

**FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT**



**U.S. Department of Energy
Office of Science
Office of Basic Energy Sciences
Office of Energy Efficiency and Renewable Energy
Advanced Research Projects Agency – Energy
*Energy Innovation Hub – Batteries and Energy Storage***

Funding Opportunity Number: DE-FOA-0000559

Announcement Type: [Amendment 000001](#)

CFDA Number: 81.049 - Office of Science Financial Assistance Program

Issue Date:	02-01-2012
Issue Date of Amendment 000001:	05-15-2012
Letter of Intent Due Date:	03-01-2012 (MANDATORY)
Pre-Application Due Date:	Not Applicable
Application Due Date:	05-31-2012 at 11:59 PM Eastern Time

[The application due date will NOT be extended as a result of this amendment.](#)

Description of amendment:

1. In Section VI.B.2 – Special Terms and Conditions and National Policy Requirements, the following language is added:

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

2. In Section VI.B.2 – Special Terms and Conditions and National Policy Requirements, the following language is added:

“Corporate Felony Conviction and Federal Tax Liability Representations (March 2012): In submitting an application in response to this FOA the applicant represents that:

(1) It is **not** a corporation that has been convicted (or had an officer or agent of such corporation acting on behalf of the corporation convicted) of a felony criminal violation under any Federal law within the preceding 24 months,

(2) **No** officer or agent of the corporation has been convicted of a felony criminal violation for an offense arising out of actions for or on behalf of the corporation under Federal law in the past 24 months,

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

For purposes of these representations the following definitions apply: A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States (but not foreign corporations). It includes both for-profit and non-profit organizations.”

3. In Section VIII.M – Availability of Funds, the sentence is hereby deleted and replaced with the following sentence:

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

END OF AMENDMENT

REGISTRATION/SUBMISSION REQUIREMENTS

Registration Requirements

There are several one-time actions you must complete in order to submit an application in response to this Funding Opportunity Announcement (FOA) (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contractor Registration (CCR), register with Grants.gov, and register with FedConnect). If not previously registered, applicants should allow at least 21 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 Grants.gov to submit their application. Grants.gov website – <http://www.grants.gov>

Applicants must register with FedConnect to submit questions. FedConnect website – <https://www.fedconnect.net>

Questions

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

Questions regarding the content of the FOA 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 on the FedConnect website.

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

Application Preparation and Submission

Applicants must download the application instructions and application package from Grants.gov.

Where to Submit

Applications must be submitted through Grants.gov to be considered for award. You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements carefully and start the process immediately. Additional instructions are provided in Section IV.A. of this FOA.

TABLE OF CONTENTS

SECTION I – FUNDING OPPORTUNITY DESCRIPTION	1
A. SUMMARY.....	1
B. STATUTORY AUTHORITY	2
C. APPLICABLE REGULATIONS.....	2
D. HUB BACKGROUND.....	2
E. HUB DEVELOPMENT REQUIREMENTS.....	3
F. RESEARCH FOCUS: BATTERIES AND ENERGY STORAGE	6
G. DEFINITION OF TERMS	10
SECTION II – AWARD INFORMATION	13
A. TYPE OF AWARD INSTRUMENT	13
B. ESTIMATED FUNDING	13
C. MAXIMUM AND MINIMUM AWARD SIZE.....	14
D. EXPECTED NUMBER OF AWARDS.....	14
E. ANTICIPATED AWARD SIZE	14
F. PERIOD OF PERFORMANCE	14
G. TYPE OF APPLICATION	14
SECTION III – ELIGIBILITY INFORMATION	15
A. ELIGIBLE APPLICANTS	15
B. OTHER ELIGIBILITY REQUIREMENTS.....	15
C. COST SHARING	17
SECTION IV – APPLICATION AND SUBMISSION INFORMATION	19
A. ADDRESS TO REQUEST APPLICATION PACKAGE	19
B. LETTER OF INTENT AND PRE-APPLICATION	19
C. CONTENT AND APPLICATION FORMS	20
D. SUMMARY OF REQUIRED FORMS AND FILES	30
E. SUBMISSION FROM SUCCESSFUL APPLICANT	30
F. APPLICATION SUBMISSION DATE AND TIME	31
G. INTERGOVERNMENTAL REVIEW	31
H. FUNDING RESTRICTIONS.....	31
I. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS	32
SECTION V – APPLICATION REVIEW INFORMATION.....	33
A. CRITERIA	33
B. REVIEW AND SELECTION PROCESS.....	36
C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES	36
SECTION VI – AWARD ADMINISTRATION INFORMATION	37
A. AWARD NOTICES	37
B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS	37
C. REPORTING.....	39
SECTION VII – QUESTIONS/AGENCY CONTACTS	40
A. QUESTIONS.....	40
B. AGENCY CONTACT	40

SECTION VIII – OTHER INFORMATION	41
A. MODIFICATIONS	41
B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE	41
C. COMMITMENT OF PUBLIC FUNDS	41
D. PROPRIETARY APPLICATION INFORMATION	41
E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL..	42
F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM.....	42
G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER.....	43
H. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES.....	43
I. PROPERTY	43
J. ENVIRONMENTAL AND REGULATORY REQUIREMENTS	44
K. ENVIRONMENTAL, SAFETY AND HEALTH (ES&H) PERFORMANCE OF WORK AT DOE FACILITIES	44
L. COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA).....	44
M. AVAILABILITY OF FUNDS.....	44
SECTION IX – APPENDICES/REFERENCE MATERIAL.....	46

Section I – FUNDING OPPORTUNITY DESCRIPTION

A. SUMMARY

Batteries and energy storage hold one key to our energy future. Few areas of science and technology are more crucial to our efforts to develop a fundamentally new energy economy with decisively reduced dependence on imported oil. Batteries and electrical energy storage technologies are pivotal and straddle two major energy sectors: the grid and transportation. Improved storage is essential to effectively integrate intermittent renewable energy sources such as wind and solar power into the electrical grid; it will also be a critical component of more efficient “smart grid” systems for electricity delivery. At the same time, radical advances in battery technology are needed to move the transportation sector, on a truly major scale, away from petroleum consumption and toward cleaner, more flexibly sourced, grid-based power.

Progress in battery and electrical energy storage technologies over the past decade has been impressive, and work continues apace, including research sponsored by the U.S. Department of Energy (DOE or the Department) Office of Science (SC), the Office of Energy Efficiency and Renewable Energy (EERE), and, most recently, Advanced Research Projects Agency-Energy (ARPA-E). But the improvements so far achieved, while meaningful and important, fall short of the genuinely transformational advances in technology that will be needed to usher in a new era of decisively greater reliance on renewable energy and reduced consumption of petroleum. There is a need to build on and accelerate the progress made thus far.

