

FINANCIAL ASSISTANCE FUNDING OPPORTUNITY ANNOUNCEMENT



U. S. Department of Energy

National Energy Technology Laboratory

Recovery Act – Smart Grid Demonstrations

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**CFDA Number: 81.122 Electricity Delivery and Energy Reliability
Research, Development and Analysis**

Issue Date:	June 25, 2009
Letter of Intent Due Date:	Not Applicable
Pre-Application Due Date:	Not Applicable
Application Due Date:	August 26, 2009 at 3:00:00 PM Eastern Time

This announcement will remain open until the Application Due Date. Applications may be submitted any time before the Application Due Date.

This Amendment 000001 serves as the FINAL version of Funding Opportunity Announcement (FOA) DE-FOA-0000036, which was previously issued in DRAFT form for comments on April 16, 2009. This FINAL version of the FOA supersedes the DRAFT version of the FOA. DOE reviewed all of the questions and comments submitted during the comment period and utilized them, as appropriate, in creating this FINAL version of the FOA. A list of questions and DOE responses will be posted to FedConnect separately, with a target posting date of June 26, 2009.

NOTE: REGISTRATION/SUBMISSION REQUIREMENTS

Registration Requirements

There are several one-time actions you must complete in order to submit an application in response to this Announcement (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contractor Registration (CCR), and register with FedConnect). Applicants who are not registered with CCR and FedConnect, should allow at least 10 days to complete these requirements. It is suggested that the process be started as soon as possible.

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

Applicants must register with the CCR. CCR website: <http://www.ccr.gov/>

Applicants must register with FedConnect to submit their application. FedConnect website: www.fedconnect.net

The following contact phone numbers are provided to assist with these actions:

DUNS Customer Assistance: 1-800-234-3867

CCR Assistance Center: 1-888-227-2423

FedConnect Support: 1-800-899-6665

Questions

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

Questions regarding the FINAL Funding Opportunity Announcement (FOA):

Questions regarding the **content** of the **FINAL** announcement must be submitted through the FedConnect portal. You must register with FedConnect to respond as an interested party to submit questions, and to view responses to questions. It is recommended that you register as soon after release of the FOA as possible to have the benefit of all responses. More information is available at <http://www.compusearch.com/products/fedconnect/fedconnect.asp>. DOE will try to respond to questions submitted regarding the **FINAL** FOA within 3 business days, unless a similar question and answer have already been posted on the website. DOE will not respond to questions received within 5 days of the FOA closing date.

Questions pertaining to the **submission** of applications through FedConnect should be directed by e-mail to support@FedConnect.net or by phone to FedConnect Support at 1-800-899-6665.

Application Preparation and Submission

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

Applicants must submit their application through the FedConnect portal. FedConnect website: www.fedconnect.net (Additional instructions are provided in Section IV H of this FOA.)

TABLE OF CONTENTS

PART I – FUNDING OPPORTUNITY DESCRIPTION.....	4
PART II – AWARD INFORMATION.....	22
A. TYPE OF AWARD INSTRUMENT	22
B. ESTIMATED FUNDING.....	22
C. MAXIMUM AND MINIMUM AWARD SIZE.....	22
D. EXPECTED NUMBER OF AWARDS.....	22
E. ANTICIPATED AWARD SIZE	23
F. PERIOD OF PERFORMANCE.....	23
G. TYPE OF APPLICATION	23
PART III - ELIGIBILITY INFORMATION	24
A. ELIGIBLE APPLICANTS	24
B. COST SHARING	24
C. OTHER ELIGIBILITY REQUIREMENTS	24
PART IV – APPLICATION AND SUBMISSION INFORMATION.....	26
A. ADDRESS TO REQUEST APPLICATION PACKAGE.....	26
B. LETTER OF INTENT AND PRE-APPLICATION	26
C. CONTENT AND FORM OF APPLICATION – 424 (R&R)	26
D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS.....	39
E. SUBMISSION DATES AND TIMES	39
F. INTERGOVERNMENTAL REVIEW	39
G. FUNDING RESTRICTIONS.....	39
H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS.....	39
Part V - APPLICATION REVIEW INFORMATION.....	41
A. CRITERIA.....	41
B. REVIEW AND SELECTION PROCESS.....	43
C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES	44
Part VI - AWARD ADMINISTRATION INFORMATION	45
A. AWARD NOTICES	45
B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS.....	45
C. REPORTING	47
PART VII - QUESTIONS/AGENCY CONTACTS	48
A. QUESTIONS.....	48
B. AGENCY CONTACT.....	48
PART VIII - OTHER INFORMATION	49
A. MODIFICATIONS.....	49
B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE.....	49
C. COMMITMENT OF PUBLIC FUNDS	49
D. PROPRIETARY APPLICATION INFORMATION	49
E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL	50
F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM	50
G. CLASS PATENT WAIVER	50
APPENDIX A – DOE ESTIMATION OF PROJECT COSTS AND BENEFITS	51

PART I – FUNDING OPPORTUNITY DESCRIPTION

American Recovery and Reinvestment Act of 2009 (ARRA 2009)

Projects under this Funding Opportunity Announcement (FOA) will be funded, in whole or in part, with funds appropriated by the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, (Recovery Act or Act). The Recovery Act's purposes are to stimulate the economy and to create and retain jobs. The Act gives preference to activities that can be started and completed expeditiously. Accordingly, special consideration will be given to projects that promote and enhance the objectives of the Act, especially job creation, preservation and economic recovery, in an expeditious manner.

Be advised that special terms and conditions may apply to projects funded by the Act relating to:

- Reporting, tracking and segregation of incurred costs;
- Reporting on job creation and preservation;
- Publication of information on the Internet;
- Access to records by Inspectors General and the Government Accountability Office;
- Prohibition on use of funds for gambling establishments, aquariums, zoos, golf courses or swimming pools;
- Ensuring that iron, steel and manufactured goods are produced in the United States;
- Ensuring wage rates are comparable to those prevailing on projects of a similar character;
- Protecting whistleblowers and requiring prompt referral of evidence of a false claim to an appropriate inspector general; and
- Certification and Registration.

These special terms and conditions will be based on provisions included in Titles XV and XVI of the Act. The special terms and conditions can be found at http://management.energy.gov/policy_guidance/1672.htm.

The Office of Management and Budget (OMB) has issued Implementing Guidance for the Recovery Act. See M-09-10, Initial Implementing Guidance for the American Recovery and Reinvestment Act of 2009 and M-09-15, Updated Implementing Guidance for the American Recovery and Reinvestment Act of 2009. OMB will be issuing additional guidance concerning the Act in the near future. Applicants should consult the DOE website, www.energy.gov, the OMB website <http://www.whitehouse.gov/omb/>, and the Recovery website, www.recovery.gov regularly to keep abreast of guidance and information as it evolves.

Recipients of funding appropriated by the Act shall comply with requirements of applicable Federal, State, and local laws, regulations, DOE policy and guidance, and instructions in this FOA, unless relief has been granted by DOE. Recipients shall flow down the requirements of applicable Federal, State and local laws, regulations, DOE policy and guidance, and instructions in this FOA to subrecipients at any tier to the extent necessary to ensure the recipient's compliance with the requirements.

Be advised that Recovery Act funds can be used in conjunction with other funding as necessary to complete projects, but tracking and reporting must be separate to meet the reporting requirements of the Recovery Act and related OMB Guidance. Applicants for projects funded by sources other than the Recovery Act should plan to keep separate records for Recovery Act funds and to ensure those records comply with the requirements of

the Act. Funding provided through the Recovery Act that is supplemental to an existing grant is one-time funding.

Applicants should require their first tier subawardees to obtain a DUNS number (or update the existing DUNS record) and register with the Central Contractor Registration (CCR).

BACKGROUND INFORMATION

From funds made available by The American Recovery and Reinvestment Act of 2009, the Office of Electricity Delivery and Energy Reliability (OE) has issued this competitive Funding Opportunity Announcement (FOA) for Smart Grid Demonstrations.

Smart Grid projects will include regionally unique demonstrations to verify smart grid technology viability, quantify smart grid costs and benefits, and validate new smart grid business models, at a scale that can be readily adapted and replicated around the country. Thus, awards made under this Announcement will include a requirement to ensure that the technologies demonstrated are widely available for use in the United States.

To reap the full benefits of Smart Grid technologies, advancements in grid-scale energy storage are needed. Electric grid operators can utilize electricity storage devices to manage the amount of power required to supply customers at times when the need is greatest, which is during peak load. Electricity storage devices can also help make renewable energy resources, whose power output cannot be controlled by grid operators, more manageable. They can also balance microgrids to achieve a good match between generation and load. Storage devices can provide frequency regulation to maintain the balance between the network's load and power generated, increase asset utilization of both renewables and electric systems, defer T&D investments, and achieve a more reliable power supply for high tech industrial facilities.

Projects to demonstrate energy storage technologies include battery storage for utility load shifting, wind farm diurnal operations, ramping control, frequency regulation services, distributed energy storage, compressed air energy storage, and demonstration of promising energy storage technologies.

STATUTORY AUTHORITY

American Recovery and Reinvestment Act of 2009
Energy Independence and Security Act of 2007 (EISA)

SPECIAL RESTRICTION UNDER THE ENERGY INDEPENDENCE AND SECURITY ACT OF 2007

Some Applicants may be interested in both the Regional Demonstration Initiative, of which this FOA is part, and the Smart Grid Investment Grants FOA as identified in EISA sections 1304 and 1306, respectively. However, subsection (D) of EISA section 1304(b)(3) states that “[n]o person or entity participating in any demonstration project conducted under this subsection [Regional Demonstration Initiative] shall be eligible for grants under section 1306 “Federal Matching Fund for Smart Grid Investment Costs” [Smart Grid Investment Grants] for otherwise qualifying investments made as part of that demonstration project.” **DOE reminds Applicants of this prohibition so they may plan accordingly.** Applicants can

submit separate applications to both programs, or multiple applications to each program, but they must be for distinctly different projects and they cannot involve the use of federal funds from both programs in a single project.

RELATIONSHIP BETWEEN THE SMART GRID INVESTMENT GRANT (SGIG) AND THE SMART GRID DEMONSTRATION PROGRAMS (SGDP)

While the two programs are both aimed at modernization of the nation's electric grid through the application of smart grid technologies, tools, and techniques, they are separate and distinct undertakings.

The SGIG is authorized by EISA, Title XIII, Section 1306 as amended by the Recovery Act. The intent of the SGIG FOA is to provide grants of up to one-half of qualifying smart grid investments to support the manufacturing, purchasing and installation of smart grid devices and related technologies, tools, and techniques for immediate commercial use in electric system and customer-side applications including electric transmission systems, electric distribution systems, building systems, advanced metering, appliances, and equipment. The ultimate aim is to enable smart grid functions on the electric system as soon as possible.

The Smart Grid Demonstration Program (SGDP) is authorized by the EISA, Title XIII, Section 1304 as amended by the Recovery Act. The intent of the SGDP FOA is to provide financial support, up to one-half of the total project cost, to demonstrate how a suite of existing and emerging smart grid technologies can be innovatively applied and integrated to prove technical, operational and business-model feasibility. The ultimate aim is to demonstrate new and more cost-effective smart grid technologies, tools, techniques, and system configurations that significantly improve upon the ones that are either in common practice today or are likely to be proposed in the SGIG Program. Furthermore, these demonstration projects should serve as models for other entities to readily adapt and replicate across the country.

Unlike SGIG, SGDP applications to Area of Interest 1 can include the costs of distributed energy and storage equipment. Under SGDP, the costs of distributed energy and storage equipment can be included up to 20% of the total value of the project.

To the extent possible, impacts, costs, and benefits of projects in both programs will be assessed in a consistent and comparable manner. However, each FOA has technical merit review criteria that are designed to evaluate applications against the intended purpose of the specific FOA.

PURPOSE/OBJECTIVES

The goal of this FOA is to demonstrate technologies in regions across the States, Districts, and Territories of the United States of America that embody essential and salient characteristics of each region and present a suite of use cases for national implementation and replication. From these use cases, the goal is to collect and provide the optimal amount of information necessary for customers, distributors, and generators to change their behavior in a way that reduces system demands and costs, increases energy efficiency, optimally allocates and matches demand and resources to meet that demand, and increases the reliability of the grid. The social benefits of a smart grid are reduced emissions, lower costs, increased reliability, greater security and flexibility to accommodate new energy technologies, including renewable, intermittent and distributed sources.

