260M in annual operating costs was estimated with a 10 to 20% improvement in forecasting accuracy above the current state-of-the-art[1]. Under the same study, annual operating cost savings were estimated between $500M and $975M with similar forecasting accuracy improvements and an assumed 20% wind penetration scenario. In light of this information, DOE announced the Wind Forecasting Improvement Project (WFIP) in late 2010. This collaborative effort between DOE, NOAA and the wind industry analyzed impacts of additional meteorological instrumentation on 0 to 6 hour wind forecasting accuracy. The final reports associated with the WFIP project are expected to be released by the end of April 2014. This FOA will support a similar collaborative model with the focus on a 0 to 15 hour forecasting period, with possible positive implications for the day-ahead forecast, in areas of complex terrain where unique meteorological phenomena that impact turbine height winds commonly occur.

Project Objectives

Specific objectives of this FOA are to fund a project that will:

- Design and implement an observational field campaign in an area, nominally 800 by 800 kilometers in scale, of complex terrain, by working with project partners and available resources described in this FOA.
- Improve the understanding of physical phenomena, processes, and the atmospheric properties that occur in these regions and impact wind speeds and direction at turbine hub heights.
- Develop new or improved WRF model schemes or atmospheric modeling theories in conjunction with NOAA and the DOE National Labs identified under this FOA. These schemes or theories should better represent physical processes and increase accuracy of predicted wind changes in the 0 to 15 hour forecasts, with positive implications for day-ahead forecasts, in foundational weather models.
- Develop decision support tools which could include probabilistic forecast information, uncertainty quantification and forecast reliability for system operations.
- Disseminate results that contribute to improvements in the state-of-the-art of short-term forecasting methods as well as any unintended discoveries that benefit the meteorological and/or wind community.

DOE Partners Supporting this FOA

The awardee will work collaboratively with current DOE partners described below that are funded separately in support of this FOA. Applicants should not contact these partners directly for assistance in preparing their application and will collaborate with these contributors at DOE

[1] Lew, D., M. Milligan, G. Jordan, and R. Piwko, 2011: The Value of Wind Power Forecasting. NREL/CP-5500-50814, 10 pp

expense only if competitively selected and awarded. Applicants will have the opportunity during the informational webinar on April 21st, 2014 from 3:00 PM to 5:00 PM ET to learn more about the roles and responsibilities of DOE partners in support of the FOA.

Applications should indicate how the applicant will work collaboratively with these partners in support of the FOA objectives. Additional information about NOAA's role and modeling capabilities can be found in Appendix F (Federal Capabilities and Prospective Roles).

NOAA
The NOAA's Office of Oceanic and Atmospheric Research (OAR) and National Weather Service (NWS) play a critical role in providing and deploying meteorological instrumentation, conducting data assimilation, and operating experimental foundational weather forecast models to support this FOA.

Federally Funded Research and Development Centers (National Labs)
The WWPTO has identified government-owned assets, along with technical and analytical expertise, at several Federally Funded Research and Development Centers (FFRDC) and will fund them directly in support of the awardee. These labs have proven expertise in deploying observational equipment and have provided similar services for the WWPTO in the past. Providing these assets and services in support of the FOA will ensure the awarded amount is concentrated towards innovative research and key model improvement aspects of the project. The WWPTO will fund Argonne National Laboratory (ANL), Pacific Northwest National Laboratory (PNNL), Lawrence Livermore National Laboratory (LLNL), and NREL separately in a direct FOA support role to provide government-owned observational equipment and technical services to the awardee. Additionally, the WWPTO is planning to fund the NREL to provide support for economic analysis to the awardee for the duration of the award.

Applicants should not contact ANL, PNNL, LLNL, NREL or NOAA personnel during the application process. The WWPTO will conduct an informational webinar during the FOA process which will be held after the initial FOA release but before the due date for Concept Papers. During the webinar, further information on the support roles of the National Labs and NOAA was provided and is included as Appendix G in this FOA.

B. APPLICATION REQUIREMENTS

The awardee is expected to bring various data, capabilities, and perspectives to the project, including access to necessary data and cooperation from wind power plants within a proposed project region, wind measurement equipment and data, power output conversion techniques and data, the ability to determine the operational system benefits with use of new forecasts, and other capabilities.

Project Team
In addition to current DOE project partners, the awardee MUST include involvement or support from one or more electric power system Balancing Authorities (BA). The BA can be a public or

private electric utility or electric power system operator (Regional Transmission Organization or Independent System Operator). The proposed team may include wind plant operators, owners, developers and manufacturers, wind forecasters, weather service providers, wind measurement instrument suppliers, regional academia, and others. Each of the participants should be able to bring added value to the research agenda or coordination needs of the project such as historic wind and output data, on-going wind and output measurements, measurement hardware, wind plant outage and availability data, conversion of a wind forecast to an output forecast, and/or other evaluations, analysis, and project implementation support as required.

Regions of Interest

The WWPTO is interested in the region between the Rocky Mountains and the Pacific coastline as candidate areas for studying physical processes. Applicants should select a study area (approximately 800 by 800 kilometers) within this region that experiences the physical processes of interest listed in the next section. This region provides DOE and NOAA the opportunity to validate long range forecasts in the Midwest or Eastern portions of the U.S., while conducting the field campaign in complex terrain that experiences a variety of physical processes pertinent to wind forecasting.

Physical Processes of Interest

The awardee will work with NOAA and other project partners to design and implement a data measurement campaign in the region of interest to collect data on observations, physical processes and atmospheric properties including:

- temperature and moisture profiles of the atmosphere, at a minimum, through the depth of the turbine rotor (approximately 200 meters) and deeper, if possible, to capture a more complete profile of certain phenomena (e.g. low-level jet, full depth of sea breezes);
- low-level jets;
- mountain drainage winds;
- other boundaries such as fronts, outflows and wakes;
- surface flux measurements from which atmospheric stability parameters can be derived; and
- pressure measurements.

Additional physical processes for research under this FOA can include, but are not limited to:

- land-sea breezes;
- turbulence; and
- snow and soil moisture

Instrumentation and Data Management

DOE and its partners have made available a suite of Government Furnished Equipment (GFE), listed in Table 1. Applicants are strongly encouraged to consider these resources as part of the

proposed project. If an applicant decides against using any instrumentation listed in Table 1 for the proposed project, a brief (one to two sentences) explanation is recommended.

Table 1. List of Potential Government Furnished Equipment

Observational Equipment/Instrumentation		Number Available	Notes
Wind Profiling Radars	915-MHz	4	At least 2 WPRs will be provided for the project
Lidars	Scanning	2	
	Doppler	1	Available for at least 2 four-week periods
	Vertical Profiling	3	1 ZephIR 300, 2 Wind Cube v2
Sodars	Vertical Profiling	6	1 Scintec sodar
Radiometers		3	1 Net (Kipp & Zonen) 1 Albedometer, 1 Net Radiometer, and 1 IRT 1 ECOR Flux module
Anemometers	Sonic	13	1 CSAT3 3-D (Campbell Scientific)
	Cup	3	
Sensors	Temperature/RH	3	1 Vaisala, At least 2 from ANL
	CO_2/H_2O	2	1 EC150 infrared gas analyzer (Campbell Scientific)
	Soil heat flux plates	4	
	Soil temperature probes	3	
	Soil moisture probes	3	
	Energy Balance Bowen Ratio system	1	
Hygrometers	Krypton	1	
	Infrared	1	
Tipping Rain Gauge		1	
Surface Weather Stations		10	Campbell Scientific Measures surface wind speed, direction, temperature pressure, and RH
3-m tall towers		2	
Wind Vane Direction		1	
Wind Bird (combined speed and direction)		1	

In addition to the GFE listed in Table 1, DOE anticipates data from three (3) new Wind Profiling Radars being placed along the Pacific Coast to be available during the latter portion of the field campaign. Two floating lidar buoys may also be available to the awardee and should be considered for use in the proposed project.

The application should indicate GFE of interest to use during the proposed project as well as any additional instrumentation or sensors, provided by the applicant, to complement the GFE equipment, as necessary. Additional instrumentation by the applicant can include but is not limited to: wind profiling radars (WPR), lidars, radiometers, sodars, surface flux stations, pressure sensors, and instrumentation on wind plant turbine nacelles, tall towers and other locations. Turbulence and thermal measurements from multiple levels on at least one tall tower (80 meters or higher) in the proposed project region are particularly desirable.

All meteorological observations provided by the applicant must follow Meteorological Assimilation Data Ingest System (MADIS) format and in Universal Coordinated Time (UTC) (see http://madis.noaa.gov/ for more information). Applicants must describe their processes for applying quality control and assurance processes to collected data.

The ability to openly share data, possibly wind plant SCADA (Supervisory Control and Data Acquisition) data and load-related information, amongst partners is critical to success of this project. Where necessary, data for ingest into NOAA NWP models should be supplied in near real-time. Data collected over the life of the project should be made available for archive at a DOE facility. Applicants should describe data collection and formatting, archival, quality assurance/quality control and processes for sharing data among partners in the Data Management Plan (Appendix E).

Model Development and Decision Support Tools

The successful applicant will use the WRF model, specifically the Advanced Research WRF (WRF-ARW) version 3.5.1 or newer, to develop new or improved physical schemes or atmospheric modeling theories along with NOAA and the DOE National Labs mentioned under this FOA for incorporation into NOAA's Numerical Weather Prediction (NWP) models (see www.wrf-model.org/ for more information on the WRF model). The NWP models that provide the basis for demonstrating forecast improvements include the 13-km Rapid Refresh (RAP), the 3-km High-Resolution Rapid Refresh (HRRR), and the experimental NAM Rapid Refresh (NAMRR) models. For more information on NOAA NWP models and forecasting output refer to Appendix F.

Applicants should also describe development of high-level decision support tools that enable system operators to more effectively use foundational forecasting model output on a national-level. These capabilities can include general methodologies for defining probabilistic forecast information, uncertainty quantification and forecast reliability for system operations. Applicants must describe how software developed under this Award will be distributed as open source in the Open Source Software Plan (Appendix D).

Budget Periods

The proposed project performance period should not exceed 39 months and will consist of 3 budget periods.

In Budget Period 1 (up to 9 months), the awardee will work with NOAA, DOE, and lab partners to acquire land easements for instrumentation deployment and design a plan for instrumentation layout, data acquisition and data sharing among partners as well as archival.

During Budget Period 2 (up to 18 months), the awardee will conduct a field campaign collecting representative data for all four seasons. This phase will include operation and timely maintenance of instrumentation, identification of case studies for further analysis, and replacing instrumentation as required, and preliminary analysis of data.

During Budget Period 3, the awardee will allow 12 months for thorough data analysis and model improvement. This phase will include analyzing data from the field campaign, identifying ways to better represent physical processes in model physical schemes or atmospheric modeling theories, testing those schemes or theories with the NOAA RAP, HRRR, and NAMRR models, and disseminating information.

C. APPLICATIONS SPECIFICALLY NOT OF INTEREST

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D of the FOA):

- Applications that fall outside the technical parameters specified in the FOA, including but not limited to using forecast models that are not WRF or WRF-based; applications that limit the sharing data with project partners (e.g. NOAA) or significantly restrict the access of data collected from this field measurement campaign for any potential future use.

- Applications for developing new instrumentation or measurement technologies, including remote sensors.

- Applications that do not include complex terrain or are outside the region of interest described.

- Applications for development of new models or WRF planetary boundary layer schemes that are not open source and publically available.

- Applications limited to addressing one or two physical processes in areas of complex terrain.

- Applications limiting the field campaign phase to less than four seasons.

II. AWARD INFORMATION

A. AWARD OVERVIEW

1. ESTIMATED FUNDING

EERE expects to make up to $2,500,000 of Federal funding available for new awards under this FOA subject to the availability of appropriated funds. EERE anticipates making approximately one award under this FOA. EERE may issue one, multiple, or no awards.
Individual awards are anticipated to not exceed $2,500,000.

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods is not guaranteed.

2. PERIOD OF PERFORMANCE

EERE anticipates making awards with durations up to **39 months in length** including three Budget Periods:

1) Up to 9 months for planning integration and acquiring land easements;
2) Up to 18 months to conduct a field campaign, including deployment of instrumentation, with representative data for each season; and
3) 12 months for data analysis and model improvement or development.

Project continuation will be contingent upon satisfactory performance and go/no-go decision review at the end of Budget Period 1 (planning integration and acquiring land lease/easements) and Budget Period 2 (conducting field campaign) of the project. At the go/no-go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE will make a determination to continue the project, re-direct the project, or discontinue funding the project. Only those projects demonstrating a high probability of successfully meeting the program targets will be continued.

3. NEW APPLICATIONS ONLY

EERE will accept only new applications under this FOA. EERE will not consider applications for renewals of existing EERE-funded awards through this FOA.

B. EERE FUNDING AGREEMENTS

The FOA award will be under a Cooperative Agreement. Through Cooperative Agreements and other similar agreements, EERE provides financial and other support to projects that have the

potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States Government.

1. COOPERATIVE AGREEMENTS

EERE generally uses Cooperative Agreements to provide financial and other support to Prime Recipients.

Through Cooperative Agreements, EERE provides financial or other support to accomplish a public purpose of support or stimulation authorized by Federal statute. Under Cooperative Agreements, the Government and Prime Recipients share responsibility for the direction of projects.

EERE has substantial involvement in all projects funded via Cooperative Agreement. See Section VI.C.8 of the FOA for more information on what substantial involvement may involve.

III. ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

1. INDIVIDUALS

U.S. citizens and lawful permanent residents are eligible to apply for funding as a Prime Recipient or Subrecipient.

2. DOMESTIC ENTITIES

For-profit entities, educational institutions, and nonprofits[2] that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States are eligible to apply for funding as a Prime Recipient or Subrecipient.

State, local, and tribal government entities are eligible to apply for funding as a Prime Recipient or Subrecipient.

DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) and DOE Government-Owned, Government-Operated laboratories (GOGOs) are not eligible to apply as either a Prime or a Subrecipient.

Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

[2] Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995, are not eligible to apply for funding.

3. *FOREIGN ENTITIES*

Foreign entities, whether for-profit or otherwise, are eligible to apply for funding under this FOA.

Other than as provided in the "Individuals" or "Domestic Entities" sections above, 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 in the Full Application 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. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

Foreign entities may request a waiver of the requirement to designate a subsidiary in the United States as the Prime Recipient in the Full Application (i.e., a foreign entity may request that it remains the Prime Recipient on the award). To do so, the Applicant must submit an explicit waiver request in the Full Application, which includes the following information:

- Entity name;
- Country of incorporation;
- Description of the work to be performed by the entity for whom the waiver is being requested; and
- Countries where the work will be performed.

In the waiver request, the Applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the interests of EERE to have a foreign entity serve as the Prime Recipient. The Contracting Officer may require additional information before considering the waiver request. Save the waiver request(s) in a single PDF file using the following convention for the title: "ControlNumber_LeadOrganization_Waiver".