To accelerate the transformational advances in basic science needed to develop storage technologies capable of reshaping our energy economy, DOE will establish an Energy Innovation Hub for Batteries and Energy Storage (“Hub”). Federal management of the Hub will be led by SC-Office of Basic Energy Sciences (BES) in close coordination with EERE and ARPA-E in the review and ongoing assessments of the Hub R&D activities. Modeled after a combination of the Department’s Bioenergy Research Centers, Bell Laboratories, and World War II’s Manhattan Project and the MIT Radiation Laboratory, the Energy Innovation Hubs comprise highly collaborative research teams, spanning multiple scientific, engineering, and where appropriate, economics, and public policy disciplines. By bringing together top talent from across the full spectrum of R&D performers—including universities, private industry, non-profits, and National Laboratories—the Hubs serve as world-leading R&D centers in their topical areas. The Department of Energy established three Energy Innovation Hubs in FY 2010 – Fuels from Sunlight; Energy Efficient Building Systems Design; and Modeling and Simulation for Nuclear Reactors.

The Batteries and Energy Storage Hub will seek to rapidly drive towards electrochemical energy storage solutions beyond the current limits. It will support cross-disciplinary R&D focused on transforming electrochemical energy storage, including the exploration of new materials, devices, systems and novel approaches for transportation and utility-scale storage. Current battery research is typically focused on one particular problem or research challenge and thus lacks the resources and the diverse breadth of talent to consider holistic solutions. The Hub should provide this critical mass for the best, most innovative and far-reaching ideas. Based on new understanding, the Hub should foster new energy storage designs that begin with a “clean sheet of paper” – overcoming current manufacturing limitations through innovation to reduce complexity and cost. The

ultimate goal will be to overcome the current technical limits for electrochemical energy storage to the point that the risk level will be low enough for industry to further develop the innovations discovered by the Hub and deploy these new technologies into the marketplace.

The Batteries and Energy Storage Hub will foster unique collaborations that will be critical to success. The initial award period is for five years. The Hub will be funded up to a total of \$20 million in the first year; up to \$10 million of those funds can be devoted to infrastructure start-up for the Hub, including building renovation (but not new construction), lease arrangements, equipment, and instrumentation. It is anticipated that the Hub will be funded up to \$25 million per year for Hub operations in the final four years of the initial award period, pending Congressional appropriations.

Funding will be competitively awarded to the successful Batteries and Energy Storage Hub selected by Federal officials, based on rigorous review procedures as detailed in Section V of this Funding Opportunity Announcement (FOA). Hub progress will be monitored by DOE Senior Leadership, acting upon recommendations of DOE staff and external reviewers.

B. STATUTORY AUTHORITY

Public Law 95-91, U.S. Department of Energy Organization Act

Public Law 109-58, Energy Policy Act of 2005

Public Law 112-74, Energy and Water Development Appropriations Act, 2012

C. APPLICABLE REGULATIONS

U.S. Department of Energy, Financial Assistance Rules, 10 CFR Part 600

U.S. Department of Energy, Technology Investment Agreement Rules, 10 CFR Part 603

U.S. Department of Energy, Office of Science Financial Assistance Program Rule, 10 CFR Part 605

D. HUB BACKGROUND

Orchestrating rapid, transformative changes to the energy system portfolio represents a technological challenge of historic scale. Success requires a major national mobilization of basic and applied energy research capabilities, accompanied by commensurate investments in engineering and development necessary to accelerate the deployment of revolutionary energy technologies. Early and close coordination with the private sector to facilitate the transition to deployment is also essential.

The paths of scientific discovery and technology development need to inform each other: Advances in basic sciences create entirely new technology possibilities; likewise, technology development efforts identify key roadblocks that require improved scientific understanding or wholly new approaches. Connecting fundamental research and technology development through forceful and scientifically astute management of an integrated team is essential to rapid achievements.

The Energy Innovation Hubs embrace a centrally led “integrated” model of research and development towards a challenging goal. The Department recognizes that the traditional “staged” model of separate entities undertaking discovery science, technology development, demonstration, and finally deployment is not likely to provide the scale and pace of effort necessary to produce the revolutionary solutions we need in the near term. Rather, there is a need for bold and innovative approaches that better couple all elements of the Nation’s innovation system and combine the talents of universities, national labs, and the private sector in concerted efforts to define and construct a sustainable energy economy. The Hub should take advantage of science advances and new technologies that are developed nationally and internationally to drive toward the best possible solutions, playing an integrating role for future technologies.

The purpose of the Energy Innovation Hubs is to assemble the most talented scientists, engineers, and technologists to focus intense research and development efforts on critical areas, including Batteries and Energy Storage. The Hubs are designed to accelerate the current state-of-the art energy science and technology toward their fundamental limits and support high-risk, high-reward research projects that produce revolutionary changes in how we produce, store, and use energy.

Additional information on the Hubs can be found on the Energy Innovation Hubs website at <http://energy.gov/hubs> including the Hubs formed in FY 2010, other current examples of collaboration between industry and practitioners of basic and applied R&D in both academia and national laboratories, and historical lessons from previous successful R&D centers. These examples highlight the critical role of strong scientific leadership in the acceleration of progress, and demonstrate that integration of foundational science and concentrated engineering efforts can have tremendous long-term impact on science and technology well beyond the mission of the center.

E. HUB DEVELOPMENT REQUIREMENTS

Overview

The Energy Innovation Hubs take a holistic, systems approach to science and technology and act as an integrator of basic and applied research and development. To accelerate technological innovation and reduce the barriers to movement of new innovations and technologies to the marketplace, the Hub is expected to include robust interactions with private industry. The Hub will support additional analysis and practical efforts aimed at understanding and achieving technology transfer and eventual large-scale commercialization and deployment of cost-effective technologies.

The scientific problems to be addressed by the Hub are inherently interdisciplinary. The Hub will require personnel with varied skills and expertise in a wide range of scientific and engineering disciplines. This depth is required for the Hub’s research team to understand the potential roadblocks and bottlenecks that must be overcome to achieve sustainable and commercially viable energy storage technologies. The Hub will need to combine exceptional skill and creativity in general energy technology research with cutting-edge expertise in the specific problems to be addressed, either by including researchers specializing in this field or developing strong partnerships and working relationships with the individuals and institutions, governmental and nongovernmental, that have been engaged in research on these or related problems. The Hub is also

expected to develop enabling technologies to facilitate and accelerate this research.

Infrastructure and Operation

Strategies for development of the Hub may include renovation of existing buildings and/or leasing buildings. The Hub will be funded at up to \$20 million in the first year, with up to \$10 million of this total devoted to infrastructure start-up for the Hub. Allowable costs include those necessary to house the Hub (including a possible lease for the first five years of the project), to renovate laboratories as needed, and to purchase research equipment and instrumentation. Costs for new construction (including new buildings or additions to existing buildings) will not be allowed in the Hub award.