SMART GRID (Program Area of Interest 1)

An objective of this FOA is to support regionally unique demonstration projects to quantify smart grid costs, benefits and cost-effectiveness, verify smart grid technology viability, and validate new smart grid business models, at a scale that can be readily adapted and replicated around the country. Smart grid technologies of interest include advanced digital technologies for use in planning and operations of the electric power system and the electricity markets such as microprocessor-based measurement and control, communications, computing, and information. These demonstration projects directly support the Smart Grid Regional Demonstration Initiative, as described under section 1304 (b) (2) (A)-(E) of the Energy Independence and Security Act of 2007, which aims at providing regional solutions and best practices in implementing smart grid technologies. Implementation of the Initiative will take into consideration regional differences in electric and market operations and regulatory environment. Each regionally unique demonstration project should represent the common elements that are characteristic of the region. Collectively, DOE anticipates that these regional projects should embody the essential and salient characteristic of the entire nation in order to arrive at a suite of use cases for national implementation and replication.

ENERGY STORAGE (Program Area of Interest 2)

An objective of this FOA is to support demonstration projects for major, utility-scale, energy storage installations. The projects will help to establish costs and benefits, verify technical performance, and validate system reliability and durability, at scales that can be readily adapted and replicated across the United States. Energy storage systems include the following technologies: advanced battery systems (including flow batteries), ultra-capacitors, flywheels, and compressed air energy systems. Application areas include wind and photovoltaic (PV) integration with the grid, upgrade deferral of transmission and distribution assets, congestion relief, and system regulation. Applications are also sought to demonstrate promising utility-scale storage technologies in order to rapidly advance their market readiness in the U.S.

PROGRAM AREAS OF INTEREST

This FOA contains two Program Areas of Interest as further described below. Applicants must identify the Area of Interest they are applying to in the Project Narrative and identify the Area of Interest in the file name. For example if an Applicant were applying to Area of Interest 1, identify the filename as Project01.pdf; if applying to Area of Interest 2 identify the file name as Project02.pdf.

You may submit more than one application; however, Applicants must select and target only one Area of Interest per application. Each application must have its own unique title on the subject line (i.e., project title and principal investigator/project director, if any).

Applicants should submit their application under the Program Area of Interest that best fits the majority of the effort proposed. When DOE believes an application more appropriately fits in another Program Area of Interest than the one to which it was submitted, DOE will consider the application under the more appropriate Area of Interest or direct the Applicant to resubmit to the appropriate Area of Interest. Do not submit identical applications under more than one Area of Interest.

All project activities must be conducted primarily within the States, Districts, and Territories of the United States of America. Demonstration projects proposed shall not represent marginal improvements of commercial technology or previously demonstrated technology. Instead, projects proposed should be of a scale and scope sufficient to significantly advance smart grid deployments throughout the U.S. toward the vision of a 21st century grid.

DOE Estimation of Project Costs and Benefits

Submitted Project Management Plans are required to include a discussion of the plan for data collection and determination of project costs and benefits. With respect to project costs and benefits, DOE is interested in having project data collection efforts focus on the determination of overall and net benefits to consumers, companies, and society as a whole that result from project activities to enable smart grid functions and deploy smart grid technologies, tools, and techniques.

In addition, DOE plans to apply the framework in Appendix A to determine overall and net benefits of the demonstration projects. The framework provides the types of benefits that DOE would like to examine, as well as the data required to estimate those benefits. DOE intends to work with Recipients after selection and prior to award on the specific types and formats of data and information that will be needed for the DOE cost-benefit analysis. However, Applicants should provide a comprehensive discussion of the data to be collected and the types of benefits that will be expected from the project. In addition, Applicants should discuss all of the relevant costs that should be included in the analysis of costs, including the un-depreciated costs of existing (to-be-replaced) equipment.

Applicants should also provide a concise discussion that includes quantitative estimates of the expected impact of their project on the areas of benefit (all that apply) listed in Table A.5. These areas include:

- Lower electricity costs
- Lower peak demand
- Lower T&D losses
- Lower O&M costs
- Reduced transmission congestion costs
- Reduced costs of power interruptions
- Lower emissions of greenhouse gases
- Lower consumption of imported oil

It is an important DOE goal to analyze costs and benefits of demonstration projects in the most complete and comprehensive manner possible. In developing their Project Management Plans, Applicants should be aware that this analysis will require that projects provide a baseline set of conditions using a control group or other means so that appropriate estimates can be made of project costs and benefits in comparison with before- and after-, or without- and with- the installation of smart grid technologies, tools, and techniques. For example, data would be collected for a period of time before and after the smart grid technologies, tools, techniques are installed and activated.

DOE welcomes a discussion or additional suggestions from Applicants on methods and approaches for conducting cost-benefit analysis in relation to the framework provided in Appendix A, including ideas on the types, formats, and availability of data needed for the analysis.

Interoperability and Cyber Security

One of OE's top smart grid priorities is the work with NIST and FERC on a framework for interoperability standards. This effort is focused on an accelerated timetable for the development of a standards development roadmap and a process for getting standards for interoperability in place as rapidly as possible. As the smart grid develops and the grid becomes more interconnected, the Nation needs to guard against introducing cyber related vulnerabilities that would allow for disruption of the grid. This could occur, at least in theory, either through unintended pathways from the Internet or less secure customer networks into the infrastructure control systems or through the ability of malicious actors to manipulate large numbers of small systems that would affect the load on the grid and thus destabilize grid operations. As smart grid technologies are placed into operation, careful consideration should be given to how these components affect the security of the grid as a whole by avoiding unnecessary connectivity or functionality or by providing by appropriately secured, authenticated activity while still allowing for the sharing of information necessary to enable innovation and cost savings. Particular care is required where different networks of varying security levels converge to share information, whether it is a utility interface to the home (e.g. smart meters) or a server belonging to a utility or a third-party service provider.

In addition to NIST and FERC, DOE is working on this activity with many other private organizations including the North American Electric Reliability Corporation, the Institute of Electrical and Electronic Engineers, the National Electrical Manufacturers Association, and the GridWise Architecture Council.

Interoperability

All applications shall include a section on the technical approach to addressing interoperability with respect to the integration of smart grid devices covering the application of procedures and practices involving interface identification, specification, testing, and lifecycle management. The technical approach to addressing interoperability should include:

- A summary of the information exchange interfaces for communicating automation devices and systems (i.e., their points of connection with other elements of the system)
- A summary of how the project will provide openly available and proprietary aspects of the interface specifications, and how existing (legacy) communicating devices or systems will be integrated into the project
- A summary of how the project will address response to failure and device upgrade scenarios, such that overall system impact is mitigated
- A summary of how the project will support compatibility with NIST's emerging smart grid framework for standards and protocols
- In addition, the Applicant, should further detail:
 - The information exchange interface points for each type of communicating automation device and system.
 - The openly-available and proprietary aspects of the interface specifications.
 - Where a type of communicating device or system is expected in large numbers (e.g., meters, sensors, customer interfaces), the extent of support for multiple suppliers who will integrate their devices or systems that may be based on different technologies at the points of interface.

- If existing (legacy) communicating devices or systems are integrated into the project, the extent to which they integrate and interoperate at the points of interface with new components.
- The interacting parties' anticipated response to failure scenarios, particularly loss of communications, such that overall system impact is mitigated in the event of such failure.
- The anticipated process for upgrading devices or systems (hardware and software) so that overall system operation impact is mitigated.
- The evidence that will be provided (interface specifications, interoperability test plans and results, reviews, and other engineering artifacts) to ensure interoperability at the interfaces of communicating automation devices and systems.
- The project's ability to support compatibility with NIST's emerging smart grid framework for standards and protocols as information becomes available.

Cyber Security

Applicants must provide clear documentation that demonstrates that their proposed approach to cyber security will prevent broad based systemic failures in the electric grid in the event of a cyber security breach.

All applications shall include a section on the technical approach to cyber security. Cyber security should be addressed in every phase of the engineering lifecycle of the project, including design and procurement, installation and commissioning, and the ability to provide ongoing maintenance and support. Cyber security solutions should be comprehensive and capable of being extended or upgraded in response to changes to the threat or technological environment. The technical approach to cyber security should include:

- A summary of the cyber security risks and how they will be mitigated at each stage of the lifecycle (focusing on vulnerabilities and impact)
- A summary of the cyber security criteria utilized for vendor and device selection
- A summary of the relevant cyber security standards and/or best practices that will be followed
- A summary of how the project will support emerging smart grid cyber security standards
- In addition, the Applicant, should further detail:
 - The methodology used to identify cyber security risks and the results of this assessment (e.g., the assessment should consider the mission of the new smart grid project and also potential impacts to other critical grid control functions to which they are connected).
 - How cyber security risks will be mitigated at each phase of the engineering lifecycle, including policy, procedural, and technical (logical and physical) controls, with special emphasis on strategies for:
 - ensuring the confidentiality, integrity, and availability of device and system data and communications commensurate with the application requirements,
 - securing, logging, monitoring, alarming, and notification, and

- applications where logical and physical security may not be under the direct jurisdiction of the installing entity.
- The relevant cyber security standards or best practices that will be used.
- The capability of the components or system to be updated to meet future cyber security requirements or technologies.
- How evidence will be provided (e.g., a test plan, engineering artifacts, independent testing and review) to demonstrate and validate the effectiveness of the cyber security controls

Only applications that specifically address topics described in the following two program areas of interest will be accepted under this announcement.

Program Area of Interest 1: Regional Demonstrations

Smart grid technologies of interest include advanced digital technologies for use in planning and operations of the electric power system and the electricity markets such as microprocessor-based measurement and control, communications, computing, and information.

Each regional demonstration project should be carried out in cooperation and collaboration with the electric utility that owns the grid facilities in electricity control areas, or the electric utility that is a rural cooperative or publicly owned. The electric utility may be either the proposing Applicant or a team member. An integrated team approach that includes members of utilities, product and service suppliers, end users, state and municipal governments, Independent System Operators (ISOs) or Regional Transmission Operators (RTOs), the financial community, and others is strongly encouraged.

Applications in response to Area of Interest 1 can include distributed energy resources (DER), e.g., solar, photovoltaics, wind, fuel cells, turbines, and storage technologies as part of the project; however, the total cost of the DER/storage effort can not exceed 20% of the total project value. The kinds of storage equipment eligible include all conventional storage technologies already available on the commercial market; it does not include the emerging storage technologies specifically sought under Area of Interest 2 of this announcement. The DER/storage effort can either be funded via federal funds or be considered Recipient provided cost share; however, in either case, the proposed DER/storage effort must be considered essential to the objectives of the project.

For the purpose of applications submitted under this Area of Interest, a “region” is defined as any area across which similar characteristic elements exist for the electric infrastructure. Similar characteristic elements would include similarities in generation resources, current and future electric infrastructure, regionally unique environmental or regulatory factors, etc.

For each regional demonstration project the application must:

- A. Define the geographical boundaries of the region and characterize the region. Regional factors such as energy resources, electric network structures, climatic conditions, topography, environmental concerns, and public policy influence on smart grid technology deployment shall be described for the region. DOE suggests that Applicants define the region’s geographical boundaries according to the eight NERC regional entities¹ plus Alaska and Hawaii, the 27 eGrid subregions (subregions of NERC

¹ <http://www.nerc.com/page.php?cid=1%7C9%7C119>

regions)², or service territories of electric co-operatives or publicly owned utilities in the NERC region or eGrid subregion. However, other regional definitions may be proposed but must be adequately justified. Applications shall identify and discuss similar characteristic elements in the proposed demonstration region. These elements should encompass similarities that affect smart grid deployment in that region.