A foreign entity may receive funding as a Subrecipient.

4. *INCORPORATED CONSORTIA*

Incorporated consortia, which may include domestic and/or foreign entities, are eligible to apply for funding as a Prime Recipient or Subrecipient. For consortia incorporated (or otherwise formed) under the laws of a State or territory of the United States, please refer to "Domestic Entities" above. For consortia incorporated in foreign countries, please refer to the requirements in "Foreign Entities" above.

Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the EERE Contracting Officer.

5. UNINCORPORATED CONSORTIA

Unincorporated Consortia, which may include domestic and foreign entities, must designate one member of the consortium to serve as the Prime Recipient/consortium representative. The Prime Recipient/consortium representative must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. The eligibility of the consortium will be determined by the eligibility of the Prime Recipient/consortium representative under Section III.A of the FOA.

Upon request, unincorporated consortia must provide the EERE Contracting Officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This agreement binds the individual consortium members together and should discuss, among other things, the consortium's:

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

B. COST SHARING

Notwithstanding the exceptions noted below, the cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the Government share and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-Federal sources unless otherwise allowed by law. (See 10 CFR 600.30 for the applicable cost sharing requirements.)

The cost share requirement for applied R&D projects will be reduced to 10% if (1) the prime recipient is a domestic institution of higher education , domestic non-profit entity or state, local, or tribal government, and (2) the prime recipient incurs more than 50% of the total project cost [see Section IV.I.5 for use of government-owned equipment].

To assist Applicants in calculating proper cost share amounts, EERE has included a cost share information sheet and sample cost share calculation as Appendices C-1 and C-2 to this Funding Opportunity Announcement.

1. *Legal Responsibility*

Although the cost share requirement applies to the project as a whole, including work performed by members of the project team other than the Prime Recipient, the Prime Recipient is legally responsible for paying the entire cost share. The Prime Recipient's cost share obligation is expressed in the Assistance agreement as a static amount in U.S. dollars (cost share amount) and as a percentage of the Total Project Cost (cost share percentage). If the funding agreement is terminated prior to the end of the project period, the Prime Recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The Prime Recipient is solely responsible for managing cost share contributions by the Project Team and enforcing cost share obligations assumed by Project Team members in subawards or related agreements.

2. *Cost Share Allocation*

Each Project Team is free to determine how best to allocate the cost share requirement among the team members. The amount contributed by individual Project Team members may vary, as long as the cost share requirement for the project as a whole is met.

3. *Cost Share Types and Allowability*

Every cost share contribution must be allowable under the applicable Federal cost principles, as described in Section IV.I.1 of the FOA. In addition, cost share must be verifiable upon submission of the Full Application.

Project Teams may provide cost share in the form of cash or in-kind contributions. Cash contributions may be provided by the Prime Recipient or Subrecipients. Allowable in-kind contributions include, but are not limited to: personnel costs, indirect costs, facilities and administrative costs, rental value of buildings or equipment, and the value of a service, other resource, or third party in-kind contribution.

Project teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding was not provided to the state or local government by the Federal Government.

The Prime Recipient may not use the following sources to meet its cost share obligations including, but not limited to:

- Revenues or royalties from the prospective operation of an activity beyond the project period;

- Proceeds from the prospective sale of an asset of an activity;

- Federal funding or property (e.g., Federal grants, equipment owned by the Federal Government); or

- Expenditures that were reimbursed under a separate Federal Technology Office.

In addition, Project Teams may not use independent research and development (IR&D) funds to meet their cost share obligations. Project Teams may not use the same cash or in-kind contributions to meet cost share requirements for more than one project or program.

Cost share contributions must be specified in the project budget, verifiable from the Prime Recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are considered part of total project cost, the cost share dollars will be scrutinized under the same Federal regulations as Federal dollars to the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

Applicants are encouraged to refer to 10 CFR Parts 600 and 603 for additional guidance on cost sharing, specifically 10 CFR §§600.30, 600.123, 600.224, 600.313, and 603.525-555.

4. COST SHARE VERIFICATION

Applicants are required to provide written assurance of their proposed cost share contributions in their Full Applications.

Upon selection for award negotiations, Applicants are required to provide additional information and documentation regarding their cost share contributions. Please refer to Appendix C-1 and C-2 of the FOA for guidance on the requisite cost share information and documentation.

5. COST SHARE PAYMENT

All proposed cost share contributions must be reviewed in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

EERE requires Prime Recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the Prime Recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated).

In limited circumstances, and where it is in the government's interest, the EERE Contracting Officer may approve a request by the Prime Recipient to meet its cost share requirements on a less frequent basis, such as monthly or quarterly. Regardless of the interval requested, the Prime Recipient must be up-to-date on cost share at each interval. Such requests must be sent

by email to the Contracting Officer during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to demonstrate that the Prime Recipient has complied with its cost share obligations to date. The Contracting Officer must approve all such requests before they may go into effect.

C. COMPLIANCE CRITERIA

To be considered for substantive evaluation, an applicant submission must meet the Compliance criteria set forth below. **Concept Papers and Full Applications must meet all Compliance criteria listed below or they will be considered noncompliant. EERE will not review or consider noncompliant submissions**, including Letters of Intent, Concept Papers, Full Applications, and Replies to Reviewer Comments that were: submitted through means other than EERE Exchange; submitted after the applicable deadline; and/or submitted incomplete. EERE will not extend the submission deadline for Applicants that fail to submit required information due to server/connection congestion.

1. COMPLIANCE CRITERIA

i. Concept Papers

Concept Papers are deemed compliant if:

- The Applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in this FOA.

ii. Full Applications

Full Applications are deemed compliant if:

- The Applicant submitted a compliant and responsive Concept Paper;
- The Full Application complies with the content and form requirements in Section IV.D of the FOA; and
- The Applicant entered successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in the FOA.

iii. Replies to Reviewer Comments

Replies to Reviewer Comments are deemed compliant if:

- The Reply to Reviewer Comments complies with the content and form requirements in Section IV.F of the FOA; and

- The Applicant successfully uploaded all required documents to EERE Exchange by the deadline stated in the FOA.

D. RESPONSIVENESS CRITERIA

EERE performs a preliminary technical review of Full Applications. Any "Applications Specifically Not of Interest," as described in Section I.C of the FOA, are deemed nonresponsive and are not reviewed or considered.

E. LIMITATION ON NUMBER OF CONCEPT PAPERS AND FULL APPLICATIONS ELIGIBLE FOR REVIEW

Applicants may only submit one Concept Paper and one Full Application for consideration under this FOA. If an applicant submits more than one Concept Paper or Full Application, EERE will only consider the last timely submission for evaluation. Any other submissions received listing the same applicant will be considered noncompliant and not eligible for further consideration. This limitation does not prohibit an applicant from collaborating on other applications (e.g., as a potential Subrecipient or partner) so long as the entity is only listed as the Prime Applicant on one Concept Paper and Full Application submitted under this FOA.

F. QUESTIONS REGARDING ELIGIBILITY

EERE will not make eligibility determinations for potential applicants prior to the date on which applications to this FOA must be submitted. The decision whether to submit an application in response to this FOA lies solely with the applicant.

IV. APPLICATION AND SUBMISSION INFORMATION

A. APPLICATION PROCESS

The application process will include two phases: a Concept Paper phase and a Full Application phase. **Only applicants who have submitted a compliant Concept Paper will be eligible to submit a Full Application**. At each phase, EERE performs an initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III of the FOA. EERE will not review or consider noncompliant and/or nonresponsive submissions. All submissions must conform to the following form and content requirements, including maximum page lengths, described below and must be submitted via EERE Exchange at https://eere-exchange.energy.gov/, unless specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than EERE Exchange, submissions submitted after the applicable deadline, and incomplete submissions**. EERE will not extend

deadlines for Applicants who fail to submit required information and documents due to server/connection congestion. A control number will be issued when an Applicant begins the Exchange application process. This control number must be included with all Application documents, as described below.

The Concept Paper, Full Application, and Reply to Reviewer Comments must conform to the following requirements:

- Each must be submitted in Adobe PDF format.
- Each must be written in English
- All pages must be formatted to fit on 8.5 x 11 inch paper with margins not less than one inch on every side. Use Times New Roman typeface, a black font color, and a font size of 12 point or larger (except in figures or tables, which may be 10 point font). A symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies. References must be included as footnotes or endnotes in a font size of 10 or larger. Footnotes and endnotes are counted toward the maximum page requirement.
- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page.
- Each must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If Applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their Concept Papers and Full Applications at least 48 hours in advance of the submission deadline**. Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), Applicants should allow at least 1 hour to submit a Concept Paper, Full Application, or Reply to Reviewer Comments. Once the Application is submitted in EERE Exchange, Applicants may revise or update their application until the expiration of the applicable deadline.

EERE urges Applicants to carefully review their Concept Papers, and Full Applications and to allow sufficient time for the submission of required information and documents. All Full Applications that pass compliance review will undergo comprehensive technical merit review according to the criteria identified in Section V.A.2 of the FOA.

1. *Additional Information on EERE Exchange*

EERE Exchange is designed to enforce the deadlines specified in this FOA. The "Apply" and "Submit" buttons will automatically disable at the defined submission deadlines. Should applicants experience problems with Exchange, the following information may be helpful: Applicants that experience issues with submission PRIOR to the FOA deadline: In the event that an Applicant experiences technical difficulties with a submission, the Application should contact the Exchange helpdesk for assistance (***EXCHANGEHELP@HQ.DOE.GOV***). The Exchange helpdesk and/or the EERE Exchange system administrators will assist Applicants in resolving issues. Applicants that experience issue with submissions that result in late submissions: In the event that an Applicant experiences technical difficulties so severe that they are unable to submit their application by the deadline, the Applicant should contact the Exchange helpdesk for assistance (***EXCHANGEHELP@HQ.DOE.GOV***). The Exchange helpdesk and/or the EERE Exchange system administrators (***EXCHANGE@GO.DOE.GOV***) will assist the Applicant in resolving all issues (including finalizing submission on behalf of and with the Applicant's concurrence). PLEASE NOTE, however, that Applicants who are unable to timely submit their application due to their waiting until the last minute when network traffic is at its heaviest to submit their materials will not be able to use this process.

B. Application Forms

The application forms and instructions are available on EERE Exchange. To access these materials, go to https://eere-Exchange.energy.gov and select the appropriate funding opportunity number.

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:
ControlNumber_LeadOrganization_Project_Part_1
ControlNumber_LeadOrganization_Project_Part_2, etc.

C. Content and Form of the Concept Paper

To be eligible to submit a Full Application, Applicants must submit a Concept Paper by the specified due date.

Each Concept Paper must be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated into a single Concept Paper.

1. *CONCEPT PAPER CONTENT REQUIREMENTS*

The Concept Paper must be submitted as a single document and must conform to the following content requirements:

SECTION	PAGE LIMIT	DESCRIPTION
Technology Description	5 pages maximum	Applicants are required to describe succinctly: • The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges; • The basic technical approach to the project and how it is unique and innovative which should include: o Potential measurements used to conduct a field campaign aimed at investigating the physical phenomena such as those already listed in this FOA; o Anticipated approach for data collection, data analysis and data sharing with project partners; and o Knowledge of, and experience with, development of software packages and forecasting models described in this FOA; • The target level of performance for the project (Applicants should provide technical data or other support to show how the proposed target could be met); the high-level understanding of the stakeholders necessary to enable a successful project and their general roles and responsibilities. • How the project will overcome the shortcomings, limitations, and challenges in the relevant field and application; • The potential impact that the proposed project would have on the relevant field and application; • The key technical risks/issues associated with the proposed technology development plan; • The impact that EERE funding would have on the proposed project.
Addendum	5 pages maximum	Applicants may provide graphs, charts, or other data to supplement their Technology Description. Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed Project Team, including: • Whether the Principal Investigator (PI) and Project Team have the skill and expertise needed to successfully execute the project plan; • Whether the Applicant has prior experience which demonstrates an ability to perform tasks of similar risk and complexity; • Whether the Applicant has worked together with its teaming partners on prior projects or programs; and • Whether the Applicant has adequate access to equipment and facilities necessary to accomplish the effort and/or how it intends to obtain access to the necessary equipment and facilities.

EERE will not review or consider ineligible Concept Papers (see Section III of the FOA).

EERE makes an independent assessment of each Concept Paper based on the criteria in Section V.A.1 of the FOA. EERE will encourage a subset of Applicants to submit Full Applications. Other Applicants will be discouraged from submitting a Full Application. An applicant who receives a "discouraged" notification may still submit a Full Application. EERE will review all compliant and responsive Full Applications. However, by discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project in an effort to save the Applicant the time and expense of preparing an application that is unlikely to be selected for award negotiations.

In order to provide Applicants with feedback on their Concept Papers, EERE will include general comments provided from independent reviewers on an Applicant's Concept Paper in the encourage/discourage notification sent to Applicants at the close of that phase.

D. CONTENT AND FORM OF THE FULL APPLICATION

Applicants must submit a Full Application by the specified due date to be considered for funding under this FOA. Applicants must complete the following application forms found on the EERE Exchange website at https://eere-Exchange.energy.gov/, in accordance with the instructions.

Applicants will have approximately 30 days from receipt of the Concept Paper Encourage/Discourage notification to prepare and submit a Full Application. Regardless of the date the Applicant receives the Encourage/Discourage notification, the submission deadline for the Full Application remains the date stated on the FOA cover page.

All Full Application documents must be marked with the Control Number issued to the Applicant. Applicants will receive a control number upon submission of their Concept Paper, and should include that control number in the file name of their Full Application submission (i.e., *Control number_Applicant Name_Full Application*).

1. FULL APPLICATION CONTENT REQUIREMENTS

EERE will not review or consider ineligible Full Applications (see Section III of the FOA).

Each Full Application should be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated in a single Full Application.

Full Applications must conform to the following requirements:

SUBMISSION	COMPONENTS	FILE NAME (IF NECESSARY)
Full Application (PDF, unless stated otherwise)	Technical Volume (See Chart in Section IV.D.2)	ControlNumber_LeadOrganization_TechnicalVolume
	SF-424 (no page limit)	ControlNumber_LeadOrganization_App424
	Budget Justification (EERE 159) (no page limit, Microsoft Excel format. Applicants must use the template available in EERE Exchange)	ControlNumber_LeadOrganization_Budget_Justification
	Summary for Public Release (1 page max)	ControlNumber_LeadOrganization_Summary
	Summary Slide (1 page limit, Microsoft PowerPoint format)	ControlNumber_LeadOrganization_Slide
	Subaward Budget Justification (EERE 159);	ControlNumber_LeadOrganization_Subawardee_Budget_Justification
	SF-LLL Disclosure of Lobbying Activities	ControlNumber_LeadOrganization_SF-LLL
	Foreign Entity and Performance of Work in the United States waiver requests (if applicable)	ControlNumber_LeadOrganization_Waiver
	U.S. Manufacturing Plans	ControlNumber_LeadOrganization_USMP
	Data Management Plan	ControlNumber_LeadOrganization_Data Plan
	Open Source Software Distribution Plan	ControlNumber_LeadOrganization_Open Source Software

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:

ControlNumber_LeadOrganization_Project_Part_1
ControlNumber_LeadOrganization_Project_Part_2, etc.