The Hub may develop agreements with respect to access to major scientific instrumentation, including DOE user facilities, on an as-needed basis rather than as an integral component of the initial Hub request and budget since funding at DOE user facilities is determined and administered separately from this announcement.

Technical Capabilities and Instrumentation

The Hub will need to have available the technical capabilities that the applicant considers necessary to implement its proposed approach, including experimental and computational tools. A portion of the research at the Hub may be devoted to developing new technological capabilities for overcoming challenges that cannot be addressed with currently available technologies and instrumentation. Research capabilities and resources to be accessed outside of the Hub should be clearly identified.

Management

DOE recognizes that effective management of scientific facilities, programs, and projects is critical to the success of research. The Hub must have well-designed management plans for the establishment and operations of the Hub. Plans should include provisions for coordination with other basic and applied research and development activities supported by the Department. The Hub's management structure must enable empowered scientist-managers to execute quick decisions to shape the course of research. Management of the establishment, research, technology development, resources (both personnel and physical resources), and scientific data of the Hub are critical to its success, its overall contribution to the broader DOE Energy Innovation Hubs activities, and the Department's missions. In addition, the Hub must have an advisory board that includes industry, academia, and federal laboratory participation.

Key elements for the successful management of a Hub include:

- a clear lead institution with strong scientific leadership and central location for the Hub;
- a clear organization and management plan for achieving the collaborative and synergistic goals of a Hub and "infusing" a culture of empowered central research management throughout the Hub; and
- when needed, a clear commitment to the use of state-of-the-art technology and frequent virtual meetings to enable meaningful long distance collaboration.

The Hub will be subject to regular, rigorous peer review of the research and development program and the management structure, policies, and practices. Within DOE, the Department's Senior Leadership will periodically review the progress of the Hubs. Federal management of the Hub will be led by SC-BES in close coordination with EERE and ARPA-E in the review and ongoing assessments of the Hub activities.

Staffing

The research program of the Hub should be led by internationally-recognized scientists and engineers. The Batteries and Energy Storage Hub may be composed of diverse institutions including national laboratories, academia and non-profit research institutes, and the private sector. In assembling its research team, the Hub should strive to achieve the synergies that arise when individuals with forefront expertise in different methodologies, technologies, disciplines, and areas of content knowledge tackle a problem together, overcoming impasses with fresh angles and discovering novel solutions.

Quality Assurance and Information Management

Applicants will be expected to have sound quality assurance plans for all aspects of the Hub proposed programs. National and international standards for quality assurance for the different categories of experimentation to be carried out in the Hub should be identified and plans for qualifying for certification by the International Organization for Standardization (ISO) and other organizations should be described in the application as appropriate.

Deliverables / Benchmarks

The work of the Hub will span basic research to engineering and technology development with an eventual transition to industrial development. The Hub will support cross-disciplinary research and development focused on the scientific barriers to enable the next generation of batteries and energy storage. The Hub will advance highly promising areas of energy science and technology from their early stages of research to the point that the risk level will be low enough for further development by industry and successful deployment of new technologies into the marketplace. As such, the Hub is expected to have deliverables or benchmarks that help focus the objectives of the research to the proposed short, intermediate, and long term goals they are addressing.

Training and Outreach

The Hub should include educational/training programs for students, postdoctoral fellows, and scientists. On-site scientific staff as well as visiting researchers should be included in proposed, regularly available programs. Outreach activities in which the Hub interacts with the public in educational activities are also encouraged, but not required.

Research Collaboration and Coordination

Applicants should describe plans for coordinating their fundamental research and technology development with other basic and applied activities supported by the Department. The Hub may require research and technology capabilities that are beyond the scope of the Hub's skills and resources. If so, the application should demonstrate

plans for obtaining these additional capabilities, including collaboration with outside scientists.

In pursuing a focused R&D plan for the Hub, it is likely (and desirable) that new avenues of basic and applied R&D will be discovered. To the extent that such new opportunities diverge from the Hub's primary mission, these should be "spun out" as potential candidates for support from other programs within or outside of the Department or from industry.

The Hub is expected to include robust interaction with private industry, academia, and universities. The interactions should enable accelerated technological innovation and reduction of the barriers to movement of new technologies to the marketplace. Examples of this type of activity include (but are not limited to) research partnerships, research personnel exchanges, institution-sponsored post-doctoral or graduate fellowships, involvement in the Hub advisory board, and multi-institutional seminars and conferences. Applicants are encouraged to provide information regarding their plans to create a collaborative research environment among industry, academia, and federal laboratories to enable cognizance of industry readiness, technology transfer, and eventual market penetration.

Other Considerations

While capital investment in instrumentation and start-up needs are expected as part of the Hub awards, usage and leverage of existing facilities, including the Department's user facilities, is encouraged. DOE user facilities, including light sources, neutron scattering sources, nanoscale science research centers, advanced computational facilities, and other specialized user facilities, are considered foundational resources. As such, they are expected to serve as independent resources for the Hub funded under this announcement. Funding for user research activities at DOE user facilities is determined and administered separately from this announcement and should not be included in the budget requests of applications to this announcement.

F. RESEARCH FOCUS: BATTERIES AND ENERGY STORAGE

Introduction

Electrical energy storage is a critical technology for the Nation – for vehicles; the electric grid; portable electronics, sensors, and equipment; and industrial systems. Storing energy is essential for managing effective energy systems and solutions. As an energy carrier, electricity has no rival with regard to its environmental cleanliness, flexibility in interfacing with multiple production sources and end uses, and efficiency of delivery. The expanded deployment of renewable energy sources, including the electrification of vehicles, has greatly enhanced the demand for advanced energy storage solutions. For the electrical grid, new approaches to electrochemical energy storage are needed to enable inherently intermittent renewable energy sources to meet continuous, diurnal electricity demand. For vehicles, new batteries with improved lifetimes and storage capacities are needed to expand the vehicle's range on a single charge while simultaneously decreasing the manufacturing cost and weight.

Current Technology Status and Goals¹

Today's electrical energy storage approaches based on electrochemistry suffer from combinations of limited energy and power density, lower than desired rates of charge and discharge, calendar and cycle life limitations, low abuse tolerance, high cost, and poor performance at high or low temperatures. For example, deep discharges and fast charging rates are known to shorten the life of conventional batteries. And, battery formation before use to tailor a stable solid electrolyte interface (SEI) layer is a major manufacturing cost. It is widely recognized that no existing electrochemical materials or systems currently satisfy the projected energy and power densities required for advanced vehicle technologies and for widely deployed utility storage needs. These different applications have widely varying requirements for energy, power, lifetime, and cost that may not be adequately addressed by one single technology.