- B. Describe the demonstration project. The proposed project must be of a scale large enough to validate the feasibility of smart grid technologies and infrastructure requirements that can be widely transferable throughout the region. Each application should describe at a minimum: the scale of the demonstration project, performance objectives of the demonstration, the criteria and requirements used in selecting demonstration site(s) and how these sites relate to smart grid technologies, the data collection and evaluation plan, the metrics for success, and the measurements that will be made to confirm success.
- C. Address the goals of the Smart Grid Regional Demonstration Initiative as described under section 1304 (b) (2) (A)-(E) of the Energy Independence and Security Act of 2007. Specifically, applications must describe: the potential benefits of the project's investments in smart grid technologies on a regional grid; the commercial transition from use of current technologies to use of smart grid technologies; the integration of smart grid technologies in existing electric networks to improve system performance, power flow control, and reliability; the design and use of measurement, monitoring, and verification (MMV) protocols for energy savings and fossil fuel emission reductions associated with the use of smart grid technologies and practices; and the best practices in implementing smart grid technologies in the proposing region. Each application should adequately describe the extent that each of the above goals will be addressed by the proposed demonstration project with respect to the region as a whole.
- D. Identify and describe the smart grid technology proposed for demonstration, along with its application areas and expected advancement of smart grid metrics. The term "smart grid technology" denotes the use of digital technologies, including microprocessor-based measurement and control, communications, computing, and information, etc., to improve reliability, security, and efficiency of the electric system. Each application must: identify and describe smart grid technologies proposed for demonstration; describe their technology application areas associated with any and all applicable smart grid domains (described below); and describe the extent that the demonstration project will advance the smart grid metrics for those application areas. Applicants are also encouraged to identify additional metrics, beyond those listed here, that they feel are appropriate. Advancement in smart grid metrics must be quantifiable to indicate progress in penetration, maturity, or trending, from the beginning of the project to the conclusion of the project.

The four smart grid domains, technology application areas, and associated smart grid metrics are described below:

- D.1. Area, regional, and national coordination regions: This domain includes balancing areas, independent system operators (ISOs), regional transmission operators (RTOs), electricity market operations, and government emergency-operation

² <http://www.epa.gov/cleanenergy/energy-resources/egrid/faq.html#egrid6>

centers. Technology application areas include collecting measurements from across the system to determine system state and health, and coordinating actions to enhance economic efficiency, reliability, environmental compliance, or response to disturbances. Smart grid metrics for the technology application areas are:

- D.1.1. Dynamic pricing: fraction of customers and total load served by tariffs that allow prices to change in response to system operating conditions
- D.1.2. Real-time system operations data sharing: Amount of system status measurement and control data shared among the operating organizations
- D.1.3. Distributed-resource interconnection policy: percentage of utilities with distributed generation and storage interconnection policies that ease their integration into the electric system
- D.1.4. Policy/regulatory progress: percentage of smart grid investment recovered through rates (respondents' input weighted based on total customer share)

D.2. Distributed energy resources technology: Technology application areas in this domain include integration of distributed energy resources and their innovative aggregation mechanisms for participation in the electric system operation. Distributed energy resources for integration encompass distributed generation (including renewable generation such as those derived from solar and local wind sources, and non-renewable, energy-efficient generation resources on or near the loads), storage (including advanced battery-based and non-battery-based storage devices), and demand-side resources (such as smart appliances, electric vehicles [EVs] or plug-in hybrid electric vehicles [PHEVs], and electricity-using equipment in industrial or commercial applications engaging in smart grid functions). Smart grid metrics for the technology application areas are:

- D.2.1. Load participating based on grid conditions: fraction of load served by interruptible loads, utility-directed load control, and incentive-based, consumer-directed load control
- D.2.2. Load served by microgrids: fraction of entire load served by microgrids
- D.2.3. Grid-connected distributed generation (renewable and non-renewable) and storage: percentage of all generation capacity that is distributed generation and storage
- D.2.4. EVs and PHEVs: percentage shares of on-road, light-duty vehicles comprised of EVs and PHEVs
- D.2.5. Grid-responsive, non-generating, demand-side equipment: total load served by smart, grid-responsive equipment (smart appliances, industrial/commercial equipment including motors and drivers)

D.3. Transmission and distribution (T&D) infrastructure: Technology application areas at the transmission level include substation automation, dynamic limits, relay coordination, and the associated sensing, communication, and coordinated action. Distribution-level application areas include distribution automation (such as feeder-load balancing, capacitor switching, and restoration), enhanced customer participation in demand response, outage management systems, voltage regulation, VAR (Volt Ampere Reactive) control, geographic information systems, data management, and mobile workforce management, and improved power quality to meet the range of customer needs. Smart grid metrics for the T&D technology application areas are:

- D.3.1. T&D system reliability: duration and frequency of power outages
- D.3.2. T&D automation: percentage of substations using automation
- D.3.3. Advanced meters: percentage of total demand served by advanced metered customers

- D.3.4. Advanced system measurement: percentage of substations possessing advanced measurement technology
 - D.3.5. Capacity factors: yearly average and peak-generation capacity factor
 - D.3.6. Generation and T&D efficiencies: energy conversion efficiency of electricity generation, and electricity T&D efficiency
 - D.3.7. Dynamic line ratings: percentage miles of transmission circuits being operated under dynamic line ratings
 - D.3.8. Power quality: percentage of customer complaints related to power quality issues (e.g., flicker), excluding outages
- D.4. Information networks and finance: Information technology and pervasive communications are cornerstones of a smart grid. Technology application areas include: enhanced interoperability, ease of integration of automation components, and cyber security enhancements, as well as implementation of information technology related standards, methodologies, and tools. In addition, this domain also covers the economic and investment environment for procuring smart grid technology, which is important to smart grid implementation progress. Smart grid metrics for information networks and finance are:
- D.4.1. Cyber security: percent of total generation capacity under companies in compliance with the NERC Critical Infrastructure Protection standards
 - D.4.2. Open architecture/standards: Interoperability Maturity Level – the weighted average maturity level of interoperability realized between electricity system stakeholders
 - D.4.3. Venture capital: total annual venture capital funding of smart-grid startups located in the U.S.
- E. Identify issues and describe approach to develop action plans to mitigate the issues. The smart grid technology proposed for demonstration must be assessed according to the following aspects that relate to large scale deployment in and/or beyond the proposed region: analysis vis-à-vis other technology options; safety; estimated cost and cost-effectiveness; regulatory and permitting requirements; perceived public acceptability; environmental efficacy; and any modifications required for broad deployment to varying application sites. Any potential issues or risks should be identified, and the approaches to overcome the issues and mitigate the risks should be provided.
- F. Describe approach to develop and implement a public outreach and education plan. Each application should describe the approach to provide a public outreach and education plan that raises awareness of smart grid opportunities in the region and informs interested stakeholders about the planned demonstration project and future deployment efforts applicable to the region. This public involvement plan may consist of, but is not limited to, public forums, mailings and Web publication of smart grid information brochures, and education programs available at libraries, schools, and local businesses. Each application must describe how each field project will comply with NEPA and regulatory, permitting, and public involvement requirements.
- G. Describe approach to collect, organize and present smart grid regional demonstration project data. During performance of the project, each recipient will be required to supply smart grid regional demonstration data to the developer of the Smart Grid Information Clearinghouse for storage and sharing with the public. A separate FOA has been issued

by NETL³ for an entity to develop and maintain this Smart Grid Information Clearinghouse database and website; the awardee for this Clearinghouse effort is expected to be announced in June 2009. Each application must describe its approach to provide the developer of the Clearinghouse with the following, in a non-proprietary way: the scope, schedule, and results of the smart grid demonstration project; smart grid technology testing and operation data; standards related to smart grid technologies; smart grid technology use cases and functional requirements; cost and benefits of smart grid technologies; applicable legislation and regulation concerning smart grid technology demonstration and deployment; and lessons learned and best practices.

Program Area of Interest 2: Grid-Scale Energy Storage Demonstrations

Grid-scale energy storage demonstration projects will help to establish costs and benefits, verify technical performance, and validate system reliability and durability, at scales that can be readily adapted and replicated around the country. Energy storage systems include the following technologies: advanced battery systems (including flow batteries), ultracapacitors, flywheels, and compressed air energy systems. Areas of application include wind and PV integration, upgrade deferral of transmission and distribution assets, congestion relief, system regulation, utility load shifting, ramping control, and distributed energy storage. Energy storage can also provide dynamic reactive compensation for mitigation of voltage and transient instability, backup power for customers during islanding of grid, peak shaving the load, arbitrage, and offset new peak capacity. Projects are also sought to demonstrate promising grid-scale storage technologies in order to rapidly advance their market readiness in the U.S.

These demonstration projects directly support the Energy Storage Competitiveness Act and include projects to accelerate development and strengthen energy storage manufacturing capabilities of the U.S. They also further the aims of the Act at providing regional solutions and best practices in implementing smart grid technologies.

Demonstration projects should be carried out in cooperation and collaboration with the electric utility or ISO/RTO that controls the grid facilities in which the energy storage system is being installed. Electric utilities may propose as Applicants or team members. An integrated team approach that includes, as appropriate, system operators, utilities, prospective merchant plants, product and service manufacturers and suppliers, end users, state and municipal governments, the financial community, etc. is strongly encouraged.

Each of the demonstrations shall address one or more of the following objectives:

- Energy storage to improve the feasibility of microgrids (islanding) or transmission and distribution capability to improve reliability in rural areas
- Integration of an energy storage system with a self-healing grid
- Use of energy storage to improve security to emergency response infrastructure and ensure availability of emergency backup power for consumers
- Integration with intermittent renewable energy production, at the source or anywhere on the grid
- Use of energy storage to provide ancillary services, such as spinning reserve services, for grid management
- Advancement of power conversion systems to make the systems smarter, more efficient, able to communicate with other inverters, and able to control voltage

³ <http://www07.grants.gov/search/search.do?&mode=VIEW&flag2006=false&oppId=45833>

- Use of energy storage to optimize transmission and distribution operation and power quality, which could address overloaded lines and maintenance of transformers and substations
- Use of advanced energy storage for peak load management of residential complexes, businesses, and the grid
- Use of energy storage devices to store energy during non-peak generation periods to make better use of existing grid assets

For each grid-scale energy storage demonstration project the application must:

- A. Describe the demonstration project. Identify and describe the energy storage systems proposed for demonstration, along with its application areas and the specific objective(s) from the list above that it aims to address. Each application must: identify and describe in detail the energy storage systems proposed for demonstration; describe specifically the goals, objectives, and expected benefits to the utility or ISO/RTO, customers, and society as a whole, including environmental impacts; and describe the extent that the demonstration project will accelerate development of more cost-effective energy storage systems and be replicable in other regions of the country. The proposed project must be of a scale sufficient to validate the feasibility of energy storage system and must have infrastructure requirements that allow wide-scale utilization throughout the region and across the nation. Each application should describe at a minimum: the scale of the demonstration project, performance objectives of the demonstration, the criteria and requirements used in selecting demonstration site(s) and how these sites can benefit from energy storage systems, the data collection and evaluation plan, the metrics for success, and the measurements that will be made to confirm success.
- B. Describe approach to collect, organize and present energy storage system demonstration project data. Each successful awardee will be required to provide energy storage demonstration data to the public through posting on the Department's website. Each application must describe a plan to provide, in a non-proprietary manner, the scope, schedule, and results of the demonstration project; testing and operational data; applicable standards affecting energy storage systems; energy storage case studies and functional requirements; cost and benefits; applicable legislation and regulation concerning energy storage demonstration and deployment; and lessons learned and best practices.
- C. Describe approach to collect and analyze economic data, from both before and after commissioning, to determine the economic benefits of the project.
- D. Describe approach to collect, organize and deliver technical performance and economic data for a period of six months prior to commissioning of the demonstration and for a period of 24 months following the commissioning of the demonstration

Grid-Scale Energy Storage Demonstration Subareas

Applications are sought in the following project areas:

2.1 Battery Storage for Utility Load Shifting or for Wind Farm Diurnal Operations and Ramping Control

Utility load shifting can reduce T&D congestion, improve asset utilization and defer system upgrades. Utility load shifting can offer many advantages to electric service utilities. Applications should include descriptions of these advantages and the potential for widespread deployment.

Wind energy is entering the grid at an ever-increasing pace. As penetration levels increase, utilities are adjusting to the variable nature of wind-generated energy. Substantial penetration of such intermittent generation can place considerable, localized stress on the electricity grid in the U.S. Any need to back up these variable generators with conventional fossil-fired generators limits their positive impact on emissions production. Large-scale, efficient, electrical energy storage (EES) systems should be able to compensate for intermittent or variable generation and still ensure that electricity is reliably available 24 hours a day without the need for fossil-fueled generation backup.