EERE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed 10MB.

EERE provides detailed guidance on the content and form of each component below.

2. TECHNICAL VOLUME

The Technical Volume must be submitted in Adobe PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If Applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A.2 of the FOA. Save the Technical Volume in a single PDF file using the following convention for the title: "ControlNumber_LeadOrganization_TechnicalVolume".

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. EERE and reviewers may review primary research literature in order to evaluate applications. However, EERE and reviewers are under no obligation to review cited sources (e.g., internet websites).

The Technical Volume to the Full Application may not be more than 35 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria (see Section V.A.2 of the FOA) when preparing the Technical Volume.

SECTION/PAGE LIMIT	DESCRIPTION
Cover Page	The cover page should include the project title,), both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Project Overview (This section should constitute approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Background: The Applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • Project Goal: The Applicant should explicitly identify the targeted improvements to the baseline technology and the critical success factors in achieving that goal. • DOE Impact: The Applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.
Technical Description, Innovation, and Impact (This section should constitute approximately 25% of the Technical Volume)	The Technical Description should contain the following information: • Relevance and Outcomes: The Applicant should provide a detailed description of the technology, including the scientific and other principles and objectives that will be pursued during the project. This section should describe the relevance of the proposed project to the goals and objectives of the FOA, including the potential to meet specific DOE technical targets or other relevant performance targets. The Applicant should include the number of instruments they can provide, the type of data, and communications for data delivery. The Applicant should clearly specify the expected outcomes of the project. • Feasibility: The Applicant should demonstrate the technical feasibility of the proposed technology and capability of achieving the anticipated performance targets, including a description of previous work done and prior results. • Innovation and Impacts: The Applicant should describe the current state of the art in the applicable field, the specific innovation of the proposed

	technology, the advantages of proposed technology over current and emerging technologies, and the overall impact on advancing the state of the art/technical baseline if the project is successful.
Work plan (This section should constitute approximately 50% of the Technical Volume)	The Work plan should contain the following information: • Project Objectives: The Applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes. • Technical Scope Summary: The Applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on go/no-go decision points). The applicant should describe the specific expected end result of each performance period. • Project/Performance Site Location(s): Indicate the primary site(s) 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) Include maps and/or other geographic identifiers to illustrate the proposed performance site location(s) and the complex terrain features as necessary. • Work Breakdown Structure (WBS) and Task Descriptions: The Work plan should fully describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Work plan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard work breakdown structure (WBS) for any project. The Work plan shall contain a concise detailed description of the specific activities to be conducted over the life of the project. "Detailed" is defined as a full explanation and disclosure of the project being proposed (i.e., a statement such as "we will then complete a proprietary process" is unacceptable). It is the Applicant's responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA. To this end each task and subtask is to have a unique number and title and an indication of the duration of the task or subtask in months. Each task and subtask is to have a task summary that describes the objectives, what work is to be accomplished, and relationship to project deliverables or expected results. Appropriate milestones should be incorporated into the task and subtask structure. Each task and subtask is to have a technical details section, as appropriate, to discuss how the work will be done, anticipated problems or uncertainties, and any further clarification, such as why a specific approach is being taken. An example Work Breakdown Structure is provided below. • Milestones: The Applicant should provide appropriate milestones throughout the project to demonstrate success, where success is defined as technical achievement rather than simply completing a task. To ensure that milestones are relevant, Applicants should follow the SMART rule of thumb, which is that all milestones should be **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**imely. Unless otherwise specified in the FOA, the minimum

	requirement is that each project must have at least one milestone per quarter for the duration of the project (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The Applicant should also provide the means by which the milestone will be verified. In addition to describing milestones in the Work plan text and including them in the schedule, the Applicant is required to complete the Milestone Summary Table shown below. • Go/No-Go Decision Points: The Applicant should provide project-wide go/no-go decision points at appropriate points in the Work plan, such as at the end of the land leasing and field campaign phases of the project. A go/no-go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one project-wide go/no-go decision point for each year (12-month period) of the project. The Applicant should also provide the specific technical criteria to be used to make the go/no-go decision. In addition to describing the go/no-go decision points in the Work plan text and including them in the schedule, the Applicant is required to complete the Milestone Summary Table shown below, which must include go/no-go decision points and their method of verification. • Project Schedule (Gantt chart or similar): The Applicant should provide a detailed schedule for the entire project, including task and subtask durations, milestones, and go/no-go decision points. • Project Management: The Applicant should discuss the team's proposed management plan, including the following: o The overall approach to and organization for managing the work; o The roles of each Project Team member; o Any critical handoffs/interdependencies among Project Team members; o The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices; o The approach to project risk management; o A description of how project changes will be handled; and o If applicable, the approach to Quality Assurance/Control o How communications will be maintained among Project Team members. • Market Transformation/Commercialization Plan: The Applicant should provide a market transformation/commercialization plan, including the following: o A complete Open Source Software Plan (Appendix D) and Data Management Plan (Appendix E); o If applicable, identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation

	plan; and o If applicable, identification of a product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution. • Instrumentation and Observational Data Sources: The Applicant should provide a list of instruments and observational data sources to be used for the proposed project. The list should include: o The Government-Furnished Equipment listed in Table 1, along with a brief explanation (one to two sentences) for each instrument on how the instrument, if selected for inclusion, will be used in the proposed project or why the instrument does not contribute to the proposed project if not selected. o Any applicant-provided instrumentation, sensors and/or data sources such as measurements from a tall tower (80+ m) in the proposed project location (please include the approximate distance from wind plants if meteorological towers are included as data sources). o A brief description of how the overall suite of instruments and/or observational data sources will be used and contribute to the FOA objectives.
Technical Qualifications and Resources (This section should constitute approximately 15% of the Technical Volume)	The Technical Qualifications and Resources should contain the following information: • Describe the Project Team's unique qualifications and expertise, including those of key subrecipients. • Describe the Project Team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project. • This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the Applicant to achieve the project objectives. • Describe the time commitment of the key team members to support the project. • Attach one-page resumes for key participating team members as an appendix. Resumes do not count towards the page limit. Multi-page resumes are not allowed. • Describe the technical services to be provided by DOE/NNSA FFRDCs and GOGOs, if applicable. • Attach any letters of support from partners/end users as an appendix (1 page maximum per letter). Letters of support do not count towards the page limit. • For multi-organizational or multi-investigator projects, describe succinctly: o The roles and the work to be performed by each PI and Key Participant;

	o Business agreements between the Applicant and each PI and Key Participant; o How the various efforts will be integrated and managed; o Process for making decisions on scientific/technical direction; o Publication arrangements; o Intellectual Property issues; and o Communication plans.

Example Milestone Summary Table and Work Breakdown Structure are provided on following two pages.

Milestone Summary Table							
Recipient Name:							
Project Title:							
Task Number	Task Title or Subtask Title (If Applicable)	Milestone Type (Milestone or Go/No-Go Decision Point)	Milestone Number* (Go/No-Go Decision Point Number)	Milestone Description (Go/No-Go Decision Criteria)	Milestone Verification Process (What, How, Who, Where)	Anticipated Date (Months from Start of the Project)	Anticipated Quarter (Quarters from Start of the Project)

*Milestone numbering convention should align with Task and Subtask numbers, as appropriate. For example, M1.1, M3.2, etc.

Note 1: It is required that each project has at least one milestone per quarter for the entire project duration. It is not necessary that each task have one milestone per quarter.

Note 2: It is required that each project have at least one project-wide go/no-go decision point each year. If a decision point is not specific to a particular task, then you may leave the task information blank for those decision points.

Note 3: All milestones should follow the SMART rule of thumb: Specific, Measureable, Achievable, Relevant, and Timely

Example Work Breakdown Structure

Technical Summary: Provide a high-level overview of the final result of this project. Explain the final objective, outcome, milestone and/or deliverable that are to be produced and the rationale for why the applicant has organized the tasks in the way they have.

Technical Details (Optional): Describe the relevant management, engineering, design, process, scientific or other principles and aspects of the project that warrant discussion.

Task 1: Distinctive Title, Date range of the task in months (M1-M4)

Task Summary: Task summaries shall explicitly describe what work is to be accomplished, identify the project objectives/outcomes being addresses and provide a concise statement of the objectives of that task. In addition, the description should indicate the project deliverables that this task will help achieve (D1, D2, D5 etc. note that deliverables may be applicable to multiple or all tasks.]

Task Details: Within this section, the barriers and risks should be identified, as well as the approaches for overcoming those barriers and risks. Where appropriate, multiple pathways early in the effort can be outlined for risk reduction.

Milestone 1.1 (if applicable)
Milestone 1.2 (if applicable)
Etc.

Subtask 1.1: Date range (M1-M2)

Subtask Summary: Describe the specific and detailed work efforts that go into achieving the higher-level tasks.

Subtask Details: Describe the evaluation techniques that will be used and the expected result that will be generated from the effort.

Milestone 1.1.1 (if applicable)
Milestone 1.1.2 (if applicable)
Etc.

Subtask 1.2:
(Continue until all Task 1 subtasks are listed)

Task 2: (continue in the format above until all tasks and subtasks are listed)
Subtask 2.1: Description and Discussion
Subtask 2.2: Description and Discussion

3. SF-424: APPLICATION FOR FEDERAL ASSISTANCE

Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period. Save the SF-424 in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_App424".

4. BUDGET JUSTIFICATION WORKBOOK (EERE 159)

Applicants are required to complete the Budget Justification Workbook. This form is available on EERE Exchange at https://eere-Exchange.energy.gov/. Prime Recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the Prime Recipient and its Subrecipients and Contractors, and provide all requested documentation (e.g., a Federally-approved forward pricing rate agreement, Defense Contract Audit Agency or Government Audits and Reports, if available). Applicants should include costs associated with required annual audits and incurred costs proposals in their proposed budget documents. The "Instructions and Summary" included with the Budget Justification Workbook will "auto-populate" as the Applicant enters information into the Workbook. Applicants must carefully read the "Instructions and Summary" tab provided within the Budget Justification Workbook. Save the Budget Justification Workbook in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Budget_Justification".

5. SUMMARY/ABSTRACT FOR PUBLIC RELEASE

Applicants are required to submit a one-page summary/abstract of their project. 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 identified the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the DOE may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 11 point. Save the Summary for Public Release in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Summary".

6. SUMMARY SLIDE

Applicants are required to provide a single PowerPoint slide summarizing the proposed project. The slide must be submitted in Microsoft PowerPoint format. This slide is used during the

evaluation process. Save the Summary Slide in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

The Summary Slide template requires the following information:

- A technology Summary;
- A description of the technology's impact;
- Proposed project goals;
- Any key graphics (illustrations, charts and/or tables);
- The project's key idea/takeaway;
- Project title, Prime Recipient, Principal Investigator, and Key Participant information; and
- Requested EERE funds and proposed applicant cost share.

7. SUBAWARD BUDGET JUSTIFICATION (EERE159)

Applicants must provide a separate budget justification, EEERE 159 (i.e., budget justification for each budget year and a cumulative budget) for each subawardee that is expected to perform work estimated to be more than $250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section, above. Save each subaward budget justification in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Subawardee_Budget_Justification".

8. SF-LLL: DISCLOSURE OF LOBBYING ACTIVITIES

Prime Recipients and Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Prime Recipients and Subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (http://www.whitehouse.gov/sites/default/files/omb/grants/sflllin.pdf) if any non-Federal funds have been paid or will be paid to any person for influencing or attempting to influence any of the following in connection with your application:

- An officer or employee of any Federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

Save the SF-LLL in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_SF-LLL".

9. WAIVER REQUESTS: FOREIGN ENTITIES AND PERFORMANCE OF WORK IN THE UNITED STATES

i. Foreign Entity Participation:

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. To request a waiver of this requirement, the Applicant must submit an explicit waiver request in the Full Application. Waiver information is provided in Section III.A.3 of the FOA.

ii. Performance of Work in the United States

All work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. Section IV.I.3 lists the necessary information that must be included in a request to waive this requirement.

10. U.S. MANUFACTURING COMMITMENTS

EERE requires subject inventions (i.e., inventions conceived or first actually reduced to practice under EERE awards) to be substantially manufactured in the United States by Project Teams and their licensees, as described below. The Applicant may request a modification or waiver of the U.S. Manufacturing Requirement.

i. Domestic Small Businesses, Educational Institutions and Nonprofits

Domestic Small businesses (including Small Business concerns), domestic educational institutions, and nonprofits that are Recipients or Subrecipients under EERE funding agreements must require their exclusive licensees to substantially manufacture the following products in the United States for any use or sale in the United States: (1) articles embodying subject inventions, and (2) articles produced through the use of subject inventions. This requirement does not apply to articles that are manufactured for use or sale overseas.

Domestic small businesses, domestic educational institutions and nonprofits must require their assignees to apply the same U.S. Manufacturing requirements to their exclusive licensees.

These U.S. Manufacturing requirements do not apply to nonexclusive licensees.

ii. Large Businesses, Foreign Entities, and State and Local Government Entities

Large businesses and foreign entities that are Recipients or Subrecipients under EERE funding agreements that take title to subject inventions through a patent waiver are required to substantially manufacture the following products in the United States: (1) products embodying subject inventions, and (2) products produced through the use of subject invention(s). This

requirement applies to products that are manufactured for use or sale in the United States or overseas.

Large businesses and foreign entities must apply the same U.S. Manufacturing requirements to their assignees, licensees, and entities acquiring a controlling interest in the large business or foreign entity. Large businesses and foreign entities must require their assignees and entities acquiring a controlling interest in the large business or foreign entity to apply the same U.S. Manufacturing requirements to their licensees.

11. DATA MANAGEMENT PLAN

Applicants are required to submit a Data Management Plan with their Full Application. The Data Management Plan is a document that outlines the proposed plan for data sharing or preservation and will be evaluated as part of your overall data dissemination plan within your Market Transformation/Commercialization Plan. Submission of a Data Management Plan with the Full Application is required; failure to submit a complete Data Management Plan may result in a determination of non-compliance for your Full Application. Guidance for preparing a Data Management Plan is included in Appendix E of the FOA.