The Hub's research vision should go beyond current technology with a proposed research plan that leverages DOE's current programs and provides avenues for interactions and information flow. The Hub's research should not be duplicative of or otherwise indistinguishable from current DOE funded research. For reference, the current DOE research portfolio is described in a number of on-line resources that are listed in Section IX of this FOA. Also, as background information, the current status of technologies and goals for transportation and grid storage are summarized below.

Transportation Technologies: Today's commercial lithium-ion batteries for electric vehicles are at about half of DOE's long-term volumetric and gravimetric energy density targets of 300 Wh/L and 250 Wh/kg, respectively. Furthermore, the current cost of EV batteries is about \$650/kWh, which is much greater than an estimated target of \$125/kWh of usable energy for widespread implementation. These targets were developed in conjunction with the automotive and battery industry to reflect the battery size and weight – including the non-energy producing components such as cell interconnects, thermal management system, electronics, and packaging – for a mid-sized electric sedan with a 300-mile range.

In addition to limited energy density, these batteries also suffer from calendar and cycle life limitations, and perform poorly at high and low temperatures. Moreover, to accommodate degradation and ensure safety over the life of the battery, commercial batteries are often "overbuilt," resulting in expensive, over-sized batteries.

To accelerate widespread penetration of electric vehicles into the market place, the current cost of batteries needs to be reduced by a factor of three. Achieving such dramatic cost reductions along with improved battery performance, durability and abuse tolerance will require significant advances in new materials, chemistries, engineering and manufacturing.

Grid Technologies: Controlling the dynamic nature of the electric grid has, since its inception, required continuous, nearly real-time balance between electricity generation and load at multiple system levels. Today, ever-increasing demands are imposing new stresses on the grid's reliability. The broad range of requirements for grid-level energy storage make it difficult for any single solution to satisfy them all, but electrochemical storage can be a solution to many small- to medium-sized requirements such as

¹ See references at the end of the FOA for more information.

frequency regulation and load balancing, required for incorporating renewable energy onto the grid. Robust and low cost electrochemical-based energy storage solutions have the potential to transform the electric power grid by facilitating the temporal separation of electricity generation and load across a diverse range of power magnitudes, durations, and frequency variations. Separating the dynamics of generation and load would provide grid operators with new, vital tools to manage a changing electricity landscape, perhaps even forestalling the need to construct new base-load generation capacity to meet peak loads.

There are numerous potential applications for robust grid level electrochemical energy storage solutions, including:

- Megawatts-scale battery systems for frequency regulation at millisecond to minute timescales at transmission and distribution substations for power quality and load balancing.
- Community and home energy management systems at kilowatts-scale power levels and seconds to hours timescales to support reliable electric power and integration of renewable energy sources near the consumer.
- Peak load shifting and outage mitigation at megawatts and minute to hour timescales to accommodate large variations in energy demand or supply.

To accelerate widespread adoption of these technologies across the electric sector, it is essential that the installed cost of electrochemical grid storage systems fall to the low \$100's/kWh range. Beyond cost, key technical attributes that will influence widespread use are charge/recharge efficiency, safety, reliability, and long lifetime. Achieving such dramatic cost reductions and technological advances will undoubtedly require significant advances of the science underpinning the materials and chemistries comprising these storage systems.

Scientific and Engineering Challenges

Many of the fundamental performance limitations of electrochemical energy storage systems are rooted in materials chemistry and structure. Novel approaches are needed to develop multifunctional materials that offer new self-healing, self-regulating, failure-tolerant, impurity-sequestering, and sustainable characteristics. The current focus on limiting use (and enhancing recycle and recovery) of critical materials that have limited global availability provides additional motivation for discovery of materials relevant to electrochemical energy storage that can be created from earth-abundant sources.

To achieve breakthroughs in the understanding of catalysis and chemical processes that are essential to energy storage, application of the newest capabilities to directly measure, model, and “observe” the dynamic composition and structure in real-time, during charge transport and transfer processes, is needed. For example, *in situ* photon- and particle-based microscopic, spectroscopic and scattering techniques with spatial and time resolution at the relevant molecular and mesoscopic scales will likely be needed to meet this challenge. Insights into physical mechanisms, prediction of trends, and identification of new materials will result from the predictive knowledge of structural and functional relationships. Approaches that couple the exploration of new materials with advanced experimental probes and theory-based methods that integrate across different time and length scales will be powerful tools in this research.

Many of the desired properties of future batteries pose engineering challenges and

opportunities. The integration of scientific research with innovative engineering approaches will greatly broaden the potential solution space. Engineering research should fully exploit the scientific discoveries of electrochemical reactions and translate these into innovative energy storage devices that deliver dramatically improved performance. Knowledge of the constraints and manufacturing challenges of complete battery systems will help guide the direction of the electrochemical studies, leading to a system which optimizes end device performance. New battery architectures that take a systems view of battery design as well as those that incorporate new discoveries that lead to enhanced performance, safety, fault tolerance and reliability should be a key feature in this Hub. Truly innovative approaches to manufacturing and battery packaging, where appropriate, should be part of the R&D portfolio. While the refinement of manufacturing processes should be the work of the private sector, exploration of new approaches that can greatly reduce the complexity and cost of fabrication, from materials to complete systems would be appropriate.

Goals and Focus for the Batteries and Energy Storage Hub

The ***Batteries and Energy Storage*** Hub should accelerate the discovery of new electrochemical energy storage concepts and incorporate these into new prototypes for storing energy in a reliable, economic, and efficient manner. Rather than initially focusing on a single technology or incremental improvements to current technologies, the Hub must deliver revolutionary research that will result in new technologies and approaches.

The Hub should incorporate appropriate research opportunities for energy storage that were identified in the BES workshop reports “*Basic Research Needs for Electrical Energy Storage*” and “*Science for Energy Technology: Strengthening the Link between Basic Research and Industry.*” These opportunities focus on the need for new materials, new architectures, and understanding/control of electrochemical behavior, interfaces, charge and mass transfer processes, and degradation.

The Hub’s ultimate technological impact should go well beyond current research and development activities. While advancing the understanding and science for energy storage, the Hub should incorporate transformational engineering approaches that fully exploit scientific discoveries. The Hub should develop working bench-top prototype devices that demonstrate radically new approaches for electrochemical storage and are scalable. These devices should have the potential to be produced at low manufacturing cost from earth-abundant materials and possess greatly improved properties compared to commercially available energy storage technologies – higher energy and power densities, longer cycle life, and higher safety and abuse tolerance. Knowledge of the constraints and manufacturing challenges of complete battery systems will help guide the direction of the electrochemical studies, leading to a system which optimizes end device performance.

In the quest to develop new understanding and totally new energy storage technologies, the Hub may create fundamentally new manufacturing approaches. The scale of the challenges associated with this goal requires that the Hub draw expertise from a broad range of scientific and engineering disciplines.