Applications are sought to demonstrate an 8-15 MW / 4-8 hour battery storage system placed in the grid for load shifting or reliability. The system may be centralized or consist of aggregated, distributed units controlled centrally. Applications are also sought for systems in the same power and duration regime, for storage systems operating directly in conjunction with an established wind farm in order to make the renewable source more fully dispatchable. The storage demonstration facility may have a shorter storage period but correspondingly higher power output if it specifically addresses ramp control.

Applications should address the following goals at a minimum:

- Include the electric transmission and/or distribution operating entity as a team member.
- Address one or more of the following applications
 - Utility load shifting
 - Increasing the dispatchability of wind generated energy to meet desired utility criteria
 - Ramp rate control to minimize need for and affect on fossil fueled backup generator operation
- Monitoring and Performance Reporting of the project, including:
 - Six months of economic and technical data to baseline the application proposed for the energy storage installation
 - Twenty-four months of economic and technical data to demonstrate the effect of the installation on the utility region.
 - Efficiency of energy storage system
 - Availability and reliability of energy storage system
 - Predicted economic payback based on the 24 months of project data

2.2 Frequency Regulation Ancillary Services:

Frequency regulation ancillary services are important to balancing areas, independent system operators (ISOs), regional transmission operators (RTOs), and electricity market operations. Technology application areas include balancing generation and load to maintain system frequency within NERC-defined limits, maintain power transmission and distribution stability and reliability, improve regional energy efficiency, and reduce CO₂ greenhouse gas emissions.

Applications should address the following goals at a minimum:

- Fast response multi megawatt system that can achieve full power in 4-seconds or less, up or down

- Zero direct CO₂ emissions from operations: system does not consume any fossil fuel but recycles electricity between the grid and energy storage system on a continuous basis
- Energy storage capacity: shall be sufficient to perform frequency regulation as defined by the applicable tariff, but in no case less than 15 minutes as measured from a state of rated charge to rated discharge
- Efficiency: Minimum round trip efficiency of 75% as measured at the last transformer interconnecting the system to the grid and inclusive of all losses of the storage system and ancillary equipment, based on an actively managed control signal designed for energy storage assets
- Frequency Response capability: in addition to performing frequency regulation, system has the capability to perform Frequency Response to help the regional system recover from events such as loss of generator or transmission capacity
- System life: 10-year minimum; also provide cost option to extend life to 20-years
- Installation, commissioning and start-up: 3 years or less after project award
- Capacity: must be sufficient to bid into open regulation market
- Hazardous materials: provide MSDS listing, as relevant
- Prior to installation, ability to operate at maximum rated charge/discharge rate sufficient to reach stable operating temperature must be adequately demonstrated or otherwise verified
- Prior to installation, ability to accurately respond to ISO/RTO signaling must be demonstrated

2.3 Distributed Energy Storage for Grid Support

Distributed energy storage will find applications on both the utility and customer sides of the meter. Utilities are using storage to defer equipment upgrades and to reduce loads at congestion points. Customers use energy storage to improve power quality, reduce demand charges and to participate in demand response programs with minimal impact on their operations. Communities, campuses and bases can use storage as critical elements of micro-grids and energy management systems. Both customers and utilities can use energy storage in conjunction with photovoltaic (PV) or wind systems to smooth output and time-transfer energy generated at times of low value to times of high value. Community PV/Storage systems are being considered for green residential, light commercial and micro-grid projects. Rural community wind projects are being considered for green rural projects.

This announcement seeks to demonstrate energy storage projects placed on distribution circuits. The storage project should be at least 1-3 MW in size with storage discharge durations of 30 minutes to 8 hours, depending on application. Aggregated systems, centrally controlled and operated as a fleet will be considered.

Applications should address the following goals at a minimum:

- Include the operating electric service utility management unit and, as appropriate, customers as team members
- Address one or more of the following applications
 - Upgrade deferral
 - Peak shaving
 - Demand management
 - Micro-grid operations
 - Renewable system integration
 - Congestion reduction
 - Ancillary services

- Other energy storage applications as detailed in application
- Monitoring and Performance Reporting of the project, including:
 - Six months of economic and technical data to baseline the application proposed for energy storage installation
 - If a new construction is proposed, options including both with-storage and without-storage shall be examined
 - Twenty-four months of economic and technical data to demonstrate the effect of the installation on the utility region.
 - Efficiency of energy storage system
 - Availability and reliability of energy storage system
 - Predicted economic payback based on the 24 months of project data

2.4 Compressed Air Energy Storage (CAES)

In the United States, there is a dramatically increasing need to take advantage of renewable-generated energy (in particular, wind-generated energy) and to use its output to serve on-peak loads and meet daily power regulation, ramping, and spinning reserve duty. Advanced, second generation Compressed Air Energy Storage (CAES), as well as isothermal CAES and adiabatic CAES plants have the capability to augment such renewable generators, meet the on-peak needs of the grid, minimize environmental impact, and mitigate the power fluctuation and energy management (ramping and regulation) issues associated with wind and other renewable resources.

CAES plants use off-peak electricity to compress air into an air storage system. When the grid needs additional electric power, air is withdrawn from the store, heated, and passed through an expansion turbine driving an electric generator. Such plants consume about 35% of the amount of premium fuel utilized by a conventional combustion turbine (CT) and thus produce about 35% of the pollutants per kWh generated from a CT. The compressed air may be stored in several types of underground media, which include porous rock formations, depleted gas/oil fields, and caverns in salt or rock formations; or, the air may be stored in above ground vessels or air pipelines. Both above ground and below ground CAES projects will be considered for demonstration under this announcement. For above ground systems, projects in the range of 10 MW to 50 MW and 2 to 5 hours nominal energy storage capacity, or better, are desired. For below ground systems, all projects meeting the scheduling requirements of the electric service utility or ISO/RTO will be considered.

Applications should address the following goals at a minimum:

- Involve the electric transmission and/or distribution operating entity or the relevant ISO/RTO as appropriate.
- Control of surface and storage rights
- Address one or more of the following applications
 - Time shifting of wind or other renewable resource generated energy to meet desired utility or ISO/RTO criteria
 - Ramp rate control to minimize need for and affect on fossil fueled backup generator operation
 - Firming of wind farm output
- Include the monitoring of the project which shall include (in addition to those mentioned above):
 - Efficiency of energy storage system - the focus is to demonstrate the CAES technology with an optimized energy ratio and heat rate at both full load and part load conditions. The overall goal is to have an energy ratio of 0.80 kWh-

In per kWh-Out and a heat rate of 4000 Btu-In per kWh-Out or better, depending on site specifics.

- Ramping power rate; the plant's generation cycle shall be 20% per minute of the plants maximum power generation capability, or better
- Regulation power rate; the system shall begin to ramp up within seconds at grid operator requests to steady the power fluctuations from load, wind and/or other renewable power generators
- Availability and reliability of energy storage system

Applications should also describe at a minimum:

- How the CAES fits into the current generation mix
- How the CAES results in reduced CO₂ emissions; to provide the above load leveling, ramping and regulation duty with at least 35% lower CO₂ emissions than simple-cycle combustion turbines produce for the same type of duty cycles
- How the predicted economic payback will be calculated, based on the 24 months of project data

2.5 Demonstration of Promising Energy Storage Technologies

Electrical energy storage is an emerging technology. Several grid-scale products and systems are entering the marketplace. Lead acid battery technology is well established for some application areas. Technologies such as lithium ion, nickel metal hydride, nickel cadmium, metal air batteries, vanadium redox and zinc bromine flow batteries, as well as SMES, flywheels and electrochemical capacitors are in various stages of development and deployment. Compressed air energy storage and pumped hydro storage systems complete the available technologies.

Other electrochemical couples and processes have been identified and proven in the lab but have not yet been developed to the demonstration stage. Projects submitted under this subarea shall address concepts that could revolutionize the grid-scale energy storage landscape. They should seek to bring promising technologies rapidly to demonstration scale and ultimately towards market readiness. Proposed projects should be based on known processes and products, proven in the lab, but not yet applied and demonstrated for energy storage market application. Teaming with an industrial, university, or National Laboratory partner is desirable.

Applications should address the following goal at a minimum:

- Deliver a prototype system that can be grid connected and electrically charged and discharged with a plan for scaling the system to utility power levels

Applications should also at a minimum:

- Identify and describe elements of electric storage systems that the project will significantly improve (i.e. cost, storage capacity or density, lifetime, environmental impact, safety, etc.) through the demonstration
- Describe targeted market applications for the proposed new energy storage solution and provide an analysis of the value proposition for various stakeholders
- Describe anticipated performance and installed cost targets over time
- Address potential environmental impacts of the proposed system
- Contain a demonstration plan with multiple milestones, at appropriate points, in the development cycle
- Propose a project capable of being ready for operation within 4 years of project award.

PART II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

- DOE anticipates awarding cooperative agreements under this program announcement (See Section VI.B.2 Statement of Substantial Involvement)

B. ESTIMATED FUNDING

- Approximately \$615,000,000 in Federal funds is expected to be available for new awards under this announcement.

C. MAXIMUM AND MINIMUM AWARD SIZE

- Ceiling (i.e., the maximum amount for an individual award made under this announcement): **None**
- Floor (i.e., the minimum amount for an individual award made under this announcement): **None**
- However, Applicants should refer to Section E “Anticipated Award Size”

D. EXPECTED NUMBER OF AWARDS

- Under this announcement, DOE expects to make the following number of awards for each Program Area of Interest:

Area of Interest (AOI)	Title	Estimated Number of Selections Anticipated
1	Smart Grid Demonstrations	8-12 Total
2	Energy Storage	12-19 Total
2.1	Battery Storage for Utility Load Shifting or for Wind Farm Diurnal Operations and Ramping Control	1-2
2.2	Frequency Regulation Ancillary Services	1-2
2.3	Distributed Energy Storage for Grid Support	4-5
2.4	Compressed Air Energy Storage (CAES)	1-4
2.5	Demonstration of Promising Energy Storage Technologies	5-6

E. ANTICIPATED AWARD SIZE

- The anticipated award size for projects under each Program Area of Interest in this announcement is:

Area of Interest (AOI)	Title	Anticipated Award Sizes (Government Funding)
1	Smart Grid Demonstrations	Up to \$100M
2	Energy Storage	See below
2.1	Battery Storage for Utility Load Shifting or for Wind Farm Diurnal Operations and Ramping Control	\$40M to \$50M <u>total</u>
2.2	Frequency Regulation Ancillary Services	\$40M to \$50M <u>total</u>
2.3	Distributed Energy Storage for Grid Support	\$25M <u>total</u>
2.4	Compressed Air Energy Storage (CAES)	\$50M to \$60M <u>total</u>
2.5	Demonstration of Promising Energy Storage Technologies	\$25M <u>total</u>

F. PERIOD OF PERFORMANCE

- DOE anticipates making awards with project periods of three to five years.

G. TYPE OF APPLICATION

- DOE will accept only new applications under this announcement.

PART III - ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

- All types of domestic entities are eligible to apply as a prime Applicant (including but not limited to State Government agencies, local Government agencies, institutions of higher education, other non-profit organizations, and for project organizations) except other Federal agencies, Federally Funded Research and Development Center (FFRDC) Contractors, and nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.
- Federal agencies, including Power Marketing Administrations, Tennessee Valley Authority, and the United States Postal Service, are eligible only for supporting roles, but not for lead or prime roles.
- Some Applicants may be interested in both the Regional Demonstration Initiative, of which this FOA is part, and the Smart Grid Investment Grants FOA as identified in EISA sections 1304 and 1306, respectively. However, subsection (D) of EISA section 1304(b)(3) states that “[n]o person or entity participating in any demonstration project conducted under this subsection [Regional Demonstration Initiative] shall be eligible for grants under section 1306 “Federal Matching Fund for Smart Grid Investment Costs” [Smart Grid Investment Grants] for otherwise qualifying investments made as part of that demonstration project.” **DOE reminds Applicants of this prohibition so they may plan accordingly.**

B. COST SHARING

- The cost share must be at least 50% of the total allowable costs for demonstration and commercial application projects (i.e., the sum of the Government share, including FFRDC contractor costs if applicable, 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. Applicants are encouraged to propose projects that exceed this minimum cost share requirement. Such projects may be selected for award based upon the Other Selection Factors stated in Part V.A.3.