12. OPEN SOURCE SOFTWARE DISTRIBUTION PLAN

Applicants are required to submit an Open Source Software Distribution Plan as part of their Full Application. This plan describes how software produced under this FOA will be distributed. Submission of an Open Source Software Distribution Plan is required; failure to submit a complete Plan may result in a determination of non-compliance for your Full Application. Guidance for preparing an Open Source Software Distribution Plan is included in Appendix D of the FOA.

E. POST-AWARD INFORMATION REQUESTS

If selected for award, EERE 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;
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable;
- Name and phone number of the Designated Responsible Employee for compliance with national policies prohibiting discrimination (See 10 CFR 1040.5);
- Representation of Limited Rights Data and Restricted Software, if applicable;
- Environmental Questionnaire; and
- Land lease information for instrumentation, if known.

F. Content and Form of Replies to Reviewer Comments

EERE will provide Applicants with reviewer comments following evaluation of all compliant and responsive Full Applications. Applicants will have approximately three (3) business days to prepare a short Reply to Reviewer Comments responding to comments however they desire or supplementing their Full Application.

EERE will not review or consider ineligible Replies to Reviewer Comments (see Section III of the FOA). EERE will review and consider each compliant and responsive Full Application, even if no Reply is submitted or if the Reply is found to be noncompliant.

Replies to Reviewer Comments must conform to the following content and form requirements, including maximum page lengths, described below. If a Reply to Reviewer Comments is more than three pages in length, EERE will review only the first three pages and disregard any additional pages.

SECTION	PAGE LIMIT	DESCRIPTION
Text	2 pages max	Applicants may respond to one or more reviewer comments or supplement their Full Application.
Optional	1 page max	Applicants may use this page however they wish; text, graphs, charts, or other data to respond to reviewer comments or supplement their Full Application are acceptable.

G. Submission Dates and Times

Concept Papers, Full Applications, and Replies to Reviewer Comments must be submitted no later than 5p.m. EST on the dates provided on the cover page of this FOA.

H. Intergovernmental Review

This Technology Office is not subject to Executive Order 12372 – Intergovernmental Review of Federal Technology Offices.

I. Funding Restrictions

1. Allowable Costs

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable Federal cost principles.

Refer to the following applicable Federal cost principles for more information:

- 2 CFR 220 for Educational Institutions;
- 2 CFR 225 for State, Local, and Indian Tribal Governments;
- 2 CFR 230 for Non Profit Organizations; and
- FAR Part 31 for For-Profit entities.

2. PRE-AWARD COSTS

Selectees may charge pre-award costs incurred on R&D awards within the 90-day period immediately preceding the effective date of the award. If the Selectee is a for-profit, non-profit, or University, prior approval by the CO to incur pre-award costs is not required unless the costs are more than $25,000. If the Selectee is a governmental entity, it must request prior approval from the CO to incur pre-award costs, regardless of the amount.

Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis. Pre-award costs can only be incurred if such costs would be reimbursable under the agreement if incurred after award.

Pre-Award expenditures are made at the Selectee's risk; EERE is not obligated to reimburse costs: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the Selectee anticipated.

i. Pre-Award Costs Related to National Environmental Policy Act (NEPA) Requirements

EERE's decision whether and how to distribute federal funds under this FOA is subject to NEPA. Applicants should carefully consider and should seek legal counsel or other expert advice before taking any action related to the proposed project that would have an adverse effect on the environment or limit the choice of reasonable alternatives prior to EERE completing the NEPA review process.

EERE does not guarantee or assume any obligation to reimburse costs where the Prime Recipient incurred the costs prior to receiving written authorization from the Contracting Officer. If the Applicant elects to undertake activities that may have an adverse effect on the environment or limit the choice of reasonable alternatives prior to receiving such written authorization from the Contracting Officer, the Applicant is doing so at risk of not receiving Federal funding and such costs may not be recognized as allowable cost share. Likewise, if a project is selected for negotiation of award, and the Prime Recipient elects to undertake activities that are not authorized for Federal funding by the Contracting Officer in advance of EERE completing a NEPA review, the Prime Recipient is doing so at risk of not receiving Federal Funding and such costs may not be recognized as allowable cost share. Nothing contained in the pre-award cost reimbursement regulations or any pre-award costs approval letter from the Contracting Officer override these NEPA requirements to obtain the written authorization from the Contracting Officer prior to taking any action that may have an adverse effect on the

environment or limit the choice of reasonable alternatives.

3. PERFORMANCE OF WORK IN THE UNITED STATES

a. Requirement.

All work performed under EERE Awards must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment; however, the Recipient should make every effort to purchase supplies and equipment within the United States. The Recipient must flow down this requirement to its subrecipients.

b. Failure to Comply.

If the Recipient fails to comply with the Performance of Work in the United States requirement, EERE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable Recipient cost share. The Recipient is responsible should any work under this Award be performed outside the United States, absent a waiver, regardless of if the work is performed by the Recipient, subrecipients, vendors or other project partners.

c. Waiver.

There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a waiver of the Performance of Work in the Unites States requirement, the Recipient must submit a written waiver request to EERE, which includes the following information:

- The countries in which the work is proposed to be performed;
- A description of the work to proposed to performed outside the U.S.;
- Proposed budget of work to be performed; and
- The rationale for performing the work outside the U.S.

For the rationale, the Recipient must demonstrate to the satisfaction of EERE that a waiver would further the purposes of the FOA that the Award was selected under and is otherwise in the interests of EERE and the United States. EERE may require additional information before considering a waiver request. Save the waiver request(s) in a single PDF file titled "ControlNumber_PerformanceofWork_Waiver".

4. CONSTRUCTION

EERE generally does not fund projects that involve major construction (i.e., construction of new buildings, major renovations, or additions to existing buildings). Recipients are required to obtain written authorization from the Contracting Officer before incurring any major construction costs.

5. EQUIPMENT AND SUPPLIES

To the greatest extent practicable, all equipment and products purchased with funds made available under this award should be made or manufactured in the United States. This requirement does not apply to used or leased equipment.

Property disposition will be required at the end of a project if the property is no longer used by the Prime Recipient for the objectives of the project, and the fair market value of property exceeds $5,000. The rules for property disposition are set forth in the following sections of 10 CFR Part 600:

- 10 CFR 600.130 to 600.137 for Universities, Hospitals, or other Nonprofit Institutions;
- 10 CFR 600.231 to 600.233 for State and Local Governments; and
- 10 CFR 600.320 to 600.325 for For-Profit organizations.

6. LOBBYING

Recipients and Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Recipients and Subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (http://www.whitehouse.gov/sites/default/files/omb/grants/sflllin.pdf) if any non-Federal funds have been paid or will be paid to any person for influencing or attempting to influence any of the following in connection with your application:

- An officer or employee of any Federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

V. APPLICATION REVIEW INFORMATION

A. TECHNICAL REVIEW CRITERIA

1. CONCEPT PAPERS

Concept Papers are evaluated based on the following criteria:

Criterion 1: Overall Scientific and Technical Merit (50%)
This criterion involves consideration of the following factors:

- A clear description of the challenge to the industry;
- Development of a high-level approach that addresses this challenge and is within the parameters described in this FOA; and
- If technical success is achieved, how the proposed idea would significantly improve technical and economic performance relative to the current practice.

Criterion 2: Team and Resources Roles, Responsibilities (50%)
This criterion involves consideration of the following factors:

- An understanding of the stakeholders necessary to develop a comprehensive team to contribute to the objectives of this FOA, including roles and responsibilities; and
- The likelihood of the team to achieve success within the described approach.

2. FULL APPLICATIONS

Applications will be evaluated against the merit review criteria shown below.

Criterion 1: **Technical Merit, Innovation, and Impact** Weight: 45%

Technical Merit and Approach

- Extent to which the proposed project is innovative, supports the objectives of this FOA, and has the potential to advance the state of the art;
- Degree to which proposal describes understanding of NOAA's Numerical Weather Prediction (NWP) models and Weather Research and Forecasting (WRF) models used for wind forecasting and system operations, and atmospheric boundary layer physical processes;
- The degree to which the proposal describes the procedure for investigating physical processes, and developing and testing model-based physical packages;
- The degree to which the proposal describes procedures for public dissemination of intended or unintended discoveries as part of the application;
- The degree to which the proposed test region (nominally 800 by 800 kilometers in scale) is in the specified region of interest and suitability of that region to accommodate a network of meteorological sensors and equipment to achieve the stated FOA objectives.
- The degree to which the proposal demonstrates the ability to impact or improve wind forecasts in short term (0-15 hour) and, potentially day ahead time frames, for utility system operation; and
- Degree to which the proposal incorporates sound validation techniques and methodologies for model improvements.

Criterion 2: **Team and Resources** Weight: 30%

- The capability of the Principal Investigator(s) and the proposed team to successfully address all aspects of the proposal as well as qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed resources to support the work and identification/commitment of those resources including;
    - computational resources, time, and personnel;
    - utilization of the GFE identified in Table 1 for field deployment;
    - observational data sources, sensors and instruments beyond the identified GFE, including multiple measurements from tall towers (80+ meters) for field deployment and model improvement/development;
    - other necessary field instrumentation such as data acquisition systems, communication and data transmission equipment.
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the work plan, as well as their ability to work collaboratively to deploy observational equipment, establish data interfaces with project partners, monitor and maintain data integrity throughout the duration of the project , and share data and information relevant for the project's success; and
- Reasonableness of budget and spend plan for proposed project and objectives.

Criterion 3: **Project Management** Weight: 25%

- Degree to which the approach and critical path have been clearly described and thoughtfully considered;
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed work plan will succeed in improving wind forecasts in the time frames described in this FOA;
- The level of clarity in the definition of improvement project baseline, metrics and project milestones;
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and mid-point deliverables, such that meaningful progress will be made;
- Degree to which the approach describes the steps necessary to formally develop new WRF-based physical packages for public use;
- Degree to which the proposal describes appropriate distribution channels and procedures to ensure information dissemination amongst stakeholders;

- Quality and comprehensiveness of the Data Management Plan (per Appendix E) and Open Source Software Distribution Plan (Appendix D); and
- The extent to which the proposal demonstrates an understanding of the key risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

These factors will be considered and commented on by merit reviewers but not considered in the rating of technical/scientific merit (e.g. not point scored):

- The ability and willingness of the applicant to share SCADA data and load information during the period of performance.
- The inclusion of observation data from meteorological towers in the vicinity of existing wind plants.

3. Criteria for Replies to Reviewer Comments

EERE has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are attached to the original applications and evaluated as an extension of the Full Application.

B. Standards for Application Evaluation

Applications that are determined to be compliant will be evaluated in accordance with this FOA, by the standards set forth in EERE's Notice of Objective Merit Review Procedure (76 Fed. Reg. 17846, March 31, 2011) and the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance," which is available at: http://energy.gov/sites/prod/files/meritrev.pdf.

C. Other Selection Factors

1. Program Policy Factors

In addition to the above criteria, the Selection Official may consider the following program policy factors in determining which Applicants to encourage to submit Full Applications and which Full Applications to select for award negotiations:

- The degree to which the proposed project, including proposed cost shares, optimizes the use of available EERE funding to achieve programmatic objectives;
- The level of industry involvement and demonstrated ability to commercialize energy or related technologies;
- Technical, market, organizational, and environmental risks associated with the project;
- Whether the proposed project is likely to lead to increased employment and manufacturing in the United States;

- Whether the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty; and
- The degree to which the proposed project directly addresses EERE's statutory mission and strategic goals.

D. MERIT REVIEW AND SELECTION PROCESS

1. OVERVIEW

The Merit Review process consists of multiple phases that each includes an initial eligibility review and a thorough technical review. Rigorous technical reviews are conducted by reviewers that are experts in the subject matter of the FOA. Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as Program Policy Factors, in determining which applications to select.

2. PRE-SELECTION INTERVIEWS

As part of the merit review process, EERE may invite one or more of the top ranked applicants to participate in a final phase of the merit review evaluation process: Pre-Selection Interviews. Pre-Selection Interviews are distinct from and more formal than pre-selection clarifications (See Section V.D.3 of the FOA). The top ranked applicant(s) will meet with the Merit Review Panel to allow the Merit Review Panel to seek clarification on the contents of the Full Applications and otherwise ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

EERE will arrange to meet with the invited applicants in person at EERE's offices or a mutually agreed upon location. EERE may also arrange pre-selection site visits at certain Applicants' facilities. In the alternative, EERE may invite the top-ranked applicants to participate in a one-on-one conference with EERE via webinar, videoconference, or conference call.

EERE will not reimburse Applicants for travel and other expenses relating to the Pre-Selection Interviews, nor will these costs be eligible for reimbursement as pre-award costs.

EERE may obtain additional information through Oral Presentations and site visits that will be used to make a final selection determination. EERE may select applications for funding and make awards without Oral Presentations and site visits. Participation in Oral Presentations or site visits with EERE does not signify that Applicants have been selected for award negotiations.

3. PRE-SELECTION CLARIFICATION

EERE may determine that pre-selection clarifications are necessary from one or more applicants. These pre-selection clarifications will solely be for the purposes of clarifying the application, and will be limited to information already provided in the application

documentation. The pre-selection clarifications may occur before, during or after the merit review evaluation process. Information provided by an applicant that is not necessary to address the pre-selection clarification question will not be reviewed or considered. Typically, a pre-selection clarification will be carried out through either written responses to EERE's written clarification questions or video or conference calls with EERE representatives.
The information provided by Applicants to EERE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and EERE's selection decisions. If EERE contacts an applicant for pre-selection clarification purposes, it does not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

EERE will not reimburse applicants for expenses relating to the pre-selection clarifications, nor will these costs be eligible for reimbursement as pre-award costs.

4. SELECTION

The Selection Official may consider the merit review recommendation, program policy factors, and the amount of funds available in arriving at selections for this FOA.

VI. AWARD ADMINISTRATION INFORMATION

A. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

EERE anticipates notifying applicants selected for negotiation of award by the end of August 2014 and making awards by the end of October 2014.

B. AWARD NOTICES

1. REJECTED SUBMISSIONS

Noncompliant and nonresponsive Concept Papers and Full Applications are rejected by the Contracting Officer and are not reviewed or considered. The Contracting Officer sends a notification letter by email to the technical and administrative points of contact designated by the Applicant in EERE Exchange. The notification letter states the basis upon which the Concept Paper was discouraged or the Full Application was rejected.

2. CONCEPT PAPER NOTIFICATIONS

EERE notifies Applicants of its determination to encourage or discourage the submission of a Full Application. EERE sends a notification letter by email to the technical and administrative points of contact designated by the Applicant in EERE Exchange.

Applicants may submit a Full Application even if they receive a notification discouraging them from doing so. By discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. The purpose of the Concept Paper phase is to save Applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

A notification letter encouraging the submission of a Full Application does not authorize the Applicant to commence performance of the project. Please refer to Section IV.J.2 of the FOA for guidance on pre-award costs.