Anticipated Hub Impact and Output

It is anticipated that the Hub will provide scientific understanding for multiple issues that are preventing technological solutions for energy storage for vehicles and the grid. It should expand the knowledge base for synthesis of novel nanoscale materials with architectures tailored for specific electrochemical performance, develop new methodologies to characterize materials and dynamic chemical processes at the atomic and molecular level, and expand our competencies in simulation and prediction of structural and functional relationships using leading computational tools. The Hub will be an interaction, information, and communication nucleus for the basic and applied battery and energy storage communities – people and information will flow into it and from it to ensure that the problems and issues being faced in today's technologies are understood and to ensure that Hub research will spur innovation and problem solving broadly.

In addition to premier journal publications and intellectual property documenting new understanding and approaches, the Hub will have a continuous impact on technological advances in the nearer term, leading to truly revolutionary approaches to energy storage in the longer term. The Hub should support the flow of advances from the Hub to ensure commercial impact, as well as defining the path for moving technology advances to new and existing commercial entities. It is expected that the Batteries and Energy Storage Hub will have a significant impact within the award period, providing insights and new technologies that will spur innovation and contribute to the solutions of today's energy storage challenges. The scientific developments should provide improvement to current technologies and thus have a commercial impact in the 3-5 year timeframe. Shorter-term impact should include progress towards bench-top prototype devices that exploit radically new concepts for electrochemical storage utilizing materials that are abundant and have low manufacturing cost, high energy densities, long cycle life, and high safety and abuse tolerance for a broad range of energy storage applications. The ultimate goal will be to overcome the current technical limits for electrochemical energy storage to the point that the risk level will be low enough for industry to further develop the innovations discovered by the Hub and deploy these new technologies into the marketplace.

G. DEFINITION OF TERMS

This information is primarily derived from the article, Energy-Technology Innovation, by Kelly Sims Gallagher, John P. Holdren, and Ambuj D. Sagar, which was published in the *Annual Review of Environment and Resources*, Vol. 31: 193-237 (2006).

Energy Technology

The term *energy technology* refers to the means of locating, assessing, harvesting, transporting, processing, and transforming the primary energy forms found in nature (e.g., sunlight, biomass, crude petroleum, coal, uranium-bearing rocks) to yield either direct energy services (e.g., heat from fuel wood or coal) or secondary forms more convenient for human use (e.g., charcoal, gasoline, electricity). Also included under the heading of energy technology is the means of distributing secondary forms to their end users and the means of converting these forms to energy services (e.g., energy storage, electricity to light and refrigeration, electricity and gasoline to motive power).

A distinction is often made between *energy-supply technologies*, meaning those used to bring energy forms to a point of final use, and *energy end-use technologies*, meaning

those applied at this point of use to convert an energy form to a service such as light or motive power.

Research and Development (R&D)

Research includes basic and fundamental research that yields discoveries with potential application to the improvement of energy technologies, and applied research and development that is directed at the invention or improvement of specific energy technologies. Development is aimed at converting the fruits of fundamental and applied research into working prototypes of new or improved technologies.

The Office of Management and Budget (OMB) provides the following federal definitions of basic research, applied research, and development in OMB Circular No. A-11 (2011, Section 84, p. 12). Federal expenditures in the conduct of R&D are subcategorized by these three definitions. R&D facilities and major equipment are also reported by OMB as separate subcategories under physical assets.

- **Basic research** is defined as systematic study directed toward fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. Basic research, however, may include activities with broad applications in mind.
- **Applied research** is defined as systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.
- **Development** is defined as systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Demonstration and Deployment (D&D)

The *staged model of innovation* as a linear, sequential process beginning with R&D and proceeding to demonstration and finally commercialization is generally refined to capture some two-way or iterative interactions whereby learning in one phase is linked to the other phases. An even more *integrated model of innovation* merges the research, development, demonstration, and deployment (RDD&D) phases by designed interactions between each activity so that no work occurs in isolation. Nonetheless, it is useful to understand and define the stages separately.

The Office of Management and Budget (OMB) does not provide federal definitions of demonstration and deployment in OMB Circular No. A-11. Federal expenditures in the conduct of demonstration activities are usually (but not always) categorized as R&D depending on the nature of the activities. Deployment activities are categorized as non-R&D.

- **Demonstration** activities test scalability and preliminary operating issues to help bring promising technologies closer to market in order to increase chances of adoption by manufacturers. Demonstration projects test new technologies in

conditions that approximate real-world applications in order to gain economic and performance data that improve technologies and enhance their potential for commercialization.

- **Deployment** is market support that promotes the adoption of a new technology through greater visibility and familiarization. Even if the technological feasibility was proven during the demonstration phase, there may be a variety of barriers that make it difficult for the new technology to compete or gain acceptance in the market and thus achieve wide-scale adoption. Deployment activities that help support market penetration can help a new technology reach a tipping point into widespread commercialization. Deployment activities can take many forms, including education, marketing, communication, market research, and other non-R&D market conditioning activities, as well as incentives for adoption.

Section II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

DOE may award a cooperative agreement, Technology Investment Agreement (TIA), field work authorizations, or interagency agreements under this Funding Opportunity Announcement (FOA). A DOE field work authorization will be awarded to a successful DOE/NNSA Federally Funded Research and Development Center (FFRDC) contractor. Participation by non-DOE/NNSA Federal agencies and their FFRDC contractors' team will be funded under an interagency agreement. A cooperative agreement will be awarded to any other successful entity including, but not limited to, universities, nonprofit organizations, and for-profit organizations.

If determined appropriate, DOE will consider awarding a TIA to a non-FFRDC applicant. TIAs, governed by 10 CFR Part 603, are assistance instruments used to increase the involvement of commercial entities in the Department's research, development, and demonstration programs. A TIA may be either a cooperative agreement or an assistance transaction other than a cooperative agreement. In both cases, DOE has greater flexibility in tailoring the terms and conditions of a TIA, which is not subject to all of the requirements of 10 CFR Part 600. Agreement terms are negotiable in areas such as audits and intellectual property rights that may cause concern for commercial firms that usually do not contract with the Federal Government. A non-FFRDC applicant may request a TIA if it believes it will be beneficial to the R&D objectives of the program. After an applicant is selected for award, the Contracting Officer will determine if awarding a TIA would provide benefits to the program that would not likely be realized under another type of assistance award. As described below, DOE will be more amenable to awarding a TIA in support of a proposal from a consortium or a teaming arrangement that includes cost sharing with the private sector. Such a consortium or teaming arrangement could include a DOE/NNSA FFRDC, other Federal agency or its FFRDC. If the DOE/NNSA FFRDC contractor is a part of a consortium or teaming arrangement, the value of, and funding for the DOE/NNSA FFRDC contractor portion of the work will be authorized and funded under the DOE field work authorization system and performed under the laboratory's Management and Operating (M&O) contract. Funding for another Federal agency or its FFRDC would be through an interagency agreement under the Economy Act or other statutory authority. Other appropriate contractual accommodations such as those involving intellectual property may be made through the funds in agreement to facilitate the FFRDC's participation in the consortium or teaming arrangement. If a TIA is awarded, certain types of information described in 10 CFR Part 603.420(b) are exempt from disclosure under the Freedom of Information Act for five years after DOE receives the information.