C. OTHER ELIGIBILITY REQUIREMENTS

- **Federally Funded Research and Development Center (FFRDC) Contractors.** FFRDC contractors are not eligible for an award under this announcement, but they may be proposed as a team member on another entity’s application subject to the following guidelines:

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

Authorization for DOE/NNSA FFRDCs. The cognizant contracting officer for the FFRDC must authorize in writing the use of a DOE/NNSA FFRDC contractor on the proposed

project and this authorization must be submitted with the application. The following wording is acceptable for this authorization.

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

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

Cost Share. The Applicant's cost share requirement will be based on the total cost of the project, including the Applicant's and the FFRDC contractor's portions of the effort.

FFRDC Contractor Effort:

- The FFRDC contractor effort, in aggregate, shall not exceed 5% of the total estimated cost of the project, including the Applicant's and the FFRDC contractor's portions of the effort.

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

PART IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE

Application forms and instructions are available at Grants.gov. To access these materials, go to <http://www.grants.gov>, select “Apply for Grants,” and then select “Download Application Package.” Enter the CFDA number of the funding opportunity number located on the cover of this announcement and then follow the prompts to save the application package. Once you have SAVED the application package and completed all the required documentation, you will submit your application via the Fedconnect portal. See Section C. below for specific instructions as to the naming of your application package. **DO NOT use the Save & Submit selection in Grants.gov.**

B. LETTER OF INTENT AND PRE-APPLICATION

1. Letter of Intent

- Letters of Intent are not required.

2. Pre-application

- Pre-applications are not required.

C. CONTENT AND FORM OF APPLICATION – 424 (R&R)

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

1. **SF 424 (R&R)** Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. To activate the instructions, turn on the “Help Mode” (Icon with the pointer and question mark at the top of the form). The list of certifications and assurances referenced in Field 17 can be found on the DOE Financial Assistance Forms Page at http://management.energy.gov/business_doe/business_forms.htm under Certification and Assurances.

2. RESEARCH AND RELATED Other Project Information

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

Project Summary/Abstract (Field 7 on the Form)

The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the Applicant, the 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 Department may make it available to the public. The project summary must not exceed 1 page when

printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point. To attach a Project Summary/Abstract, click "Add Attachment."

Project Narrative (Field 8 on the Form)

The project narrative must not exceed 60 pages, including cover page, table of contents, charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right). **EVALUATORS WILL ONLY REVIEW THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE.**

The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the application, because the information contained in these sites will not be reviewed. See Part VIII.D for instructions on how to mark proprietary application information. To attach a Project Narrative, click "Add Attachment."

Applicants must identify the Area of Interest they are applying to in the project narrative and identify the Area of Interest number in the file name. For example if an Applicant were applying to Area of Interest 1, identify the filename as Project01.pdf; if applying to Area of Interest 2 identify the file name as Project02.pdf.

The project narrative must include:

- Project Objectives: This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.
- Merit Review Criterion Discussion: The section should be formatted to address each merit review criterion and sub-criterion listed in Part V.A. Provide sufficient information so that reviewers will be able to evaluate the application in accordance with these merit review criteria. **DOE WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH MERIT REVIEW CRITERION AND SUB-CRITERION.**
- Relevance and Outcomes/Impacts: This section should explain the relevance of the effort to the objectives in the program announcement and the expected outcomes and/or impacts.
- Roles Of Participants: For multi-organizational or multi-investigator projects, describe the roles and the work to be performed by each participant/investigator, business agreements between the Applicant and participants, and how the various efforts will be integrated and managed.
- Project Performance Site: Indicate the primary site where the work will be performed. If a portion of the work will be performed at any other sites, identify those sites, also. For each site, the following items should be addressed at a minimum:
 1. Street address of proposed site. (If a street address is not adequate to locate the site, provide additional location description such as latitude and longitude;
 2. A brief description of the site and its surroundings (e.g. topography, geology, etc.);

3. Access to transportation, utilities, or other amenities necessary to execute the project;
4. Evidence of ownership or legal right to utilize the site for the duration of the project (e.g. deed or lease agreement) or plans to obtain legal rights to utilize the site for the duration of the project
5. Any additional pertinent environmental information relevant to the execution of the project that has not been specifically addressed in the Environmental Questionnaire (Attached to Field 12 of the Research and Related Other Project Information Form)

- Statement Of Project Objectives (SOPO):

The project narrative must contain a single, detailed Statement of Project Objectives that addresses how the project objectives will be met. The Statement of Project Objectives must contain a clear, concise description of all activities to be completed during project performance and follow the structure discussed below. The Statement of Project Objectives may be released to the public by the DOE in whole or in part. It is therefore required that it shall not contain proprietary or confidential business information.

Several specific tasks have also been identified in the following format for the Applicant to utilize in generating their proposed Statement of Project Objectives. In addition, guidance has been provided (*in italics*) to describe the Government's minimum requirements for several of the tasks identified.

The Statement of Project Objectives is generally less than 5 pages in total for the proposed work. Applicants shall prepare the Statement of Project Objectives in the following format:

TITLE OF WORK TO BE PERFORMED

(Insert the title of work to be performed. Be descriptive yet concise.)

PROGRAM AREA OF INTEREST

(Insert the title of the Program Area of Interest to which the application is being submitted.)

A. Project Objectives

Include one paragraph on the overall objective(s) of the work. Also, include objective(s) for each phase of the work.

B. Project Scope (Scope of Work)

This section should not exceed one-half page and should summarize the effort and approach to achieve the objective(s) of the work for each Phase.

C. Tasks to be Performed (Divided into appropriate phases/budget periods)

Tasks, concisely written, should be provided in a logical sequence and should be divided into the phases of the project, as appropriate. This section provides a brief summary of the planned approach to this project. Tasks described below shall be included in the Applicant's SOPO at a minimum.

Additional tasks and subtasks should be included and described by the Applicant as appropriate for the work being proposed.

Phase I – Project Definition and NEPA Compliance

Task 1.0 – Update Project Management Plan (PMP)

Describe the approach to update the Project Management Plan that was submitted with application. At a minimum, the Project Management Plan should be revised immediately after project award and at each project decision point to reflect changes in schedule, resources, key technical drivers, and technical approach.

Task 2.0 – National Environmental Protection Act (NEPA) Compliance

Describe proposed approach to comply with NEPA. If the DOE determines that the proposed project qualifies for a Categorical Exclusion under its NEPA regulations, then no additional NEPA analyses will be needed for the DOE to authorize the Recipient to proceed to Phase II of the project. However, if the DOE determines that an Environmental Assessment (EA) or Environmental Impact Statement (EIS) is required, the Recipient will be required to work with the DOE to complete the NEPA process including performing further assessment, evaluation, analyses, and documentation to complete the EA or EIS prior to a decision by the DOE regarding authorization to proceed to Phase II. Should an EA or EIS be necessary, the DOE reserves the right to use a third party contract arrangement

Task 3.0 – Baseline for evaluating project performance

Describe approach for baselining project performance.

Task 4.0 – (Title)

(Description)

Decision Point 1 – Preliminary Design and NEPA Compliance Review (go/no-go decision point): Approval to proceed with Final Design and Construction

Phase II – Final Design & Construction

Task 5.0 – (Title)

(Description)

Decision Point 2 – Operational Readiness Review (go/no-go decision point): Approval to proceed with Commissioning and Operations

Phase III – Commissioning & Operations

Task 6.0 – Data Collection: *Describe approach for data collection. At a minimum, the Recipient is expected to accumulate 24 months of operational data during the operations phase (period(s) following commissioning) of the project ;the DOE will require the submittal of data at least yearly. The Recipient is expected to propose the data collection plan that includes parameters to be measured, reasoning for selection of identified parameters, methodology/technology employed to take measurements, data collection methodology or automated system description, data reduction or manipulation required, and method and format to present data..*

Task 7.0 – (Title)

(Description)

D. Deliverables

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

Note: The Recipient shall provide a list of deliverables other than those identified on the "Federal Assistance Reporting Checklist" that will be delivered. These reports shall also be identified within the text of the Statement of Project Objectives. See the following examples:

- 1. Task 1.1 - (Report Description)*
- 2. Task 2.2 - (Report Description)*

E. Reporting, Briefings and Technical Presentations

Reports and other deliverables will be provided in accordance with the Federal Assistance Reporting Checklist. Further, deliverables (as listed previously under Section D) will closely track the purpose, approach, and expected outcomes of each task. In addition, annual detailed briefings will be presented to the Project Officer at the Project Officer's facility located in Pittsburgh, PA; Morgantown, WV; or Washington, DC, to explain the plans, progress and results of the technical effort. The first briefing (kick-off meeting) will be presented within 30 days of the effective date of the Award. Additional briefings will be presented at least 30 days before completion of each Budget Period. A final briefing will be presented at least 30 days prior to expiration of the Award.

This project is also subject to periodic DOE Peer Reviews, and a Reasonableness Review conducted by the DOE during the first Budget Period.

(End of sample SOPO)

In order to reduce the total number of files attached to your application, the following two Appendices shall be incorporated into the Project Narrative file. However, they will not count against the 60-page limitation for the project narrative file. Do not attach the Bibliography & References Cited Appendix, the Facilities & Other

Resources Appendix, and the Equipment Appendix as separate files under fields 9 and 11 respectively of the Research & Related Other Project Information form.

- **Bibliography & References Cited Appendix:**
Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. In order to reduce the number of files attached to your application, please provide the Bibliography and References Cited information as an appendix to your project narrative. Do not attach a file in field 9. This appendix will not count in the project narrative page limitation.
- **Equipment Appendix:**
List major items of equipment already available for this project and, if appropriate identify location and pertinent capabilities. For the purposes of this section, “major” is defined as having fair-market value in excess of \$5,000. In order to reduce the number of files attached to your application, please provide the Equipment information as an appendix to your project narrative. Do not attach a file in field 11. This appendix will not count in the project narrative page limitation.

Other Attachments (Field 12 on the form):

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

Also, attach the following files:

Project Management Plan

The Project Management Plan (PMP) is included in the application but must be updated and resubmitted to the DOE Project Officer within 90 days after the effective date of an Award or the initiation of a new Budget Period. The plan shall include description of the provisions made to update the PMP throughout execution of the project. This plan should be formatted to include the following sections with each section to include, at a minimum, the information as described below:

- A. **Executive Summary:** Provide a description of the project that includes the objective, project goals, and expected results. For purposes of the application, this information is included in the Project Summary/Abstract (Field 7) of the Research and Related Other Project Information form and should be simply copied to this document for completeness, so that the Project Management Plan is a stand-alone document.
- B. **Risk Management:** Provide a summary description of the proposed approach to identify, analyze, and respond to perceived risks associated with the proposed project. Project risk events are uncertain future events that, if realized,

impact the success of the project. As a minimum, include the initial identification of significant technical, resource, and management issues that have the potential to impede project progress and strategies to minimize impacts from those issues.

C. Organizational Breakdown Structure: Provide a project Organizational Breakdown Structure (OBS) describing lines of communication, management and reporting among team members along with a description of the organizational and individual roles, responsibilities, authorities, and task assignments for each project participant.

D. Work Breakdown Structure: Provide a Work Breakdown Structure (WBS) indicating the resource requirements for each task or activity. Also include discussion of available resources to meet the labor, equipment, and material requirements as scheduled.

E. Milestone Log: Provide milestones for each budget period (or phase) of the project. Each milestone should include a title and planned completion date, Milestones should be quantitative and show progress toward budget period and/or project goals.

[Note: During project performance, the Recipient will report the Milestone Status as part of the required quarterly Progress Report as prescribed under the Reporting Requirements Checklist. The Milestone Status will present actual performance in comparison with the Milestone Log, and include:

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

F. Funding and Costing Profile: Provide a table (the Project Funding Profile) that shows, by budget period, the amount of government funding going to each project team member. Also provide a table (the Project Costing Profile) that projects, by month, the expenditure of government funds for the first budget period, and anticipated yearly costs for subsequent performance/budget periods, at a minimum.

G. Project Timeline: Provide a timeline of the project (similar to a Gantt chart) broken down by each task and subtask, as described in the Statement of Project Objectives. The timeline should include for each task, a start date, and end date. The timeline should show interdependencies between tasks and include the milestones identified in the Milestone Log (Section E).