3. FULL APPLICATION NOTIFICATIONS

EERE notifies Applicants of its determination via a notification letter by email to the technical and administrative points of contact designated by the Applicant in EERE Exchange. The notification letter may inform the Applicant that its Full Application was selected for award negotiations, or not selected. Alternatively, EERE may notify one or more Applicants that a final selection determination on particular Full Applications will be made at a later date, subject to the availability of funds or other factors.

Written feedback on Full Applications is made available to Applicants before the submission deadline for Replies to Reviewer Comments. By providing feedback, EERE intends to guide the further development of the proposed technology and to provide a brief opportunity to respond to reviewer comments.

4. SUCCESSFUL APPLICANTS

A notification letter selecting a Full Application for award negotiations does not authorize the Applicant to commence performance of the project. If an application is selected for award negotiations, it is not a commitment to issue an award. Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement.

The award negotiation process will take approximately 60 days. Applicants must designate a primary and a backup point-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. The Applicant must be responsive during award negotiations (e.g., provide requested documentation) and meet the negotiation deadlines. If the Applicant fails to do so or negotiations are otherwise unsuccessful, EERE will cancel award negotiations and rescind the Selection. EERE reserves the right to terminate award negotiations at any time for any reason.

Please refer to Section IV.I.2 of the FOA for guidance on pre-award costs.

5. *POSTPONED SELECTION DETERMINATIONS*

A notification letter postponing a final selection determination until a later date does not authorize the Applicant to commence performance of the project. EERE may ultimately determine to select or not select the Full Application for award negotiations.

6. *UNSUCCESSFUL APPLICANTS*

EERE shall promptly notify in writing each applicant whose application has not been selected for award or whose application cannot be funded because of the unavailability of appropriated funds. If the application was not selected, the written notice shall explain why the application was not selected.

C. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

1. *REGISTRATION REQUIREMENTS*

There are several one-time actions before submitting an Application in response to this Funding Opportunity Announcement (FOA), and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected. These requirements are as follows:

i. EERE Exchange

Register and create an account on EERE Exchange at https://eere-Exchange.energy.gov. This account will then allow the user to register for any open EERE FOAs that are currently in EERE Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission. Applicants should also designate backup points of contact so applicants may be easily contacted if deemed necessary. **This step is required to apply to this FOA.**

The EERE Exchange registration does not have a delay; however, **the remaining registration requirements below could take several weeks to process and are necessary for a potential applicant to receive an award under this FOA**. Therefore, although not required in order to submit an Application through the EERE Exchange site, all potential applicants lacking a DUNS number, or not yet registered with SAM or FedConnect should complete those registrations as soon as possible.

ii. DUNS Number

Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number (including the plus 4 extension, if applicable) at http://fedgov.dnb.com/webform.

iii. System for Award Management

Register with the System for Award Management (SAM) at https://www.sam.gov. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in SAM registration. Please update your SAM registration annually.

iv. Fedconnect

Register in FedConnect at https://www.fedconnect.net/. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/PublicPages/FedConnect_Ready_Set_Go.pdf.

v. Grants.gov

Register in Grants.gov (http://www.grants.gov) to receive automatic updates when Amendments to this FOA are posted. However, please note that Concept Papers, and Full Applications will not be accepted through Grants.gov.

vi. Electronic Authorization of Applications and Award Documents

Submission of an application and supplemental information under this FOA through electronic systems used by the Department of Energy, including EERE Exchange and fedconnect.net, constitutes the authorized representative's approval and electronic signature.

2. AWARD ADMINISTRATIVE REQUIREMENTS

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR 600. Grants and cooperative agreements made to universities, non-profits, and other entities subject to 10 CFR 600 are subject to the Research Terms and Conditions located on the National Science Foundation website at: http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp.

3. LIMITATIONS ON COMPENSATION COSTS

The annual compensation costs (total amount of wages, salary, bonuses and deferred compensation) for an individual allowable for an award under this FOA are capped at $250,000 (i.e. $250,000 is the maximum amount that EERE will reimburse a Recipient for any one individual's annual compensation and EERE will not recognize such costs above $250,000 as Recipient cost share).

This limitation does not restrict the Recipient or its subrecipients from providing annual compensation to an individual that exceeds $250,000. However, any amount above $250,000 cannot be included in the total project costs (i.e., Federal share or recipient cost share).

4. *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. Prime Recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier Subrecipients. Prime Recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

5. *National Policy Requirements*

The National Policy Assurances that are incorporated as a term and condition of award are located at: http://energy.gov/management/downloads/national-policy-assurances-be-incorporated-award-terms.

6. *Environmental Review in Accordance with National Environmental Policy Act (NEPA)*

EERE's decision whether and how to distribute federal funds under this FOA is subject to the National Environmental Policy Act (42 USC 4321, *et seq.*). NEPA requires Federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, at http://nepa.energy.gov/.

While NEPA compliance is a Federal agency responsibility and the ultimate decisions remain with the federal agency, all Recipients selected for an award will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project.

7. *Applicant Representations and Certifications*

i. Lobbying Restrictions

By accepting funds under this award, the Recipient agrees 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.

8. *Statement of Federal Stewardship*

EERE will exercise normal Federal stewardship in overseeing the project activities performed under EERE Awards. Stewardship Activities include, but are not limited to, conducting site visits; reviewing performance and financial reports, providing assistance and/or temporary intervention in usual circumstances to correct deficiencies that develop during the project;

assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

9. STATEMENT OF SUBSTANTIAL INVOLVEMENT

There will be a substantial involvement between EERE and the Prime Recipient during the performance of a resultant cooperative agreement. The EERE Technology Office goals and objectives addressed by the project are of such importance that shared responsibility for the management, control, direction and performance of the project is needed to ensure goals and objectives are met. EERE has the right to intervene in the conduct or performance of project activities for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities. EERE does not limit its involvement to the administrative requirements of this Award. Instead, EERE has substantial involvement in the direction and redirection of the technical aspects of the project as a whole. Substantial involvement includes, but is not limited to the following:

1. EERE shares responsibility with the Prime Recipient for the management, control, direction, and performance of work under this award.
2. EERE reviews and approves in a timely manner project plans, including project management, testing and technology transfer plans, and recommending alternate approaches, if the plans do not address the critical programmatic issues.
3. EERE participates in project management planning activities, including risk analysis, to ensure EERE Technology Office requirements or limitations are considered in performance of the work elements.
4. EERE may intervene in the conduct or performance of work under this Award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.
5. EERE promotes and facilitates technology transfer activities, including disseminating Technology Office results through presentations and publications.
6. EERE may redirect or discontinue funding projects that fail to fully and satisfactorily complete the work described in the Statement of Project Objectives as evaluated at the Go/No Go decision points.
7. EERE participates in major project decision-making processes.

10. INTELLECTUAL PROPERTY MANAGEMENT PLAN

Within 30 days of selection, Applicants must submit an executed IP Management Plan between the members of the consortia or team.

The award will set forth the treatment of and obligations related to intellectual property rights between EERE and the individual members. The IP Management Plan should describe how the members will handle intellectual property rights and issues between themselves while ensuring compliance with Federal IP laws, regulations, and policies (see Sections VIII.L-VIII.O of this FOA for more details on applicable Federal IP laws and regulations).

The following is a non-exhaustive list of examples of items that the IP Management Plan may cover:

- The treatment of confidential information between members (e.g., the use of non-disclosure agreements);
- The treatment of background IP (e.g., any requirements for identifying it or making it available);
- The treatment of inventions made under the project (e.g., any requirements for disclosing to the other members, filing patent applications, paying for patent prosecution, and cross-licensing or other licensing arrangements between the members);
- The treatment of data produced, including software, under the project (e.g., any publication process or other dissemination strategies, copyrighting strategy or arrangement between members);
- Any technology transfer and commercialization requirements or arrangements between the members;
- The treatment of any intellectual property issues that may arise due to a change in membership of the consortia or team; and
- The handling of disputes related to intellectual property between the members.

11. Subject Invention Utilization Reporting

To ensure that Prime Recipients and Subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE requires that each Recipient holding title to a subject invention submit annual reports for 10 years from the date the subject invention was disclosed to EERE on the utilization of the subject invention and efforts made by Recipient or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Prime Recipient, and such other data and information as EERE may specify.

12. 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.

13. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The checklist can be accessed at http://energy.gov/sites/prod/files/2013/05/f0/Attch_FA_RepReqChecklist_COMBINED_FINAL_4-23-13%20%283%29_0.pdf

14. Go/No-Go Review and Stage-Gate Review

Each project selected under this FOA will be subject to a period project evaluation referred to as a Go/No-Go or Stage Gate Review. Federal funding beyond the Go/No Go or Stage Gate decision point (continuation funding), is contingent, in part[3], on the outcome of the Go/No Go or Stage Gate Review.

As a result of the Go/No Go or Stage Gate Reviews, DOE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

- **Go/No-Go Decision Points**: Go/No-Go decision points are similar to project milestones, in that EERE staff will review the project based on pre-established metrics defined in the award negotiations process following selection.

- **Stage-Gate Reviews**: Stage-Gate reviews are very similar to Go/No-Go decision points, except that EERE will bring in third parties to assist with validation of project progress. These third parties are typically specialized subject matter experts that will allow EERE to evaluate crucial aspects of project performance with a greater degree of specificity and scrutiny.

VII. QUESTIONS/AGENCY CONTACTS

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with Applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted to: WFIPFOA984@go.doe.gov not later than 3 business days prior to the application due date.

All questions and answers related to this FOA will be posted on EERE Exchange at: https://eere-exchange.energy.gov. **Please note that you must first select this specific FOA Number in order**

[3] Continuation funding is contingent on (1) the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) meeting the objectives, milestones, deliverables, decision point criteria, and stage gates of Recipient's approved project and obtaining approval from EERE to continue work on the project; (3) submittal of required reports; and/or (4) compliance with the terms and conditions of the award.

to view the questions and answers specific to this FOA. EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website.

Questions related to the registration process and use of the EERE Exchange website should be submitted to: EERE-ExchangeSupport@hq.doe.gov.

VIII. OTHER INFORMATION

A. FOA MODIFICATIONS

Amendments to this FOA will be posted on the EERE Exchange website and the Grants.gov system. However, you will only receive an email when an amendment or a FOA is posted on these sites if you register for email notifications for this FOA in Grants.gov. EERE recommends that you register as soon after the release of the FOA as possible to ensure you receive timely notice of any amendments or other FOAs.

B. INFORMATIONAL WEBINARS

EERE will conduct one informational webinars during the FOA process. It will be held after the initial FOA release but before the due date for Concept Papers.

The purpose of these webinar is to give applicants a chance to ask questions about the FOA process generally. Attendance is not mandatory and will not positively or negatively impact the overall review of any Applicant submissions. As the webinar will be open to all Applicants who wish to participate, Applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project. Specific dates for the webinar can be found on the cover page of the FOA.

C. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

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

D. 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 anyone other than the Contracting Officer, either expressed or implied, is invalid.

E. TREATMENT OF APPLICATION INFORMATION

In general, EERE will use data and other information contained in applications for evaluation purposes only unless such information is generally available to the public or is already the property of the Government.

Applicants should not include trade secrets or commercial or financial information that is privileged or confidential in their application unless such information is necessary to convey an understanding of the proposed project or to comply with a requirement in the FOA. Applications containing trade secrets or commercial or financial information that is privileged or confidential, which the applicant does not want disclosed to the public or used by the Government for any purpose other than application evaluation, must be marked as described in this section.

The cover sheet of the application must be marked as follows and identify the specific pages containing trade secrets or commercial or financial information that is privileged or confidential:

> Notice of Restriction on Disclosure and Use of Data:
> Pages [list applicable pages] of this document may contain trade secrets or commercial or financial information that is privileged or confidential, and is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.
> [End of Notice]

The header and footer of every page that contains trade secrets or commercial or financial information that is privileged or must be marked as follows: “May contain trade secrets or commercial or financial information that is privileged or confidential and exempt from public disclosure.”

In addition, each line or paragraph containing trade secrets or commercial or financial information that is privileged or confidential must be enclosed in brackets.

The above markings enable EERE to follow the provisions of 10 CFR 1004.11(d) in the event a Freedom of Information Act (FOIA) request is received for information submitted with an application. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under a FOIA request or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

Subject to the specific FOIA exemptions identified in 5 U.S.C. 552(b), all information submitted to EERE by a FOA applicant is subject to public release under the Freedom of Information Act, 5 U.S.C. §552, as amended by the OPEN Government Act of 2007, Pub. L. No. 110-175. It is the applicant's responsibility to review FOIA and its exemptions to understand (1) what information may be subject to public disclosure and (2) what information applicants submit to the Government that are protected by law. In some cases, DOE may be unable to make an independent determination regarding which information submitted by an applicant is releasable and which is protected by an exemption. In such cases, DOE will consult with the applicant, in accordance with 10 C.F.R. §1004.11, to solicit the applicant's views on how the information should be treated.

F. 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.

G. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this Technology Office 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.

H. Notice of Right to Conduct a Review of Financial Capability

EERE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

I. Notice of Potential Disclosure Under Freedom of Information Act

Applicants should be advised that identifying information regarding all applicants, including applicant names and/or points of contact, may be subject to public disclosure under the Freedom of Information Act, whether or not such applicants are selected for negotiation of award.

J. REQUIREMENT FOR FULL AND COMPLETE DISCLOSURE

Applicants are required to make a full and complete disclosure of all information requested. Any failure to make a full and complete disclosure of the requested information may result in:

- The rejection of a Concept Paper, Full Application, and/or Reply to Reviewer Comments;
- The termination of award negotiations;
- The modification, suspension, and/or termination of a funding agreement;
- The initiation of debarment proceedings, debarment, and/or a declaration of ineligibility for receipt of Federal contracts, subcontracts, and financial assistance and benefits; and
- Civil and/or criminal penalties.

K. RETENTION OF SUBMISSIONS

EERE expects to retain copies of all Letters of Intent, Concept Papers, Full Applications, Replies to Reviewer Comments, and other submissions. No submissions will be returned. By applying to EERE for funding, Applicants consent to EERE's retention of their submissions.

L. TITLE TO SUBJECT INVENTIONS

Ownership of subject inventions is governed pursuant to the authorities listed below.

- Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions.
- All other parties: The Federal Non Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the Government obtains title to new inventions unless a waiver is granted (see below).
- Class Patent Waiver: DOE has issued a class waiver that applies to this FOA. Under this class waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

- Advance and Identified Waivers: Applicants may request a patent waiver that will cover subject inventions that may be invented under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to EERE within the timeframes set forth in the award's intellectual property terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.
- Determination of Exceptional Circumstances (DEC): Each applicant is required to submit a U.S. Manufacturing Plan as part of its application. If selected, the U.S. Manufacturing Plan shall be incorporated into the award terms and conditions. DOE has determined that exceptional circumstances exist that warrants the modification of the standard patent rights clause for small businesses and non-profit awardees under Bayh-Dole to the extent necessary to implement and enforce the U.S. Manufacturing Plan. For example, the commitments and enforcement of a U.S. Manufacturing Plan may be tied to subject inventions. Any Bayh-Dole entity (domestic small business or nonprofit organization) affected by this DEC has the right to appeal it.