B. ESTIMATED FUNDING

This Hub will be funded at up to \$20,000,000 in the first year of the award, of which up to \$10,000,000 may be used for the establishment of Hub infrastructure, including building renovation (but not new construction), lease arrangements, equipment, and instrumentation. This Hub will be funded at up to \$25,000,000 per year in years 2-5 of the initial award period, pending Congressional appropriations.

C. MAXIMUM AND MINIMUM AWARD SIZE

Ceiling (i.e., the maximum amount for an individual award made under this announcement): \$120,000,000.00

Floor (i.e., the minimum amount for an individual award made under this announcement): None

D. EXPECTED NUMBER OF AWARDS

DOE anticipates making one award under this announcement.

E. ANTICIPATED AWARD SIZE

DOE anticipates that a single award will be issued for up to \$120,000,000 for the total project period.

F. PERIOD OF PERFORMANCE

DOE anticipates making one award at a level up to \$20,000,000 in year one of the award and up to \$25,000,000 per year in subsequent years, up to a total of five years.

G. TYPE OF APPLICATION

DOE will accept only new applications under this announcement.

Section III – ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

All types of domestic entities (defined as any entity incorporated in the United States and having a substantial U.S. presence, as evidenced by having a significant business center and/or significant employment in the U.S.), including DOE/NNSA Federally Funded Research and Development Centers (FFRDC) contractors, are eligible to apply as prime applicants, with the exception of other Federal agencies, non-DOE/NNSA 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. DOE may also consider making an award to a consortium, under a TIA agreement (see 10 CFR Parts 603.210, 603.225(b), and 603.515).

B. OTHER ELIGIBILITY REQUIREMENTS

Letter of Intent

To be considered eligible for an award under this FOA, potential applicants are required to submit a letter of intent in accordance with the instructions provided in Section IV.B.1. Formal applications received from an applicant who has not submitted a letter of intent will not be reviewed or considered for an award.

Team Arrangements

Entities proposing as a team or consortium must designate a lead organization, with strong scientific leadership and a clearly defined central location. Applications must be submitted, on behalf of the team members, by the lead organization and DOE will enter into a prime award relationship with the designated lead organization. The designated lead organization (i.e., the prime applicant) must perform a greater percentage of the effort than any other institution that is part of the proposed team or any proposed subawardee. This is based on dollar value and will be determined by a review of the budget. **If an application is received in which the prime applicant is not performing a greater percentage of the effort than that of any individual team member or subawardee, the application will be deemed non-responsive and rejected without further review.**

Eligible/Ineligible Entities

With the exception of foreign entities, the definition of Eligible Applicants (see Section III.A.) applies to all parties involved in an application, including the lead organization that actually submits the application (prime applicant) and all other institutions involved in any way in the proposed Hub (team members and/or subawardee). Foreign entities and non-DOE/NNSA Federal agencies and their FFRDC contractors may not be the prime applicant, but may be proposed as a team member and/or subawardee. If awarded, the non-DOE/NNSA Federal agencies and their FFRDC contractor team participants will be funded under an interagency agreement or other statutory authority.

Additionally, nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995 may not be the prime applicant, a team member, and/or a subawardee, nor be involved in

any way in the application.

DOE/NNSA FFRDC Contractors

DOE/NNSA FFRDC applicants are eligible to apply for funding under this announcement if their cognizant Contracting Officer provides written authorization and this authorization is submitted with the application as part of the Budget for DOE/NNSA FFRDC Contractor File. If a DOE/NNSA FFRDC is selected for award, or proposed as a team member, the proposed work will be authorized under the DOE field work authorization system and performed under the laboratory's Management and Operating (M&O) contract. The following wording is acceptable for the authorization:

“Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory.”

If an award is made to a DOE/NNSA National Laboratory, all Disputes and Claims will be resolved in accordance with the terms and conditions of the DOE/NNSA National Laboratory's M&O contract in consultation between DOE and the prime awardee.

Non-DOE/NNSA FFRDC Contractors

Non-DOE/NNSA FFRDC contractors are not eligible for a prime award under this announcement, but they may be proposed as a team member on another entity's application subject to the following guidelines:

The prime applicant must obtain written authorization for non-DOE/NNSA FFRDC participation. The cognizant Contracting Officer for the Federal agency sponsoring the FFRDC contractor must authorize in writing the participation of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The written authorization must also contain a determination that the use of a FFRDC contractor is consistent with the contractor's authority under its award and does not place the FFRDC contractor in direct competition with the private sector, in accordance with FAR Part 17.5. The following wording is acceptable for the authorization:

“Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the _(insert agency)_ assigned programs at the laboratory. This laboratory is authorized to perform the work proposed in the application submitted under DOE Funding Opportunity Announcement # DE-FOA-0000559 by the following statutory authority _(insert statute name, citation, and section)_.”

Value/Funding

The value of, and funding for, a DOE/NNSA FFRDC contractor, a non-DOE/NNSA FFRDC contractor, or another Federal agency's portion of the work will not be included in the award to the successful applicant. DOE will fund a DOE/NNSA FFRDC contractor

through the DOE field work authorization system and will fund other non-DOE/NNSA FFRDC contractors and other Federal agencies through an interagency agreement or other statutory authority.

If a TIA is awarded as an assistance transaction other than a cooperative agreement, elements might include shared intellectual property, proprietary access to research results, and other favored relationships consistent with the level of cost sharing and the TIA regulations. Applicants should understand, however, that certain information arising out of the Hubs will be made publicly available consistent with DOE policy.

Responsibility

The successful applicant 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 any team member, and/or subawardee.

If an award is made to another Federal agency or its FFRDC, all Disputes and Claims will be resolved in accordance with the terms and conditions of the interagency agreement in consultation between DOE and the prime awardee.

C. COST SHARING

For the purposes of cost sharing, the proposed activities of the Hub are divided into two types (see the definitions in Section I.G., Definition of Terms):

- Basic and applied research and development (R&D)
- Technology demonstration and deployment (D&D)

For-profit entities are required to provide a minimum of 20% cost share for both R&D and D&D activities. This cost share will be based on the portion of the Hub budget proposed by each for-profit entity. By accepting federal funds under this award, the prime recipient agrees to be responsible for any subawardee cost share if the subawardee does not meet its cost share requirements. For all other non-Federal entities, cost sharing is encouraged, but not required for R&D, and a minimum of 20% is required for D&D activities. The cost share for D&D activities will be based on the portion of the Hub budget proposed by each entity. All entities must include required cost share in their proposed budgets. All cost shared funding must come from non-Federal sources unless otherwise permitted by law.