H. Success Criteria at Decision Points: Provide success criteria for each decision point in the project, including go/no-go decision points at the conclusion of each Phase/budget period and at the end of the project. The success criteria should be objective and stated in terms of specific, measurable, and repeatable data. Usually, the success criteria pertain to desirable outcomes, results, and observations from the project.

I. DOE Plans for Analysis of Data: Provide a discussion of the plan for data collection and determination of project costs and benefits to meet the objectives of the DOE cost benefits analysis methodology, as outlined below. An objective of the Smart Grid Demonstrations is to demonstrate the viability of Smart Grid technologies, including energy storage, to support electricity delivery systems by supplying power during periods of peak load and by enabling other ancillary services that optimize electric system operational performance. To optimize the outcome of projects for the public good, the DOE intends to be involved in Benchmarking and other project strategies as provided under the Substantial Involvement Clause. For projects awarded under this Announcement, such optimization includes a level of coordination and uniformity that ensures consistency with the broad understandings, standards, and best practices of various stakeholders involved in the nation's electrical infrastructure. This optimization requires effective measurement and determination of performance, homogenous analytical methods (including cost and benefit analysis), effective technology transfer, and assured knowledge and understanding of the anticipated benefits of the project. The DOE plans on utilizing resources to ensure that all demonstration projects selected for award are evaluated consistently. To this end, the DOE will apply a uniform cost-benefit analysis (CBA) methodology (provided in Appendix A) to ensure the consistent analysis of data gathered from all Smart Grid Demonstration projects. Details about these efforts follow.

I.1 Project performance baseline: Given the objectives of the Smart Grid Demonstrations and in addition to the previously mentioned elements, the PMP is to include sufficient historical operating data for the electric transmission and distribution systems such that a baseline is established, against which demonstration project performance can be measured. The Recipient should propose the historical operating parameters that will be used to establish the performance baseline, including any necessary augmentation or manipulation of the data necessary to affect a logical and accurate comparison to the proposed demonstration project once complete. If prior operating information is not available (such as in the case of proposed new technologies or systems) projections and results of system modeling, simulations and studies relating to the above described parameters may be used in lieu of historical operating data.

I.2 Cost and Benefit Analysis: In order to assure that all demonstration projects selected for award under the Smart Grid Demonstrations Funding Opportunity Announcement are evaluated consistently, the DOE will apply a uniform CBA methodology to ascertain the performance of the demonstrations against established baselines. The methodology will involve the collection of data and compare the performance of the demonstration technology(ies) to the established baseline(s). In addition, the Recipient may choose to conduct their own CBA using a different method than the one developed with the DOE. However, while the recipient can conduct their own analysis, the DOE will compare the collected demonstration data with baseline data using the developed CBA methodology. At the discretion of the DOE Project Officer and Program/Technology Manager, the result(s) of either the DOE evaluation or the Recipient's analysis may be considered for determining whether to continue, modify or terminate the project.

I.3 Deployment of equipment, instrumentation and processes: The PMP should also include provisions for installing, removing and relocating measurement, monitoring, communications and control devices for the proposed demonstration. This plan should include a list of the proposed devices and methodologies to be demonstrated, a brief description of the function and purpose, the location(s) where the instruments, sensors, controllers, etc. will be installed, and a deployment schedule.

I.4 Data collection, validation and analysis: The Recipient is expected to accumulate a minimum of 24 months of operational data during the operations phase (period(s) following commissioning) of the project. Therefore, the PMP should also incorporate provisions for gathering data during the operations phase and subsequently analyzing and presenting the collected data. To assist with this effort, the PMP and above-mentioned supporting historical data will be reviewed by the DOE. The PMP should also address the Recipient's plan for collaborating with the DOE in developing a methodology for gathering, analyzing, and validating collected data and measuring project performance.

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

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

Funding Plan

At the time of application submission, the Applicant must have a plan to obtain the funding for the entire non-DOE share of the total project cost. **The Applicant must submit a funding plan that identifies all sources of project funds.**

The Applicant shall provide sufficient evidence to demonstrate the Applicant's financial capability to fund, or obtain funding, for the non-DOE share of the proposed project costs. The Applicant shall include a full description of any liabilities, limitations, conditions or other factors which could affect the availability of Applicant's funding, including the need to obtain any necessary regulatory approvals. If Third Party (i.e., not from the Applicant or its parent organization) financing will be a source of project funds, the Applicant shall discuss the terms and conditions of such financing. If the application is based on funds from third party sources, such as banks or the capital markets, the timing and conditionality of any such funding shall be clearly described.

The funding plan must demonstrate funds necessary for Phase I will be committed at the time of award. Further, the plan must demonstrate that the funds necessary for the remainder of the project will be committed by the end of the Phase I.

This section must also include a schedule showing the detailed sources and uses of funds for the project, including the amount and timing for all funding to be

provided by non-DOE sources. The project sources and uses of funds schedule should include sources and uses of funds by phase (e.g., project definition, design, construction, and demonstration) and the projected schedule for each phase should be stated. The sources and uses of funds schedule should be in agreement with the project's total estimated costs and schedule for expenditures. It is important that Applicants demonstrate that they have the capacity to fund the project development costs. Therefore, the sources and uses of funds statement should begin prior to the beginning of construction, and should identify the estimated annual budget for and source of funding to meet project development costs including amounts for legal, engineering, financial, environmental, overhead, and other development costs.

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

Commitment Letters from Third Parties Contributing to Cost Sharing

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

Budget for DOE/NNSA Federally Funded Research and Development Center (FFRDC) Contractor, if applicable. If a DOE/NNSA FFRDC contractor is to perform a portion of the work, you must provide a DOE Field Work Proposal in accordance with the requirements in DOE Order 412.1 Work Authorization System. This order and the DOE Field Work Proposal form are available at http://management.energy.gov/business_doe/business_forms.htm. Use the FFRDC name as the file name (up to 10 letters) and attach to the R&R Other Project Information form in Field 12 – Add Attachments.

Environmental Questionnaire

You must complete the environmental questionnaire at <http://www.netl.doe.gov/business/forms.html>. Save the questionnaire in a single file named "Env.pdf" and click on "Add Attachments" in Field 12 to attach.

3. RESEARCH AND RELATED Senior/Key Person

Complete this form before the Budget form (described in #4 below) to populate data on the Budget form. Beginning with the PD/PI, provide a profile for each senior/key person proposed. A senior/key person is any individual who contributes in a substantive, measurable way to the scientific/technical development or execution of the project, whether or not a salary is proposed for this individual. Subawardees and consultants must be included if they meet this definition. For each senior/key person provide:

Biographical Sketch.

Complete a biographical sketch for each senior/key person and attach to the "Attach Biographical Sketch" field in each profile. The biographical information for

each person must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must include:

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

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

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

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

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

Current and Pending Support

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

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

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

Budget Justification (Field K on the form). Provide the required supporting information for the following costs (See R&R instructions): equipment; domestic and foreign travel; participant/trainees; material and supplies;

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

ARRA 2009 Additional Budget Justification Information. Proposals shall provide information which validates that all laborers and mechanics on projects funded directly by or assisted in whole or in part by and through funding appropriated by the Act are paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by subchapter IV of Chapter 31 of title 40, United States Code (Davis-Bacon Act). For guidance on how to comply with this provision, see <http://www.dol.gov/esa/whd/contracts/dbra.htm>.

5. R&R SUBAWARD (Total Fed + Non-Fed) FORM

Budgets for Subawardees, other than DOE FFRDC Contractors. You must provide a separate cumulative R&R budget for each subawardee that is expected to perform work estimated to be more than \$100,000 or 50 percent of the total work effort (whichever is less). Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET (Total Fed + Non-Fed) FORM and e-mail it to each subawardee that is required to submit a separate budget. After the Subawardee has e-mailed its completed budget back to you, attach it to one of the blocks provided on the form. Use up to 10 letters of the subawardee's name as the file name.

6. Project/Performance Site Location(s)

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

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

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

7. Disclosure of Lobbying Activities (SF-LLL)

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

Summary of Required Forms/Files

Your application must include the following documents:

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
RESEARCH AND RELATED Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 7
Project Narrative, including required appendices	PDF	Field 8
Project Management Plan	PDF	Field 12
Funding Plan	PDF	Field 12
Commitment Letters from Third Parties	PDF	Field 12
Budget for DOE/NNSA FFRDC, if applicable	PDF	Field 12
Environmental Questionnaire	PDF	Field 12
RESEARCH & RELATED SENIOR/KEY PERSON Profile (Expanded) (Optional)	Form	N/A
Biographical Sketch	PDF	Attach to appropriate block
Current and Pending Support	PDF	Attach to appropriate block
RESEARCH AND RELATED BUDGET (Total Fed + Non-Fed)	Form	N/A
Budget Justification	PDF	Field K
R&R SUBAWARD BUDGET (Total Fed + Non-Fed) ATTACHMENT(S) FORM , if applicable	Form	N/A
PROJECT/PERFORMANCE SITE LOCATION(S)	Form	N/A
SF-LLL Disclosure of Lobbying Activities , if applicable	Form	N/A

D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS

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

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Signed copy of NERC Data Disclosure Agreement

E. SUBMISSION DATES AND TIMES

1. Pre-application Due Date

- Pre-applications are not required.

2. Application Due Date

- Applications should be received by August 26, 2009, not later than 3:00 PM Eastern Time. You are encouraged to transmit your application well before the deadline. APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.

F. INTERGOVERNMENTAL REVIEW

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

G. FUNDING RESTRICTIONS

Cost Principles Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. The cost principles for commercial organization are in FAR Part 31.

Pre-award Costs Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

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

H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. Where to Submit

- **APPLICATIONS MUST BE SUBMITTED THROUGH FEDCONNECT TO BE CONSIDERED FOR AWARD.** Submit electronic applications through the FedConnect portal at www.fedconnect.net. Information regarding how to submit applications via Fed Connect can be found at https://www.fedconnect.net/FedConnect/PublicPages/FedConnect_Ready_Set_Go.pdf.

Further, it is the responsibility of the Applicant, prior to the offer due date and time, to verify successful transmission.

2. Registration Process

- There are several one-time actions you must complete in order to submit an application in response to this Announcement (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), and register with FedConnect). Applicants, who are not registered with CCR and FedConnect, should allow at least 10 days to complete these requirements. It is suggested that the process be started as soon as possible.

Part V - APPLICATION REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the Applicant is eligible for an award; (2) the information required by the announcement has been submitted; (3) all mandatory requirements are satisfied; and (4) the proposed project is responsive to the objectives of the funding opportunity announcement.