M. GOVERNMENT RIGHTS IN SUBJECT INVENTIONS

Where Recipients and Subrecipients retain title to subject inventions, the U.S. Government retains certain rights.

1. GOVERNMENT USE LICENSE

The U.S. Government retains a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world. This license extends to contractors doing work on behalf of the Government.

2. MARCH-IN RIGHTS

The U.S. Government retains march-in rights with respect to all subject inventions. Through "march-in rights," the Government may require a Prime Recipient or Subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a license for use of the invention to a third party. In addition, the Government may grant licenses for use of the subject invention when a Prime Recipient, Subrecipient, or their assignees and exclusive licensees refuse to do so.

DOE may exercise its march-in rights only if it determines that such action is necessary under any of the four following conditions:

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;

- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;

- The owner has not met public use requirements specified by Federal statutes in a reasonably satisfied manner; or

- The U.S. Manufacturing requirement has not been met.

- Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision. To date, DOE has never exercised its march-in rights to any subject inventions.

N. RIGHTS IN TECHNICAL DATA

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

"Limited Rights Data": The U.S. Government will not normally require delivery of confidential or trade secret-type technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.

Government Rights in Technical Data Produced Under Awards: The U.S. Government retains unlimited rights in technical data produced under Government financial assistance awards, including the right to distribute to the public. One exception to the foregoing is that invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

O. COPYRIGHT

The Prime Recipient and Subrecipients may assert copyright in copyrightable data, such as software, first produced under the award without EERE approval. When copyright is asserted, the Government retains a paid-up nonexclusive, irrevocable worldwide license to reproduce, prepare derivative works, distribute copies to the public, and to perform publicly and display publicly the copyrighted work. This license extends to contractors and others doing work on behalf of the Government.

P. PROTECTED PERSONALLY IDENTIFIABLE INFORMATION

In responding to this FOA, Applicants must ensure that Protected Personally Identifiable Information (PII) is not included in the following documents: Project Abstract, Project Narrative, Biographical Sketches, Budget or Budget Justification. These documents will be used by the

Merit Review Committee in the review process to evaluate each application. PII is defined by the Office of Management and Budget (OMB) and EERE as:

Any information about an individual maintained by an agency, including but not limited to, education, financial transactions, medical history, and criminal or employment history and information that can be used to distinguish or trace an individual's identity, such as their name, social security number, date and place of birth, mother's maiden name, biometric records, etc., including any other personal information that is linked or linkable to an individual.

This definition of PII can be further defined as: (1) Public PII and (2) Protected PII.

Public PII: PII found in public sources such as telephone books, public websites, business cards, university listing, etc. Public PII includes first and last name, address, work telephone number, email address, home telephone number, and general education credentials.

Protected PII: PII that requires enhanced protection. This information includes data that if compromised could cause harm to an individual such as identity theft.

Listed below are examples of Protected PII that Applicants must not include in the files listed above to be evaluated by the Merit Review Committee.

- Social Security Numbers in any form
- Place of Birth associated with an individual
- Date of Birth associated with an individual
- Mother's maiden name associated with an individual
- Biometric record associated with an individual
- Fingerprint
- Iris scan
- DNA
- Medical history information associated with an individual
- Medical conditions, including history of disease
- Metric information, e.g. weight, height, blood pressure
- Criminal history associated with an individual
- Employment history and other employment information associated with an individual
- Ratings
- Disciplinary actions
- Performance elements and standards (or work expectations) are PII when they are so intertwined with performance appraisals that their disclosure would reveal an individual's performance appraisal
- Financial information associated with an individual
- Credit card numbers
- Bank account numbers
- Security clearance history or related information (not including actual clearances held)

Listed below are examples of Public PII that Applicants may include in the files listed above to be evaluated by the Merit Review Committee:

- Phone numbers (work, home, cell)
- Street addresses (work and personal)
- Email addresses (work and personal)
- Digital pictures
- Medical information included in a health or safety report
- Employment information that is not PII even when associated with a name
- Resumes, unless they include a Social Security Number
- Present and past position titles and occupational series
- Present and past grades
- Present and past annual salary rates (including performance awards or bonuses, incentive awards, merit pay amount, Meritorious or Distinguished Executive Ranks, and allowances and differentials)
- Present and past duty stations and organization of assignment (includes room and phone numbers, organization designations, work email address, or other identifying information regarding buildings, room numbers, or places of employment)
- Position descriptions, identification of job elements, and those performance standards (but not actual performance appraisals) that the release of which would not interfere with law enforcement programs or severely inhibit agency effectiveness
- Security clearances held
- Written biographies (e.g. to be used in a Technology Office describing a speaker)
- Academic credentials
- Schools attended
- Major or area of study
- Personal information stored by individuals about themselves on their assigned workstation or laptop unless it contains a Social Security Number

Q. ANNUAL COMPLIANCE AUDITS

If a for-profit entity is a Prime Recipient and has expended greater than $500K of Federal funds in a respective fiscal year, an annual compliance audit performed by an independent auditor may be required. For additional information, please refer to 10 C.F.R. § 600.316 and for-profit audit guidance documents posted under the "Coverage of Independent Audits" heading at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms.

If an educational institution, non-profit organization, or state/local government is a Prime Recipient or Subrecipient and has expended greater than $500K of Federal funds in a respective fiscal year, then an A-133 audit is required. For additional information, please refer to OMB Circular A-133 through the link below.

http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a133/a133.pdf.

Applicants and sub-recipients (if applicable) should propose sufficient costs in the project budget to cover the costs associated with the audit. EERE will share in the cost of the audit at its applicable cost share ratio.

APPENDIX A – GENERAL DEFINITIONS

"**Applicant**" means the legal entity or individual signing the Application. This entity or individual may be one organization or a single entity representing a group of organizations (such as a Consortium) that has chosen to submit a single Application in response to a FOA.

"**Application**" means the documentation submitted in response to a FOA.

"**Authorized Organization Representative (AOR)**" is the person with assigned privileges who is authorized to submit grant applications through Grants.gov on behalf of an organization. The privileges are assigned by the organization's E-Business Point of Contact designated in the SAM.

"**Award**" means the written documentation executed by a Contracting Officer, after an Applicant is selected, which contains the negotiated terms and conditions for providing Financial Assistance to the Applicant. A Financial Assistance Award may be a Grant, Cooperative Agreement, or Technology Investment Agreement.

"**Budget**" means the cost expenditure plan submitted in the Application, including both the EERE contribution and the Applicant Cost Share.

"**Compliance**" is an eligibility determination that refers to the non-technical requirements outlined in a FOA (e.g., formatting, timeliness of submission, or satisfaction of prerequisites).

"**Consortium (plural consortia)**" means the group of organizations or individuals that have chosen to submit a single Application in response to a FOA.

"**Contracting Officer**" means the EERE official authorized to execute Awards on behalf of EERE and who is responsible for the business management and non-Technology Office aspects of the Financial Assistance process.

"**Cooperative Agreement**" means a Financial Assistance instrument used by EERE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and Substantial Involvement (see definition below) is anticipated between EERE and the Applicant during the performance of the contemplated activity. Refer to 10 CFR 600.5 for additional information regarding cooperative agreements.

"**Cost Sharing**" means that portion of the project or program's costs not borne by the Federal Government. The percentage of Applicant Cost Share is to be applied to the Total Project Cost (i.e., the sum of Applicant plus EERE Cost Shares) rather than to the EERE contribution alone. Cost sharing information can be found in the Code of Federal Regulations at 10 CFR 600.123 (non-profit and university), 600.224 (State and Local Governments), and 600.313 (for profit entities).

"**Data Universal Numbering System (DUNS) Number**" is a unique nine-character identification number issued by Dun and Bradstreet (D&B). Organizations must have a DUNS number prior to registering in the SAM. Call 1-866-705-5711 to receive one free of charge.

"**E-Business Point of Contact (POC)**" is the individual who is designated as the Electronic Business Point of Contact in the SAM registration. This person is the sole authority of the organization with the capability of designating or revoking an individual's ability to conduct SAM transactions.

"**E-Find**" is a Grants.gov webpage where you can search for Federal Funding Opportunities in FedGrants. It can be found at http://ww.grants.gov/search/searchHome.do.

"**EERE Exchange**" is the Department of Energy, Energy Efficiency and Renewable Energy's web system for posting Federal FOAs and receiving applications.
EERE Exchange website

"**Financial Assistance**" means the transfer of money or property to an Applicant or Participant to accomplish a public purpose of support authorized by Federal statute through Grants or Cooperative Agreements and sub-awards. For EERE, it does not include direct loans, loan guarantees, price guarantees, purchase agreements, Cooperative Research and Development Agreements (CRADAs), or any other type of financial incentive instrument.

"**FedConnect**" is where federal agencies make awards via the web. It can be found at https://www.fedconnect.net/FedConnect/.

"**Federally Funded Research and Development Center (FFRDC)**" means a government-sponsored operation that exists for the purpose of carrying out various functions related to both basic and applied research and development on behalf of the Government. Typically, most or all of the facilities utilized in an FFRDC are owned by the Government, but the operations are not always managed by the Government; an FFRDC may be managed by a University or consortium of Universities, other not-for-profit or nonprofit organization, or a for-profit organization, with the Government performing an oversight function.

"**Funding Opportunity Announcement (FOA)**" is a publicly available document by which a Federal agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. FOAs may be known as FOAs, notices of funding availability, solicitations, or other names depending on the agency and type of program. See 10 CFR 600.8 for more information.

"**Grants.gov**" is the "storefront" web portal which allows organizations to electronically find grant opportunities from all Federal grant-making agencies. Grants.gov is THE single access point for over 900 grant programs offered by the 26 Federal grant-making agencies. It can be accessed at http://www.grants.gov.

"**Indian Tribe**" means any Indian tribe, band, nation, or other organized group or community, including Alaska Native village or regional or village corporation, as defined in or established pursuant to the Alaska Native Claims Settlement Act (85 Stat. 688)[43 U.S.C. § 1601 et seq.], which are recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

"**Key Personnel**" mean the individuals who will have significant roles in planning and implementing the proposed Project on the part of the Applicant and Participants, including FFRDCs.

"**Marketing Partner Identification Number (MPIN)**" is a very important password designated by your organization when registering in SAM. The E-Business Point of Contact will need the MPIN to assign privileges to the individual(s) authorized to perform SAM transactions on behalf of your organization. The MPIN must have 9 digits containing at least one alpha character (must be in capital letters) and one number (no spaces or special characters permitted).

"**Modification**" means a revision to a FOA.

"**Participant**" for purposes of this FOA only, means any entity, except the Applicant substantially involved in a Consortium, or other business arrangement (including all parties to the Application at any tier), responding to the FOA.

"**Principal Investigator**" refers to the technical point of contact/Project Manager for a specific project award.

"**Project**" means the set of activities described in an Application, State plan, or other document that is approved by EERE for Financial Assistance (whether such Financial Assistance represents all or only a portion of the support necessary to carry out those activities).

"**Project Team**" means the team which consists of the Prime Recipient, Subrecipients, and others performing or otherwise supporting work under an EERE funding agreement.

"**Proposal**" is the term used to describe the documentation submitted in response to a FOA. Also see Application.

"**Prime Recipient**" means the organization, individual, or other entity that receives a Financial Assistance Award from EERE (i.e., is the signatory on the award), is financially accountable for the use of any EERE funds or property provided for the performance of the Project, and is legally responsible for carrying out the terms and condition of the award.

"**Responsiveness**" is an eligibility determination that refers to the objective technical requirements (not goals or targets) outlined in a FOA, such as a technology type or technical parameters. For example, submission of a photovoltaic solar panel design in response to a FOA calling for innovative geothermal drilling technologies should be found nonresponsive.

Likewise, an application with a design that incorporates rare earth materials to a FOA that prohibits the use of rare earth materials should be found nonresponsive. Conversely, the belief that a technology will not achieve the technical targets of the FOA will never be used as a proper basis for a rejection as nonresponsive.

"**System for Award Management (SAM)**" is the primary database which collects, validates, stores and disseminates data in support of agency missions. It can be accessed at https://www.sam.gov.

"**Selection**" means the determination by the EERE Selection Official that negotiations take place for certain Projects with the intent of awarding a Financial Assistance instrument.

"**Selection Official**" means the EERE official designated to select Applications for negotiation toward Award under a subject FOA.

"**Substantial Involvement**" means involvement on the part of the Government. EERE's involvement may include shared responsibility for the performance of the Project; providing technical assistance or guidance which the Applicant is to follow; and the right to intervene in the conduct or performance of the Project. Such involvement will be negotiated with each Applicant prior to signing any agreement.

"**Total Project Cost**" means all the funds to complete the effort proposed by the Applicant, including EERE funds (including direct funding of any FFRDC) plus all other funds that will be committed by the Applicant as Cost Sharing.

"**Tribal Energy Resource Development Organization or Group**" means an "organization" of two or more entities, at least one of which is an Indian Tribe (see "Indian Tribe" above) that has the written consent of the governing bodies of all Indian Tribes participating in the organization to apply for a grant or loan, or other assistance under 25 U.S.C. § 3503.

APPENDIX B – FOA SPECIFIC DEFINITIONS

"Balancing Authority (BA)" is the responsible entity that integrates resource plans ahead of time, maintains load-interchange-generation balance within a BA area, and supports interconnection frequency in real-time.

"Foundational Forecasting model" is an operational larger-scale weather forecast model. This model is the foundation from which other models are run (i.e. wind plant scale models from private companies utilize the foundational forecast model as input).

"High-Resolution Rapid Refresh (HRRR) model" is the core forecast model for the proposed Project that runs in rapid refresh mode through re-initializing a new set of runs every hour at 3-km horizontal resolution over the Contiguous United States (CONUS) in a research mode by NOAA/ESRL. (Note: NOAA/NWS plans to implement a version of the HRRR model into NCEP operations in 2014, but ESRL will continue to run advanced experimental versions of the HRRR and RAP model/assimilation systems toward subsequent improvement of NCEP operational versions.)

"NAM Rapid Refresh (NAMRR)" is an experimental forecast model for the proposed project that runs in rapid refresh mode through performing an analysis and subsequent forecast at hourly intervals with both the 12-km North American domain as well as a 3-km nest domain, which covers the contiguous United States. Each hour, forecasts go out to 18 hours, and at 00, 06, 12, and 18 UTC forecasts are extended to 36-84 hours, depending on the desired configuration.