These cost sharing requirements are consistent with EPLA 2005, Section 988. D&D as defined in Section I.G. falls under the category of “demonstration and commercial application” specified in EPLA 2005, Section 988. However, there is no expectation that a Hub will commercialize the energy technology it develops, but will assist in the deployment of that technology through transfer to industry, which will perform the commercial applications.

Cost sharing is also generally required for TIA awards. To the maximum extent practicable, the non-Federal parties performing the work under a TIA are to provide at

least 50% cost sharing in conformance with 10 CFR Part 603.525 through 10 CFR Part 603.555. The Contracting Officer will consider the amount of cost sharing proposed in determining if a TIA is the appropriate instrument for the project. The Contracting Officer may accept any cash or in-kind contributions that meet the criteria set forth in 10 CFR Part 603.530 through 10 CFR Part 603.555. In addition, the Contracting Officer may consider whether cost sharing is impracticable, after assessing the applicant's other commitments to successfully performing the work.

Section IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE

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

Limitation on Number of Prime Applications

An entity may not submit more than **one** application as the prime applicant for this FOA. If more than one application is received from a prime applicant, DOE will consider only the first application received based on the Grants.gov date and time stamp. The remaining application(s) will be deemed non-responsive and rejected without further review. However, there is no limitation on the number of applications in which a specific eligible entity can participate as a team member/subawardee.

B. LETTER OF INTENT AND PRE-APPLICATION

1. Letter of Intent (LOI)

Potential applicants are required to submit a letter of intent by Thursday, March 1, 2012, no later than 11:59 PM Eastern Time. Formal applications received from an applicant who has not submitted a letter of intent by the above deadline will be considered ineligible and will not be reviewed or considered for an award under this FOA. Letters of intent should be sent by e-mail to BatteriesEnergyStorage@science.doe.gov.

This letter is to include a cover sheet containing the name and mailing address of the potential applicant institution, the planned title of the Hub, the name and e-mail address of the Project Director/Principal Investigator, a listing of the institutions that are expected to be involved in the planned application in addition to the prime organization submitting the letter of intent, and a five to six page narrative containing the following:

- An overview of the research plan, including the vision, goals and objectives for the five-year period of the award;
- An overview of the management plan including approaches to ensure synergy among the partners and mechanisms for effectively translating research findings to industrial applications; and
- An overview of the infrastructure plan including laboratories, office space and critical research capabilities.

2. Pre-application

Pre-applications are not required.

3. Funding Opportunity Announcement Conference

A conference will not be held for this funding opportunity announcement.

C. CONTENT AND APPLICATION FORMS

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

1. SF 424 (R&R)

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

2. RESEARCH & RELATED BUDGET (TOTAL FED + NON-FED)

Complete the RESEARCH & RELATED BUDGET (TOTAL FED + NON-FED) form in accordance with the instructions on the form and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the “Next Period” button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement (see Section IV.H.).

Budget Justification (Field K on the RESEARCH & RELATED BUDGET (TOTAL FED + NON-FED))

Provide the required supporting information for the following costs (see form 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 a non-DOE/NNSA Federal agency and/or their FFRDC contractor will serve as a vendor of materials, supplies, equipment, space and/or scientific and technical advisory services to a proposed HUB, submit evidence of the non-DOE/NNSA Federal agencies authority and agreement to provide said items to DOE as part of the budget justification file. Attach a single budget justification file for the entire project period in Field K. The file automatically carries over to each budget year.

3. 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.

4. RESEARCH & RELATED Other Project Information

Complete questions 1 through 6 and attach files as instructed below. 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 Hub Director, 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, for collaborative projects, the dollar value of the effort to be performed by each participant organization over the five-year project period and a brief description of the capacity in which the organization(s) will be participating. 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 single spaced using standard 8.5" by 11" paper with 1" margins (top, bottom, left, and right) and font not smaller than Times New Roman 12 point. To attach a Project Summary/Abstract, click "Add Attachment".

Project Narrative (Field 8 on the Form)

The project narrative must not exceed 80 pages, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1" 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 Times New Roman 12 point. A cover page and table of contents must be included at the beginning of the project narrative but neither will count against the page limit. The cover page should contain the name and mailing address of the applicant institution, the title of the Hub, the name and e-mail address of the Project Director/Principal Investigator, a listing of the institutions that are involved in the application in addition to the prime organization. Information required in Appendices 1 through 17 is not subject to the project narrative page limit.

Headers/Footers containing page numbers **must** be inserted and project titles/logos may be inserted within the required 1" margins. Do not include any Internet addresses (URLs) that provide information necessary to review the application, because the information contained on those sites will not be reviewed. See Section VIII.D. for instructions on how to mark proprietary information in your application. To attach a Project Narrative, click "Add Attachment."

The contents of the project narrative are specified in order to ensure that the merit reviewers have the necessary information to conduct proper evaluations. All project narratives are to include the following three components:

- I. **Overview of the Project Plan.** This section must not exceed five pages and should provide a concise overview summarizing the vision for the proposed Hub, including:
 - Clearly stated short, intermediate, and long term goals of the Hub;
 - The strategy for developing and operating the Hub;
 - How the research and development (R&D) components of the Hub will be integrated into an effective whole, including coordination with other related R&D activities;
 - How the R&D program will address critical needs in the Hub's topical area; and
 - The strategy for transitioning Hub activities from R&D into technology demonstration and deployment (D&D).

- II. **Organization and Management Plan.** This section must provide a clear and substantive plan for the organization and management of the proposed Hub, including:
 - A comprehensive management plan for a world-leading program that encourages high-risk, high-reward R&D (and D&D when applicable) and encourages synergy and cohesion among investigators by infusing a culture of empowered central research management throughout the Hub;
 - A clear commitment to the use of state-of-the-art technology and frequent virtual meetings to enable meaningful long distance collaboration as needed;
 - An organizational structure that delineates the roles and responsibilities of senior/key personnel and describes the means of providing external oversight and guidance for scientific and technical direction and approval of the research program;
 - A description of the relevant experience of the lead institution and senior/key personnel in project, program, and personnel management of diverse teams of science, engineering, and other relevant technical professionals for projects of comparable magnitude;
 - An overview of the scientific, engineering, and other technical expertise in the relevant research disciplines required for the Hub;
 - A description of the relevant scientific, engineering and technical expertise and experience of the proposed Hub staff in the research disciplines needed for project success including any plans for collaboration with outside scientists and engineers, including those funded by the Department;
 - A description of the major needs and recruiting strategy for additional scientific, engineering, and technical personnel including new senior staff, students, and postdocs;