2. Merit Review Criteria

The following table indicates how criterion weighting will be applied:

Criterion	Criteria Weighting
1 – Project Approach	35%
2 – Significance & Impact	25%
3 – Interoperability and Cyber Security	20%
4 – Project Team	20%

Evaluation Criteria will be largely the same across both program areas of interest. Some criteria apply to only one program area of interest and have been so noted in the descriptions below:

1. Project Approach (35%)

- Comprehensiveness and completeness of the Statement of Project Objectives (SOPO) that describes the proposed interrelated tasks and of the Project Management Plan that includes a schedule with milestones and explains how the project will be managed to achieve objectives on time and within budget
- Completeness of the proposed demonstration approach to effectively address each of the goals of the applicable program: Area of Interest 1 shall address the goals of the Smart Grid Demonstration Initiative and Area of Interest 2 shall address the goals of the Energy Storage Competitiveness Act⁴
- Adequacy of the proposed demonstration approach to quantifiably advance program metrics
- Validity of the proposed approach and likelihood of success based on current technology maturity and regulatory/stakeholder acceptance of the technology
- Innovativeness of the project, including introduction of new technologies and creative applications of new and state-of-the-practice smart grid (Area of Interest 1) or energy storage (Area of Interest 2) technologies
- Appropriateness and completeness of the demonstration plan including performance objectives of the demonstration, the criteria and requirements used

⁴ Public Law No: 110-140: Energy Independence and Security Act of 2007

- in selecting demonstration site(s), the data collection and evaluation plan, the metrics for success, and the measurements that will be made to confirm success
- Adequacy and completeness of the project approach in delivering demonstration project data and information to the Smart Grid Information Clearinghouse (where applicable), the Department, and the public
 - Suitability and availability of the proposed project site(s) to meet the overall program objectives for scope and scale appropriate for the technology(ies) being demonstrated.
 - Adequacy of plans for data collection and analysis of project costs and benefits, including the following aspects:
 - Thoroughness of the discussion of data requirements (including what types of data and their availability) and how that data will be provided to the DOE so that project costs and benefits can be properly analyzed
 - Logic and completeness of the discussion of how the data can be used by the DOE to develop estimates of project costs and benefits, including the discussion of the Applicant's quantified estimates of project benefits
 - Comprehensiveness of the plan for determining the baseline against which the costs and benefits will be assessed
 - The degree of the proposed estimates of project benefits

2. Significance and Impact (25%)

- Significance of the proposed demonstration application vs. current practices – Completeness of this assessment to consider benefits in terms of anticipated performance improvements (technical, operational, and environmental aspects) and cost savings of the proposed application over current practices
- Degree to which the demonstration project is broadly applicable and adaptable throughout the region or the nation, including the completeness and adequacy of the deployment plan for large-scale deployment in and/or beyond the proposed region
- Adequacy and impact of the public outreach and education plan on public acceptance of smart grid transformation (Area of Interest 1 – Regional Demonstrations only)
- Completeness of the proposed commercialization strategy for the technology(ies) being demonstrated
- Extent to which demonstration advances research and demonstration objectives of the program: Area of Interest 1 shall address the goals of the Smart Grid Demonstration Initiative, and Area of Interest 2 shall address the goals of the Energy Storage Competitiveness Act
- Viability and practicality of the proposed technology to meet the needs of the target market in a cost effective manner

3. Interoperability and Cyber Security (20%)

- Adequacy and completeness of approach to address interoperability, including the description of the automation component interfaces (devices and systems), how integration is supported to achieve interoperability, and how interoperability concerns will be addressed throughout all phases of the engineering lifecycle, including design, acquisition, implementation, integration, test, deployment, operations, maintenance, and upgrade
- Adequacy and completeness of approach for cyber security concerns and protections and how they will be addressed throughout the project, including the adequacy of the discussion of the integration of the new smart grid application into the existing environment, and how any new cyber security vulnerabilities will

be mitigated through technology or other measures. Although sensitive cyber security details that would jeopardize system security if they were exposed should not be revealed in the application, sufficient detail should be included to judge the project on its cyber security merits.

4. Project Team (20%)

- Completeness and qualifications of the proposed project team, with defined roles and responsibilities for each team member and with appropriate members committed to the demonstration or technology verification
- Demonstrated level of corporate commitment to the proposed project and proposed cost share as evidenced by letters of intent from all proposed team members
- Demonstrated level of corporate commitment to commercialization of the proposed technology by providing convincing examples of the Applicant's efforts to commercialize the technology in addition to the proposed project

3. Other Selection Factors

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

1. It may be desirable to select for award a group of projects which represents a diversity of technical approaches and methods;
2. It may be desirable to support complementary and/or duplicative efforts or projects, which, when taken together, will best achieve the research goals and objectives;
3. It may be desirable to select different kinds and sizes of organizations in order to provide a balanced programmatic effort and a variety of different technical perspectives;
4. It may be desirable, because of the nature of the energy source, the type of projects envisioned, or limitations of past efforts, to select a group of projects with a broad or specific geographic distribution;
5. It may be desirable to select project(s) of less technical merit than other project(s) if such a selection will optimize use of available funds by allowing more projects to be supported and not be detrimental to the overall objectives of the program; and
6. It may be desirable to select project(s) of less technical merit than other project(s) if such a selection is likely to present a significantly lower level of risk for successful execution due to the higher proposed level of cost share.
7. It may be desirable to select project(s) which promote and enhance the objectives of the American Recovery and Reinvestment Act of 2009, P.L. 111-5, especially job creation, and/or preservation and economic recovery in an expeditious manner.

B. REVIEW AND SELECTION PROCESS

1. Merit Review

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

under Financial Assistance, Regulations and Guidance at <http://www.management.energy.gov/documents/meritrev.pdf>.

- All applications submitted to Area of Interest 2 will be evaluated using the same merit review criteria; however, applications will be ranked by sub-areas of interest, e.g., 2.1, 2.2, etc., for the selection process.

2. Selection

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

3. Discussions and Award

- The Government may enter into discussions with a selected Applicant for any reason deemed necessary, including but not limited to: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 10 CFR part 600; and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the Applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

DOE anticipates notifying Applicants selected for award by early November 2009 and making awards beginning in December 2009/January 2010.

Part VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. Notice of Selection

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

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

2. Notice of Award

- A Notice of Financial Assistance Award or Assistance Agreement issued by the contracting officer is the authorizing award document. It normally includes either as an attachment or by reference: (1). Special Terms and Conditions; (2). Applicable program regulations, if any; (3). Application as approved by DOE; (4). DOE assistance regulations at 10 CFR part 600; (5). National Policy Assurances To Be Incorporated As Award Terms; (6). Budget Summary; and (7). Federal Assistance Reporting Checklist, which identifies the reporting requirements.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR part 600 (See: <http://ecfr.gpoaccess.gov>). Grants and cooperative agreements made to universities, non-profits and other entities subject to OMB Circular A-110 are subject to the Research Terms and Conditions located on the National Science Foundation web site at <http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp>.

ARRA 2009 Award Administration Information

Special Provisions relating to work funded under American Recovery and Reinvestment Act of 2009, Pub. L. 111-5 shall apply. These provisions can be found at http://management.energy.gov/policy_guidance/1672.htm.

2. Special Terms and Conditions and National Policy Requirements

Special Terms and Conditions and National Policy Requirements

The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at

http://management.energy.gov/business_doe/business_forms.htm.

The National Policy Assurances To Be Incorporated As Award Terms are located at DOE http://management.energy.gov/business_doe/business_forms.htm.

Intellectual Property Provisions

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://www.gc.doe.gov/financial_assistance_awards.htm.

Equipment and Property

Disposition of property acquired under subject awards will be governed by the applicable sections of the DOE Financial Assistance Regulations (10 CFR 600).

Statement of Substantial Involvement

RECIPIENT'S RESPONSIBILITIES. The Recipient is responsible for:

Performing the activities supported by this award in accordance with the Project Management Plan, including providing the required personnel, facilities, equipment, supplies and services;

Managing and controlling project activities, including coordinating any Federally Funded Research and Development Center (FFRDC) activities that are performed in the project, in accordance with established processes and procedures to ensure tasks and subtasks are completed within schedule and budget constraints defined by the current Project Management Plan.

Implementing an approach to identify, analyze, and respond to project risks that is commensurate with the complexity of the project.

Defining and revising approaches and plans, submitting the plans to the DOE for review, and incorporating DOE comments;

Coordinating related project activities with external suppliers, including DOE M&O contractors, to ensure effective integration of all work elements;

Attending semiannual program review meetings and reporting project status;

Submitting technical reports and incorporating DOE comments; and;

Presenting the project results at appropriate technical conferences or meetings as directed by the DOE Project Officer (number of conferences/meetings will not exceed five).

DOE RESPONSIBILITIES. DOE is responsible for:

Reviewing in a timely manner project plans, including project management, testing and technology transfer plans, and recommending alternate approaches, if the plans do not address critical programmatic issues;

Participating in project management planning activities, including risk analysis, to ensure DOE's program requirements or limitations are considered in performance of the work elements.

Conducting semiannual program review meetings to ensure adequate progress and that the work accomplishes the program and project objectives. Recommending alternate approaches or shifting work emphasis, if needed;

Integrating and redirecting the work effort to ensure that project results

address critical system and programmatic goals established by the DOE OE, in coordination with the DOE Renewables and Distributed Systems Integration Program.

Promoting and facilitating technology transfer activities, including disseminating program results through presentations and publications; and

Serving as scientific/technical liaison between awardees and other program or industry staff.

Oversight of work performed by FFRDCs (if applicable) in support of the project. Implementation of revisions to the tasks performed by FFRDCs, if needed and within available funding;

Work to identify and provide guidance on any issues related to availability of available Smart Grid technologies/supplies

Provide the Recipient with guidance on any cyber-security requirements that are necessary.

The DOE intends to utilize resources at the National Energy Technology Laboratory (NETL) to assist in determining the appropriate data to be gathered and to provide an overall programmatically consistent approach for technical, economic, and benefit analysis based on the gathered data. In support of this effort, the Project Officer will be significantly involved to:

- Assist demonstration project team in establishing project goals, metrics, and data requirements
- Determine specific data to be collected, frequency of collection, & method of collection
- Determine approach to use raw data
- Determine baseline costs and performance prior to introduction of Smart Grid technologies and systems
- Determine demonstration costs and performance
- Compare cost and performance of demonstration circuit(s) before and after introduction of Smart Grid technologies and systems

C. REPORTING

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. For a sample Checklist, see <http://management.energy.gov/documents/DOEF46002PolicyVersion.pdf>

PART VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions regarding the FINAL Funding Opportunity Announcement (FOA):

Questions regarding the **content** of the **FINAL** announcement must be submitted through the FedConnect portal. You must register with FedConnect to respond as an interested party to submit questions, and to view responses to questions. It is recommended that you register as soon after release of the FOA as possible to have the benefit of all responses. More information is available at <http://www.compusearch.com/products/fedconnect/fedconnect.asp>. DOE will try to respond to questions submitted regarding the **FINAL** FOA within 3 business days, unless a similar question and answer have already been posted on the website. DOE will not respond to questions received within 5 days of the FOA closing date.

B. AGENCY CONTACT

Name:	Keith Carrington, Contract Specialist
E-mail:	keith.carrington@netl.doe.gov
FAX:	(304) 285-4683
Telephone (Optional):	(304) 285-4456

PART VIII - OTHER INFORMATION

A. MODIFICATIONS

Notices of any modifications to this announcement will be posted on Grants.gov and the FedConnect portal. You can receive an email when a modification or an announcement message is posted by registering with FedConnect as an interested party for this FOA. It is recommended that you register as soon after release of the FOA as possible to ensure you receive timely notice of any modifications or other announcements. More information is available at <http://www.fedconnect.net> and <http://www.compusearch.com/products/fedconnect/fedconnect.asp>.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

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

C. COMMITMENT OF PUBLIC FUNDS

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

D. PROPRIETARY APPLICATION INFORMATION

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

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

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

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

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL

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

F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM

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

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

G. CLASS PATENT WAIVER

DOE intends to issue a class patent waiver to Recipients under the Program that do not obtain rights under the Bayh-Dole Act as indicated in the following paragraph. The standard DOE waiver terms and conditions are available for review at: <http://www.gc.doe.gov/documents/patwaivclau.pdf>. However, please note that these standard terms and conditions may be modified in the class patent waiver for awards resulting from this FOA based upon requirements of the American Recovery and Reinvestment Act of 2009 and unique aspects of this program as set forth in EISA. Applicants are encouraged to review the standard class patent waiver terms to prepare for consideration of the actual class patent waiver terms that will be identified for this requirement after selection of successful Applicants.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

APPENDIX A – DOE ESTIMATION OF PROJECT COSTS AND BENEFITS

To ensure consistency in the estimation of overall and net benefits derived from all projects/awards, the DOE will apply a cost-benefit analysis (CBA) methodology. The CBA methodology will include a number of methods for estimating and calculating project costs and benefits. The specific methods will vary depending on the nature of each project, including the smart grid functionality it supports, the scope of the technology deployment and associated costs, and the specific benefits that it provides. While the details of benefits estimation for each project might vary, the CBA methodology will be applied uniformly, and to the extent possible, the DOE will use the same method, from project to project, to estimate each given type of benefit. For example, the DOE will estimate reliability-related benefits of a project the same way for all projects that provide this type of benefit. The DOE recognizes that projects will differ and does not anticipate that an Applicant's project will be able to provide every type of benefit.

This standardized approach will enable the DOE and Recipients to have their project benefits estimated consistently, as well as reduce the burden on Recipients who will not be expected to calculate the benefits of their projects. DOE will conduct cost-benefit analysis based on project impact, cost, and other data provided by Recipients during the course of the project and after the smart grid technologies, tools, and techniques have been deployed.