"Numerical Weather Prediction (NWP)" is a computer forecast or prediction based on equations governing the motions and the forces affecting motion of fluids. The equations are based, or initialized, on specified weather or climate conditions at a certain place and time.

"Rapid Refresh (RAP) model" is a second key NOAA forecast model for the proposed Project that runs in rapid refresh mode through re-initializing a new set of runs every hour at 13-km horizontal resolution over North America in an operational mode by NOAA/NWS/NCEP and in an advanced research mode by NOAA/ESRL. (Note: ESRL will continue to run advanced experimental versions of the RAP and HRRR model/assimilation systems toward subsequent improvement of the NCEP operational version.)

"Wind Forecasting Improvement Project (WFIP)" is the previous project funded by DOE to improve forecasting of short-term wind forecasts. It consisted of saturating two regions of relatively flat terrain with additional atmospheric observations upstream from existing wind plants to research the effect these observations had on predicting wind speed and direction 0 to 6 hours ahead of a wind farm.

"Weather Research and Forecasting (WRF) model" is a next-generation mesoscale numerical weather prediction system designed to serve both atmospheric research and operational forecasting needs (http://wrf-model.org). It features two dynamical cores, a data assimilation system, and a software architecture allowing for parallel computation and system extensibility. The model serves a wide range of meteorological applications across scales ranging from meters to thousands of kilometers.

APPENDIX C-1 – COST SHARE INFORMATION

Cost Sharing or Cost Matching

The terms "cost sharing" and "cost matching" are often used synonymously. Even the DOE Financial Assistance Regulations, 10 CFR Part 600, use both of the terms in the titles specific to regulations applicable to cost sharing. EERE almost always uses the term "cost sharing," as it conveys the concept that non-federal share is calculated as a percentage of the Total Project Cost. An exception is the State Energy Program Regulation, 10 CFR 420.12, State Matching Contribution. Here "cost matching" for the non-federal share is calculated as a percentage of the Federal funds only, rather than the Total Project Cost.

How Cost Sharing Is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. Following is an example of how to calculate cost sharing amounts for a project with $1,000,000 in federal funds with a minimum 20% non-federal cost sharing requirement:

- Formula: Federal share ($) divided by Federal share (%) = Total Project Cost
  Example: $1,000,000 divided by 80% = $1,250,000

- Formula: Total Project Cost ($) minus Federal share ($) = Non-federal share ($)
  Example: $1,250,000 minus $1,000,000 = $250,000

- Formula: Non-federal share ($) divided by Total Project Cost ($) = Non-federal share (%)
  Example: $250,000 divided by $1,250,000 = 20%

See the sample cost share calculation for a blended cost share percentage below. Keep in mind that FFRDC funding is DOE funding.

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under an EERE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

- Institutions of Higher Education, Hospitals, and Other Nonprofit Organizations are found at 10 CFR 600.123;
- State and Local Governments are found at 10 CFR 600.224;
- For-profit Organizations are found at 10 CFR 600.313.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, EERE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, EERE generally does not allow pre-award costs prior to the signing of the Selection Statement by the EERE Selection Official.

Following is a link to the DOE Financial Assistance Regulations. You can click on the specific section for each Code of Federal Regulations reference mentioned above.

DOE Financial Assistance Rules (10 CFR 600)

As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

(A) Acceptable contributions. All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the Prime Recipient's cost sharing if such contributions meet all of the following criteria:

(1) They are verifiable from the recipient's records.

(2) They are not included as contributions for any other federally-assisted project or program.

(3) They are necessary and reasonable for proper and efficient accomplishment of project or program objectives.

(4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:

a. For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the Federal Acquisition Regulation, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations

b. Other types of organizations. Allowability of costs incurred by other types of organizations that may be Subrecipients under a prime award is determined as follows:

i. Institutions of higher education. Allowability is determined in accordance with: 2 CFR 220 Cost Principles for Educational Institutions

ii. Other nonprofit organizations. Allowability is determined in accordance with: 2 CFR 230 Cost Principles for Nonprofit Organizations

iii. Hospitals. Allowability is determined in accordance with the provisions of: Title 45 Appendix E to Part 74—Principles for Determining Costs Applicable to Research and Development Under Grants and Contracts With Hospitals

iv. Governmental organizations. Allowability for State, local, or federally recognized Indian tribal government is determined in accordance with: PART 225—Cost Principles for State, Local, and Indian Tribal Governments (OMB Circular A–87)

(5) They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.

(6) They are provided for in the approved budget.

(B) Valuing and documenting contributions

- Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
b. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.

- Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.

- Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

- Valuing property donated by third parties.

  a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.

  b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

     i. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.

     ii. The value of loaned equipment must not exceed its fair rental value.

- Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:

  a. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

  b. The basis for determining the valuation for personal services and property must be documented.

APPENDIX C-2 – SAMPLE COST SHARE CALCULATION FOR BLENDED COST SHARE PERCENTAGE

The following example shows the math for calculating required cost share for a project with $2,000,000 in Federal funds with four tasks requiring different Non-federal cost share percentages:

Task	Proposed Federal Share	Federal Share %	Recipient Share %
Task 1 (R&D)	$1,000,000	80%	20%
Task 2 (R&D)	$500,000	80%	20%
Task 3 (Demonstration)	$400,000	50%	50%
Task 4 (Outreach)	$100,00	100%	0%

Federal share ($) divided by Federal share (%) = Task Cost

Each task must be calculated individually as follows:

Task 1
$1,000,000 divided by 80% = $1,250,000 (Task 1 Cost)
Task 1 Cost minus federal share = Non-federal share
$1,250,000 - $1,000,000 = $250,000 (Non-federal share)

Task 2
$500,000 divided 80% = $625,000 (Task 2 Cost)
Task 2 Cost minus federal share = Non-federal share
$625,000 - $500,000 = $125,000 (Non-federal share)

Task 3
$400,000 / 50% = $800,000 (Task 3 Cost)
Task 3 Cost minus federal share = Non-federal share
$800,000 - $400,000 = $400,000 (Non-federal share)

Task 4
Federal share = $100,000
Non-federal cost share is not mandated for outreach = $0 (Non-federal share)

The calculation may then be completed as follows:

Tasks	$ Federal Share	% Federal Share	$ Non-Federal Share	% Non-Federal Share	Total Project Cost
Task 1	$1,000,000	80%	$250,000	20%	$1,250,000
Task 2	$500,000	80%	$125,000	20%	$625,000
Task 3	$400,000	50%	$400,000	50%	$800,000
Task 4	$100,000	100%	$0	0%	$100,000
Totals	$2,000,000		$775,000		$2,775,000

Blended Cost Share %
Non-federal share ($775,000) divided by Total Project Cost ($2,775,000) = 27.9% (Non-federal)
Federal share ($2,000,000) divided by Total Project Cost ($2,775,000) = 72.1% (Federal)

APPENDIX D – OPEN SOURCE SOFTWARE

Open Source Software Distribution Plan

Applicants that are applying to this FOA for which open source software distribution is required must submit a plan describing how software produced under this FOA will be distributed. For a DOE National Laboratory or a FFRDC, the data rights clause, including rights and requirements pertaining to computer software, in its Management and Operating (M&O) Contract shall apply and shall take precedence over any requirement set forth in this Appendix. The plan must include the following elements:

1. A complete description of any existing software that will be modified or incorporated into software produced under this FOA, including a description of the license rights. The license rights must allow the modified or incorporated software to be distributed as open source.

2. A discussion of the open source license that the Applicant plans to use for the software it plans to produce under the FOA, and how that choice furthers the goals of this FOA. The discussion must also address how the license conforms to the conditions listed below.

3. A method for depositing the software in a source code repository.

4. A method for sharing and disseminating the software and other information to team members or others when multiple parties will contribute to the development of the software or the FOA requires that the software or other information be shared or disseminated to others.

Open Source Definition: Open source licenses must conform to all of the following conditions:

Free Redistribution
The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale. The rights attached to the software must apply to all to whom the software is redistributed without the need for execution of an additional license by those parties.

Source Code
The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, e.g., downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program.

Deliberately obfuscated source code and intermediate forms such as the output of a preprocessor or translator are not allowed.

Derived Works
The license must allow modifications and derived works, and permit the option of distributing the modifications and derived works under the same terms as the license of the original software.

Integrity of the Author's Source Code
The license may restrict source-code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

No Restriction Against Fields of Endeavor
The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

License Must Not Be Specific to a Product or Technology
The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution. No provision of the license may be predicated on any individual technology or style of interface.

License Must Not Restrict Other Software
The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.

Examples of Acceptable Licenses
Apache License, 2.0
http://www.apache.org/licenses

The 2.0 version of the Apache License was approved by the Apache Software Foundation in 2004. The goals of this license revision were to reduce the number of frequently asked questions, to allow the license to be reusable without modification by any project (including non-ASF projects), to allow the license to be included by reference instead of listed in every file, to clarify the license on submission of contributions, to require a patent license on contributions that necessarily infringe the contributor's own patents, and to move comments regarding Apache and other inherited attribution notices to a location outside the license terms

The result is a license that is compatible with other open source licenses, while remaining true to and supportive of collaborative development across both nonprofit and commercial organizations.

All packages produced by the ASF are implicitly licensed under the Apache License, Version 2.0, unless otherwise explicitly stated.

GNU General or Public License (GPLv3)
http://www.gnu.org/licenses/gpl.html

The GNU General Public License (GNU GPL or simply GPL) is the most widely used free software license, originally written by Richard Stallman for the GNU Project.

The GPL is the first copyleft license for general use, which means that derived works must be distributed under the same license terms. Under this philosophy, the GPL grants the recipients of a computer program the rights of the free software definition and uses copyleft to ensure the freedoms are preserved, even when the work is changed or additions are made. This aspect distinguishes the GPL from permissive free software licenses, including the BSD licenses.
The license's copyright disallows modification of the license. Copying and distributing the license is allowed because the GPL requires recipients to get "a copy of this License along with the Program". According to the GPL FAQ, anyone can make a new license using a modified version of the GPL as long as he or she uses a different name for the license, does not mention "GNU", and removes the preamble, though the preamble can be used in a modified license if permission to use it is obtained from the Free Software Foundation (FSF).

GNU Library or “Lesser” General Public License (LGPLv3) http://www.gnu.org/licenses/lgpl.html

The GNU Lesser General Public License (formerly the GNU Library General Public License) or LGPL is a free software license published by the Free Software Foundation (FSF). It was designed as a compromise between the strong-copyleft GNU General Public License or GPL and permissive licenses such as the BSD licenses and the MIT License. The GNU Library General Public License (as the LGPL was originally named) was published in 1991, and adopted the version number 2 for parity with GPL version 2. The LGPL was revised in minor ways in the 2.1 point release, published in 1999, when it was renamed the GNU Lesser General Public License to reflect the FSF's position that not all libraries should use it. Version 3 of the LGPL was published in 2007 as a list of additional permissions applied to GPL version 3.

The LGPL places copyleft restrictions on the program governed under it but does not apply these restrictions to other software that merely link with the program. There are, however, certain other restrictions on this software.

The LGPL is primarily used for software libraries, although it is also used by some stand-alone applications, most notably Mozilla and OpenOffice.org.

The MIT License (MIT)
http://opensource.org/licenses/MIT

The MIT License is a free software license originating at the Massachusetts Institute of Technology (MIT). It is a permissive license, meaning that it permits reuse within proprietary software provided all copies of the licensed software include a copy of the MIT License terms. Such proprietary software retains its proprietary nature even though it incorporates software under the MIT License. The license is also GPL-compatible, meaning that the GPL permits combination and redistribution with software that uses the MIT License.

Software packages that use one of the versions of the MIT License include Expat, PuTTY, the Mono development platform class libraries, Ruby on Rails, Lua (from version 5.0 onwards), and the X Window System, for which the license was written.

Mozilla Public License 2.0 (MPL-2.0)
http://www.mozilla.org/MPL/2.0/

The Mozilla Public License (MPL) is a free and open source software license. Version 1.0 was developed by Mitchell Baker when she worked as a lawyer at Netscape Communications Corporation and version 1.1 at the Mozilla Foundation. Version 2.0 was developed in the open, overseen by Baker and led by Louis Villa. The MPL is characterized as a hybridization of the modified BSD license and GNU General Public License.

The MPL is the license for the Mozilla Application Suite, Mozilla Firefox, Mozilla Thunderbird and other Mozilla software. The MPL has been adapted by others as a license for their software, most notably Sun Microsystems, as the Common Development and Distribution License for OpenSolaris, the open source version of the Solaris 10 operating system, and by Adobe, as the license for its Flex product line.

APPENDIX E – DATA MANAGEMENT PLANS

A data management plan ("DMP") explains how data generated in the course of the work performed under an EERE 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.

Specific to this FOA, the DMP should clearly address data sharing and preservation related to:

a. Data for ingest into NOAA NWP models in near real-time format
b. Data collection, formatting, quality assurance and quality control processes,
c. Data sharing, including meteorological l as well as any SCADA (Supervisory Control and Data Acquisition) and load-related data, among project partners during the project performance period.
d. Ability to make data available for archival at a DOE facility following the project performance period

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; 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 Investigator 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. Similarly, for data developed outside of the proposed work at private expense that will be used in the course of the proposed work, the Principal Investigator should indicate whether that type of data will be subject to public release or kept confidential (referred to as "limited rights data"). 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. All meteorological observations must be provided in Meteorological Assimilation Data Ingest System (MADIS) format and in Universal Coordinated Time (UTC) (see http://madis.noaa.gov/ for more information).

Sharing and Preservation: A description of the plans for data sharing and preservation, specifically addressing the DMP requirements "a" through "d". This should also 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, EERE 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, EERE 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.

APPENDIX F – FEDERAL CAPABILITIES AND PROSPECTIVE ROLES

National Oceanic and Atmospheric Administration (NOAA)

The NOAA Offices of Oceanic and Atmospheric Research (OAR) and National Weather Service (NWS) seek to improve the sensing, characterization and prediction of weather elements in the lower atmosphere (called the planetary boundary layer, or PBL). Improvements in NOAA's capability to make accurate weather predictions in the PBL will benefit the entire wind industry, as NOAA weather forecast products are the basis for most commercial wind forecast service providers serving the industry.

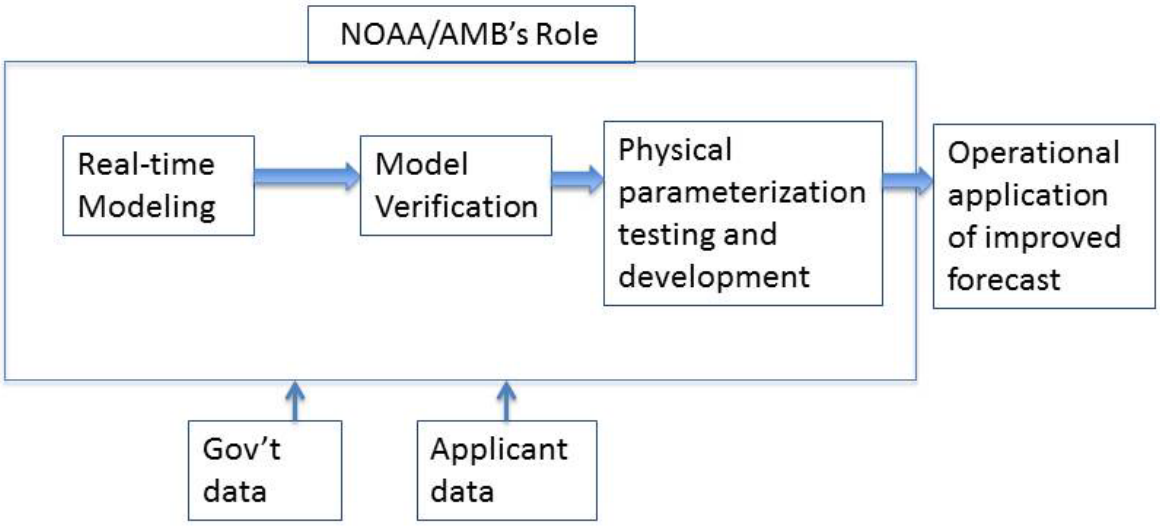
NOAA's Earth System Research Laboratory (ESRL)
ESRL has extensive experience and capabilities in numerical model and data assimilation development, high-performance computing, boundary-layer science, and in the deployment and use of state-of-the-art sensing systems. For this project, ESRL will support the project by deploying atmospheric profiling and in-situ meteorological instrumentation, developing specific assimilation and modeling techniques to improve PBL forecasts, assimilating atmospheric data (including from non-federal sources) for model input, providing forecasts through the use of a developmental high-resolution, rapid refresh model, evaluating model forecast skill, and investigating atmospheric processes that impact wind energy generation. The resulting forecasts can be used as input for industry to create improved power generation predictions.

NOAA's Air Resources Laboratory (ARL)
ARL has significant experience in characterizing the boundary layer, wind flows, and relevant processes. For this project, ARL will support the project through deployment of supplemental instrumentation to characterize air-land fluxes that influence PBL evolution, and to measure low-level winds, up to and including turbine levels.

NOAA's Environmental Modeling Center (EMC)
EMC improves numerical weather, marine and climate predictions at the National Centers for Environmental Prediction (NCEP), through a broad program of research in data assimilation and modeling. In support of the NCEP operational forecasting mission, the EMC develops, improves and monitors data assimilation systems and models of the atmosphere, ocean and coupled systems.

The figure below illustrates the major elements of the project, and the basic division of public (federal government) and private (non-federal recipient) roles. NOAA's Assimilation and Modeling Branch (AMB) will use observations from both standard sources (government data)

and from the awardee to improve model wind forecasts. The improvements from AMB's research will then be incorporated into NOAA's operational forecasts. The partnership team for this project includes DOE, several DOE national laboratories, NOAA, and the recipient funded through this FOA.



NOAA/DOE Furnished Equipment and Accompanying Expertise

NOAA equipment, tools, and personnel should be utilized to assist with the following activities:

1. Development of improved model physical parameterizations of the drivers of wind at heights and time intervals critical to the wind industry's needs,
2. Improved understanding of modeling and understanding of wind in complex terrain,
3. New observations assimilated into forecast models,
4. High resolution modeling, including that provided by NOAA's Rapid Refresh (RAP) and High-Resolution Rapid Refresh (HRRR) models as well as the NAM-Rapid Refresh system (NAMRR).
5. Ramp metric tool developed in the first WFIP (described below).

Ramp Metric Tool

The success of the project will be measured against metrics defined by NOAA during the previous WFIP. The metric that will be used in WFIP 2.0 to show the impact of improved forecasts for wind energy will be based on the ramp tool that was developed during WFIP 1.0. This tool was developed out of recognition that relatively rare ramp events (large changes of power in a short period of time) have a greater impact on grid integration costs for wind energy than do the quiescent periods between ramp events. A standard metric, such as mean

absolute error (MAE) or root-mean-square error (RMSE), that does not give special consideration to ramp events may not give an adequate representation of model skill (improvement over a climatology or persistence forecast).

The ramp tool, described above, has three components: (1) The first is a process to identify ramp events in the time series of power. Four different ramp identification methods were developed in WFIP 1.0 that each compared new theories in a test model versus an operational model with minimal and scheduled known changes. Each of these will also be tested in WFIP 2.0, and compared to the results from WFIP 1.0 to see if a consistent best method can be identified. (2) The second ramp tool component is a method for matching in time each forecast ramp event with the most appropriate observed ramp event. (3) The third and last component of the ramp tool is a process through which a skill score of the forecast model is determined. The skill score is calculated from a utility operator's perspective, incorporates both phase and amplitude errors, and recognizes that ramps, depending on whether it is increasing or decreasing, can have significantly different impacts on grid operation. No single pair of power and time thresholds defines a ramp, and in fact some utilities may be interested in several different delta power and time definitions of a ramp event. Because of this, the ramp skill metric integrates skill over a range of power and time values.

For WFIP 2.0, an overall measure of success should show improvement in the ramp tool skill score for the NOAA research experimental forecast models compared to the National Centers for Environmental Prediction (NCEP) operational forecast models (operational versions of RAP, NAM, HRRR starting in 2014).

In order to meet the instrumentation demands of this project in a timely and affordable fashion, NOAA/DOE will support the project through the deployment of sensors that are currently owned and operated by NOAA or DOE laboratories. Existing instruments from NOAA/DOE that could be deployed for the duration of this project are identified in Table 1. Additional/separate instrumentation recommended by the applicant should be included in the proposal along with cost and availability information.

All government furnished equipment provided by NOAA/DOE will be returned at the end of the project. The operation and maintenance of the deployed NOAA/DOE sensors will remain in NOAA/DOE's control through the duration of the project.

NOAA Data Collection and Assimilation Services

NOAA will be providing the following services as part of the public/private partnership:

Enhanced observations will be collected and if suitable assimilated by NOAA into analysis fields, to be used by a high-resolution numerical weather prediction (NWP) model to generate turbine level wind forecasts. The sensors for forecast verification should have very high vertical

resolution, accuracy, and relatively rapid update frequencies (e.g., 15 min) in some areas, while in others could have lower vertical resolution, lower accuracy, and update at one-hour intervals. Verification sensors need only measure within the wind turbine rotor layer.

A rating system for expending resources on instrumentation will be based on the following:

- Relevance of measurements to program goals.
- Operation costs, including availability of in-kind participant contributions.
- Accuracy and robustness of measurement data.

For accessing federal observational data during the WFIP 2.0 project, a centralized repository with reliability and low latency in serving data can be established at NOAA's Earth System Research Laboratory (ESRL). In addition, quality control procedures should be established for any new observations and implemented to ensure that those sufficiently accurate are provided to the assimilation system, with inaccurate observations identified and screened.

NOAA Furnished Forecasting Model Output

The 13-km Rapid Refresh (RAP) and the 3-km High-Resolution Rapid Refresh (HRRR) will be the primary forecast models for this study. The RAP is an hourly updating assimilation and model forecast system, capable of assimilating many types of observations, including near-surface and aircraft *in-situ* observations as well as radar reflectivity and satellite radiances. The RAP produces 18-h forecasts every hour using the Advanced Research version of the Weather Research and Forecast (WRF-ARW) model over a domain that covers all of North America. The 3-km HRRR is closely coupled to the RAP. It is also initialized every hour by combining a 1-h old RAP 13km analysis with a unique analysis / initialization procedure tailored to the 3-km resolution of the HRRR using current radar and other observational data also assimilated in the ongoing RAP cycle. The HRRR also uses RAP lateral boundary conditions. The HRRR produces 15-h forecasts every hour over a domain covering the CONUS and immediately adjacent land and ocean areas.

Advanced versions of these models are currently being run in a research mode by NOAA/ESRL/GSD (Global Systems Division). An earlier version of the RAP is already operational at NOAA/NWS/NCEP, and a version of the 3-km HRRR model is currently scheduled for implementation at NCEP in the first part of 2014. Further enhancements to the RAP and HRRR forecast model and data assimilation components will be designed and accelerated under this new project.

A second NOAA model evaluation component will be with the experimental NAM Rapid Refresh (NAMRR) model. The current, operational NCEP North American Mesoscale Forecast System (NAM) provides forecasts out to 84 hours four times a day at 00, 06, 12, and 18 UTC while its data assimilation component, the NAM Data Assimilation System (NDAS), performs atmospheric analyses every three hours on its 12-km North American domain. However, NCEP/EMC has been developing a new, hourly updated data assimilation and forecast system, the NAMRR. The developmental NAMRR performs an analysis and subsequent forecast at hourly intervals with both the 12-km North American domain as well as a 3-km nest domain, which covers the contiguous United States. Each hour, forecasts go out to 18 hours, and at 00, 06, 12, and 18 UTC forecasts are extended to 36-84 hours, depending on the desired configuration. The NAMRR assimilates a wide range of observation types, some of which include radar reflectivity, Doppler radial velocity, satellite radiances, in-situ aircraft observations, scatterometer winds, as well as wind-energy observations from tall towers and turbine nacelles (a capability developed during WFIP 1.0). Development of the NAMRR is toward an eventual North American Rapid Refresh Ensemble (NARRE), merging RAP and NAM, planned at NCEP over the next few years.

The special WFIP 2.0 observations are anticipated to include wind profiling radars (WPR), lidars, radiometers, sodars, surface flux stations, pressure sensors, and instrumentation on wind plant turbine nacelles and tall towers. These data will be used for evaluation of 3-D wind flow patterns in complex terrain and evaluations of model forecasts in this area. In addition, these observations will be assimilated, if possible, into the experimental and operational RAP and HRRR models on an hourly basis. Should a DOE lab, university, or private industry partner provide additional instrumentation, those data may also be used for assimilation and for evaluation of flow patterns and models in complex terrain.

The recipient should utilize output from the NOAA RAP and HRRR forecasting model, as well as the NAMRR system with its nests, to predict wind power generation. This could be accomplished through value-added post-processing or for initializing higher-resolution simulations. To better understand the RAP and HRRR model forecast skill, a full year of model forecasts will be evaluated by NOAA as a function of geographic location, season, height, meteorological parameter, and meteorological condition (e.g. cold front, summer convection, convective or stable boundary layer, etc.). Detailed case studies can be provided for forecast "busts," where the model did not provide accurate predictions or provided erroneous predictions, and for data denial experiments. The recipient may collaborate on this effort, and provide parallel analyses of wind power production.

NOAA's activities to improve the operational wind forecasts in complex terrain will fall into three main steps.

First, NOAA will use the special WFIP 2.0 observations to verify the operational RAP and HRRR forecasts and identify cases that are not well forecasted and that are important to wind farm operations and utility integration of wind power.

Second, each case study will later be re-simulated with modifications to key physical parameterizations (e.g., turbulence, etc.) in an attempt to improve upon the forecast errors.

Third, the most significant model improvements as well as the sum of all model improvements will further be tested in retrospective data denial experiments involving the full RAP domains and full data assimilation of standard and special WFIP 2.0 observations in order to ensure robust improvements for general weather prediction as well as the complex flows of focus in this project. Retrospective data denial runs will also be run by the NAMRR system, which includes the full 12-km North American domain and the 3-km CONUS nest domain. In addition to improvements found by enhanced physical parameterizations and use of additional observations, the NAMRR retrospective simulations in conjunction with those from the RAP/HRRR will provide insight into the potential benefit the future NARRE system may provide for wind energy forecasts in complex terrain.

If we are able to demonstrate that the enhancements made to the RAP, HRRR, and/or NAMRR systems provide significantly improved skill for wind-energy forecasting, this project will likely result in their elevation to operational status at the NWS.

APPENDIX G – NOAA AND NATIONAL LAB'S ROLES: RESEARCH AREAS

The table below identifies the proposed research areas to support this FOA and includes designations of the responsibility party. "FOA Awardee" specifies which areas are the primary responsibility of the successful applicant to this FOA. "DOE Lab Partners/NOAA" indicates research areas of primary responsibility of DOE National Laboratory Partners and NOAA. Areas identified as "Potential Collaboration" are topics where DOE lab partners, NOAA and the FOA awardee can work in a collaborative manner, which will be further defined among the parties post-award.

Applicants should account for these research areas and responsibilities in the proposed project.

Research Areas	Responsible Party
Field Campaign	
Physics of interaction between instruments and atmosphere:	Potential Collaboration
- In-situ and remote sensing instruments	Potential Collaboration
Identification of key physical processes and associated measurement design:	Potential Collaboration
- Uncertainty quantification/sensitivity analyses	DOE Labs Partners/NOAA
Field design for data use in models:	Potential Collaboration
- For evaluation of model performance from regional to wake scales	Potential Collaboration
- For assimilation for 0-15 hr operational forecasting with hourly updating	Potential Collaboration
Field deployment:	Potential Collaboration
- Instrumentation provided by FOA awardee	FOA Awardee
- Instrumentation provided by laboratories	DOE Labs Partners/NOAA
- Archival and dissemination of all federally funded data	DOE Labs Partners/NOAA
Improved Understanding of Physical Processes	
Investigation of physical processes identified in FOA	Potential Collaboration
Identification of error sources in subgrid-scale parameterizations across model scales, including examination of underlying theory	Potential Collaboration

Relationships between structure of inflow, wake flow, structural loading, and wind plant performance	Potential Collaboration

Model Improvement

Development and testing of improved subgrid-scale parameterizations across scales:	Potential Collaboration
- Coupling of PBL, surface layer, and land-surface schemes	Potential Collaboration
- Evaluation of both local and non-local parameterizations	Potential Collaboration
- Use of high-resolution models and data to understand impact of subgrid-scale nonlinearities on parameterizations	Potential Collaboration
- Development of stochastic versions of parameterizations for ensemble forecasting and data assimilation	Potential Collaboration
Downscaling methods from mesoscale to turbine scale:	Potential Collaboration
- Boundary conditions for nesting, including LES	Potential Collaboration
- Impact of stability and realistic terrain	Potential Collaboration
- Statistical downscaling methods	Potential Collaboration
Evaluation of relative importance of data assimilation and improved model physics for reducing error over a wide range of meteorological conditions and scales	Potential Collaboration
Software framework development for model coupling	Potential Collaboration
Implementation/evaluation of improved parameterizations in NOAA's RAP/HRRR models	DOE Labs Partners/NOAA

Decision Support

Application of UQ methods to establish uncertainty in key model output, including power	Potential Collaboration
Development of decision algorithms using these uncertainties addressing key needs of operators, utilities, and balancing authorities	Potential Collaboration
Development of decision support tools based on new algorithms and methods	FOA Awardee