A. Types of Benefits

Within the CBA methodology, a "benefit" is defined as a final outcome of value that accrues to a stakeholder. Benefits can be expressed directly in monetary terms, or the equivalent monetary value can be imputed. For example, an operational cost savings gained by reducing the labor required to manually operate a distribution switch can be determined directly. However, the benefit of reducing outage minutes for a group of residential customers might require estimating the value of the lost service for that customer class.

The CBA methodology distinguishes between benefits and intermediate outcomes that, in turn, lead to benefits. For example, reduced loads reduce the costs of associated reserve margin requirements as well as reduced environmental emissions. Reductions in the costs of these latter considerations are benefits, whereas load reduction is an intermediate outcome that leads to these benefits.

The CBA methodology also distinguishes between a benefit (i.e., an economic value) and progress toward smart grid characteristics. This FOA discusses the goals of the Smart Grid program and the characteristics that define a smarter electric grid as well as provides the metrics that the DOE plans to use to track the progress of smart grid implementation across the country. Although there is some overlap between the concepts, "characteristics" refer to the desirable *attributes* of a smart grid; "metrics" refer to the

physical impacts that are indicators of the deployment of smart grid technologies, tools, and techniques; “benefits” refer to the monetary advantages that result, and “net benefits” refer to the value of the benefits net of the costs incurred to produce them.

The goal of the CBA methodology is to provide a means to consistently calculate the economic value that each project provides. Examples of benefits that the DOE would like to examine include:

- Lower electricity costs to consumers from flatter load curves that result from smart meter applications and changes in consumer behavior in response to tariffs that provide incentive to use less electricity during peak hours;
- Lower transmission and distribution (T&D) losses from an optimized T&D network and from having generation closer to load (distributed generation);
- Lower operations and maintenance costs from reduced need for O&M activity and from lower equipment failure rates;
- Reduced transmission congestion costs from increased transmission transfer capability without building additional transmission capacity;
- Reduced cost of power interruptions as a result of fewer and shorter interruptions, and better power quality, that is, fewer momentary interruptions and voltage sags and swells;
- Reduced damages from greenhouse gas emissions due to lower electricity consumption, lower T&D losses, and generation from clean energy generation substituting for power from less clean sources.

Depending on the type of smart grid application, the DOE would expect various, specific types of benefits. Applicants might also suggest other types of benefits their project might provide or alternatives to the data which the DOE is expecting Recipients to provide in order for it to estimate these benefits. In these instances, Applicants should explain these benefits, how they differ from those the DOE has identified, and the data the Applicant would provide to the DOE to estimate these benefits.

Table A.1 summarizes the types of benefits that the CBA methodology is designed to quantify, along with the sources of these benefits.

Table A.1. Benefits and Sources of Benefits

Benefit	Sources of Benefit
Lower electricity cost	<ul style="list-style-type: none"> • Consumption shifted to lower price periods • Lower total electricity consumption

Lower T&D losses	<ul style="list-style-type: none"> • Optimized T&D network • Generation closer to load (DG)
Lower O&M costs	<ul style="list-style-type: none"> • Reduced O&M activity • Lower equipment failure
Greater transmission capability	<ul style="list-style-type: none"> • Increasing transfer capability without building additional transmission capacity
Reduced power interruptions	<ul style="list-style-type: none"> • Fewer outages • Shorter outages
Better power quality	<ul style="list-style-type: none"> • Fewer momentary outages • Fewer severe sags and swells • Lower harmonic distortion
Lower GHG/carbon emissions	<ul style="list-style-type: none"> • Lower T&D losses • Lower emissions from generation
Reduced oil consumption	<ul style="list-style-type: none"> • Electricity substituting for oil by “smart grid-enabled” electric vehicles

B. Data which the Recipient is to Provide

After award, the DOE will work with Recipients to finalize the types of costs and benefits which the Recipient anticipates from its project and on the specific data and cost information it will provide to the DOE in order for it to calculate overall and net benefits. Data on a baseline set of conditions will be needed as well, so as to estimate before- and after-, or the without- and with- project effects.

The purpose of data reporting is to demonstrate the impact of the project. Project data will become input to the CBA methodology which will use the data to calculate benefits. The data is important because it will make it possible to objectively assess each project. For example, two projects might both include demand response functionality enabled by smart meters and dynamic pricing. By reporting hourly load profiles, both projects will be able to demonstrate the peak shifting functionality of the smart grid technology and associated tariff. These measured impacts will then be used to determine the benefits of

each project that might result from peak shifting.

Depending on the goals of the project and the types of benefits that the Recipient anticipates from its project, it can expect to provide to the DOE the relevant data listed in Tables A.2, A.3, and A.4. Although the DOE currently regards this listing to include data of particular relevance in estimating the identified benefits, it is also interested in other useful data. For example, measurement of power quality events is currently limited, and the DOE is interested in, for example, the possible use of advanced smart meters to compile data on the frequency of voltage sags among commercial and industrial end-users.

Table A.2. Information Related to Electricity End-Use

Information Reported	Example Calculations Supported
Monthly electricity cost by customer (\$)	<ul style="list-style-type: none"> • Consumer electricity cost
Hourly consumption by customer (kWh)	<ul style="list-style-type: none"> • Consumer electricity cost • T&D capacity deferral
Tariff description by customer	<ul style="list-style-type: none"> • Consumer electricity cost
Demographic and other information affecting demand	<ul style="list-style-type: none"> • Consumer electricity cost
Smart appliances in use	<ul style="list-style-type: none"> • Consumer electricity cost • T&D capacity deferral

Table A.3. Information Related to T&D Performance

Information Reported	Example Calculations Supported
System Average Interruption Frequency Index (SAIFI)	<ul style="list-style-type: none"> • Cost savings to customers associated with fewer outages • Incentive payments to utilities through performance based rates for reliability • Cost savings associated with restoring service
System Average Interruption Duration Index (SAIDI)	<ul style="list-style-type: none"> • Cost savings to customers associated with shorter outages • Incentive payments to utilities through performance based rates for reliability

Momentary Average Interruption Frequency Index (MAIFI)	<ul style="list-style-type: none"> • Cost savings to customers associated with fewer disturbances • Cost savings to utilities from longer equipment life due to less exposure to fault current
T&D System Losses (MWh)	<ul style="list-style-type: none"> • Cost of generation for lost energy • Pollutant emissions from lost energy
Activity Based O&M Expenses	<ul style="list-style-type: none"> • Cost efficiencies from automated operations and maintenance
Equipment failure incidents	<ul style="list-style-type: none"> • Capital cost of replacing equipment • O&M cost from repair
Transmission capability (MW)	<ul style="list-style-type: none"> • Value of incremental transfer capability gained without building additional transmission capacity

Table A.4. Information Related to Energy Resources

Information Reported	Example Calculations Supported
Load served by distributed energy resources (MWh)	<ul style="list-style-type: none"> • Cost of centrally generated energy avoided • Pollutant emissions from central generation and lost energy avoided • Cost of generation for lost energy
Combined Heat and Power installed (MW)	<ul style="list-style-type: none"> • Cost of central generation avoided • Pollutant emissions and cost of generation from lost energy avoided
Capacity and energy served by renewable energy resources (MW and MWh)	<ul style="list-style-type: none"> • Cost of central generation avoided • Pollutant emissions from central generation and lost energy avoided • Cost of generation for lost energy • Cost of ancillary services avoided •
Average heat rate of system generation (BTU/MWe)	<ul style="list-style-type: none"> • Pollutant emissions from central generation • Cost of central generation avoided
Electricity consumed by electric vehicles (MWh)	<ul style="list-style-type: none"> • Reduced oil consumption

Capacity from electric vehicles (MW)	<ul style="list-style-type: none"> • Cost of central generation avoided • Pollutant emissions from central generation and lost energy avoided • Cost of generation for lost energy
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All data collection and compilation by the Recipient should be consistent with the scope of the project (e.g., at the feeder level). Also, the Recipient is to collect and compile data according to industry standards and best practices. For example, SAIFI, SAIDI, and MAIFI are to be compiled as described in IEEE Standard 1366-2003, “IEEE Guide for Electric Power Reliability Indices); daily SAIDI estimates should be with- and without major event days, as determined using the beta method, and compiled over a five year period.

C. Summary of Framework for Estimating Smart Grid Costs and Benefits

Table A.5 summarizes the DOE’s approach for estimating the benefits of smart grid projects. The “Benefit Category” is the broadly-defined category of benefits.

The “Benefit” is the final impact of the project that is of value to stakeholders. These benefits are either explicitly expressed in, or might be converted into, monetary terms. The DOE acknowledges the uncertainty and associated variance in conversion factors used to convert reliability, environmental, and energy-security related benefits into monetary values. However, the DOE will use the scientific literature and develop a range of plausible estimates.

The “Source of Benefit” column in Table A.5 lists some of the possible intermediate outcomes or goals of projects. These intermediate outcomes give rise to the various benefits listed in the previous column.

The right-most column in Table A.5 lists the data that the Recipient can expect to provide, so that the DOE can estimate the benefits of the project.

Table A.5 is not meant to encompass every possible proposed project nor be a comprehensive listing of all of the possible types of benefits and associated data needs. The benefits and data elements listed in the table reflect the benefits the DOE has identified thus far as being of interest, possibly significant in magnitude, and for which Recipients are likely able to compile the data for the DOE to estimate their project benefits

Table A.5. Summary of Benefits, the Sources of these Benefits and the Data which the Recipient can Expect to Report

Benefit Category	Benefit	Source of Benefit	Information Reported by Project
Economic	<p>Lower electricity cost</p> <p>Lower peak demand</p>	<ul style="list-style-type: none"> • Flatter load curve (from load shifted to off-peak periods, e.g., from consumer behavior and smart appliances that can respond to price signals) • Lower electricity rates (reflecting reduced generation costs with flatter load curve) • Lower total electricity consumption 	<ul style="list-style-type: none"> • Hourly load data, by customer • Monthly electricity cost, by customer • Tariff description, by customer • Demographic and other information affecting demand • For firms, square footage and SIC code • Types of smart appliances in use
	Lower T&D losses	<ul style="list-style-type: none"> • Optimized T&D network • Generation closer to load (DG) 	<ul style="list-style-type: none"> • T&D system losses (MWh) • % of MWh served by DG
	Lower O&M costs	<ul style="list-style-type: none"> • Reduced O&M activity • Lower equipment failure 	<ul style="list-style-type: none"> • Activity based O&M costs • Equipment failure incidents
	Reduced transmission congestion costs	<ul style="list-style-type: none"> • Increased transmission transfer capability without building additional transmission capacity; 	<ul style="list-style-type: none"> • Actual real-time capability of key transmission lines
Reliability and Power Quality	Reduced cost of power interruptions	<ul style="list-style-type: none"> • Fewer shortages • Shorter shortages 	<ul style="list-style-type: none"> • SAIFI • SAIDI or CAIDI

Benefit Category	Benefit	Source of Benefit	Information Reported by Project
	Reduced costs from better power quality	<ul style="list-style-type: none"> • Fewer momentary outages • Fewer severe sags and swells • Lower harmonic distortion 	<ul style="list-style-type: none"> • MAIFI
Environmental	Reduced damages as a result of lower GHG/carbon emissions	<ul style="list-style-type: none"> • Lower electricity consumption from: <ul style="list-style-type: none"> ○ Intelligent appliances 	<ul style="list-style-type: none"> • Hourly consumption against baseline/control group
		<ul style="list-style-type: none"> • Lower T&D losses from: <ul style="list-style-type: none"> ○ Optimized T&D network ○ Generation closer to load (DG) 	<ul style="list-style-type: none"> • % of MWh served by DG • T&D system losses (MWh)
		<ul style="list-style-type: none"> • Lower emissions from generation from: <ul style="list-style-type: none"> ○ CHP ○ Renewable energy (RE) ○ Operating generators at more efficient points ○ Avoiding additional generator dispatch with load response 	<ul style="list-style-type: none"> • MW of CHP installed • % of MWh served by RE • % of feeder peak load served by RE • Average heat rate of supply (or similar information)
Energy Security	Greater energy security from reduced oil consumption	<ul style="list-style-type: none"> • Electricity substituting for oil by “smart-grid enabled” electric vehicles 	<ul style="list-style-type: none"> • kWh of electricity consumed by electric vehicles