- A description of how the Hub will manage its work across the complete spectrum of basic and applied R&D (and technology D&D when applicable), and how it will accelerate technological innovation, including institutional experience/expertise in these activities and any proposed industrial partnerships beyond the Hub participants;
- A description of the performance monitoring systems to be utilized to ensure the Hub is established within the proposed scope, cost, and schedule;
- A description of the planned approach to information sharing and data management appropriate for achieving the goals of the proposed Hub;
- A description of a training and/or outreach program that provides opportunities to inspire, train, and support leading scientists and engineers of the future and supports energy awareness within the technical community;
- A description of the roles and responsibilities and prospective membership of an external advisory committee, which must include representation industry, academia, and federal laboratories;
- An assessment of the availability of the Hub Director and senior/key personnel, including analysis of their potential involvement in other major projects;
- A discussion of how the proposed research relates to existing and planned research programs at the lead institution; and
- As appropriate, a description of the environment, safety and health plan and quality assurance systems and plans to be implemented within the Hub, including national and international standards for the assessments of relevant properties and performance for technologies developed by the Hub.

III. **Program of R&D (and D&D as applicable).** Applicants must provide detailed information regarding the program proposed for the Hub. This section, which may be organized into subtasks, must clearly describe the proposed R&D (and D&D), and must:

- Briefly describe the scientific, engineering, and technical background (include references to peer-reviewed literature) leading to the application, critically evaluate existing knowledge, and specifically identify the gaps in science and technology that the Hub is intended to fill;
- State concisely the importance of the R&D (and D&D as applicable) described in the application, how the proposed program lies at the forefront in the Hub's topical area, and how the proposed program will have an impact on developing innovative new energy technology within the purview of the Hub;
- Provide an account of any preliminary studies that may be pertinent to the proposed R&D (and D&D as applicable), including any other information that will help to establish the experience and competence of the principal investigator(s) to pursue the proposed project;
- Describe a balanced and comprehensive program of R&D (and D&D as applicable) that supports experimental and theoretical/ computational efforts and develops new capabilities and approaches in the Hub's research topic;

- Describe the role and intellectual contribution of the Hub Director, each Principal Investigator, and senior/key personnel;
- Outline potential scientific, engineering, and technical obstacles to achieving the research objectives and approaches to be used to overcome them;
- State the proposed approach to rapidly reconfigure R&D thrusts to respond to key challenges and promising developments;
- Delineate plans for external collaborations and partnerships including utilization of DOE user facilities, if applicable;
- Briefly outline the resources available to the proposed Hub including access to existing research space, instrumentation, and facilities at the lead institution and its partners;
- Delineate proposed deliverables and benchmarks, including an explanation as to how these will ensure that the program remains focused on the proposed short-, intermediate- and long-term goals and the approach to measuring performance against the stated deliverables;
- Delineate plans to coordinate multiple R&D (and D&D as applicable) efforts, integrating subsystems into a prototype energy technology system; and
- Provide detailed plans to accelerate technological innovation and reduce the barriers to movement of new technologies to the marketplace.

Other Attachments (Field 12 on the Form)

In addition to the contents of the Project Narrative described above, **a separate file for each of the Appendices identified below (1 through 17) must be attached in Field 12, “Other Attachments”, on the form. All files should be named using the naming convention: appendix number followed by the name of the appendix (e.g., Appendix 1 – Bibliography & References Cited). Do not attach any of the Appendices requested below as files in fields 7, 8, 9, 10, or 11. The information provided in Appendices 1 through 17 will not count toward the Project Narrative page limitation identified above.**

Appendix 1: Bibliography & References Cited

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. **Do not attach this file in field 9.**

Appendix 2: Budget Summary

In simple tabular form, provide a high-level summary of the proposed budget for the Hub that includes the following data, by year, for each institution participating in the project, beginning with the lead organization: institution name, the Hub operating budget for the institution, the Hub equipment budget for the institution, the names and support levels (in months) of the senior/key personnel supported by the Hub at the institution, and the number and type of other personnel supported by the Hub at the institution (e.g.,

postdocs, graduate students, undergraduate students, technical support, administrative support, etc.). Budget information should be presented as both annual funding and the cumulative funding over the five-year initial award period.

Appendix 3: Environment, Safety and Health (ES&H) and Security Approaches

Applicants should provide information on the approach for handling environment, safety and health, and security issues and assuring environmental compliance during Hub establishment and research and development activities; procedures for ensuring security, including access to data stored on Hub computers; the ES&H compliance history of the lead and partner organization over the last five years (e.g., EPA and state environmental notices of violation, OSHA citations, status of any resulting action plans); and any anticipated environmental permit requirements, including NEPA, for the proposed Hub and proposed schedule for environmental permits and NEPA requirements.

Appendix 4: Intellectual Property (IP) Management Plan

Each Hub should include within their application a proposed IP Management Plan that ensures and facilitates compliance with Federal IP laws and policies, the public interest regarding dissemination of scientific reports/results, and the rapid transfer of technology in the topical area of the Hub. The plan should address title to inventions and other IP among the Hub members. Unless the applicant requests a TIA, the statutes and policies governing disposition of title to new inventions under Government agreements will be as follows:

- i. The Bayh-Dole Act, 35 U.S.C. 200 et seq., requires that universities, nonprofits and small businesses who are participating under a funding agreement will have the option to retain title to their own employees' inventions.
- ii. The Federal Non Nuclear Energy Act of 1974, 42 U.S.C. 5908, will govern disposition of title for all other parties, regardless of whether they receive Government funding and requires that the Government obtains title to new inventions unless a waiver is granted. DOE regulations at 10 CFR Part 784 address the factors that are considered in the granting of waivers, including whether the waiver is needed to secure participation, private investment being made or likely to be made, the commercial position of the waiver requestor, etc.
- iii. Inventions made by employees of an FFRDC will be subject to the M&O contract terms and conditions with respect to ownership of inventions made by lab employees.
- iv. The agreement will provide the capability for the Hub to license other forms of IP such as copyright in software and bailment of biological materials.

This FOA allows applicants to request a TIA. In a TIA, the intellectual property rights are not subject to the requirements of the Bayh-Dole Act or 42 U.S.C. 5908 and are

negotiable. If the applicant requests a TIA and DOE determines it is appropriate to award a TIA, patent rights will be negotiated pursuant to the guidance set forth in 10 CFR Parts 603.840 through 603.875.

The plan should also address a simplified means of IP licensing by the Hub, and should include a discussion on the means to distribute the benefits (royalties and equity) after expenses of any licensing among appropriate team members.

Appendix 5: Hub Infrastructure Plan

Discuss the plans for locating the proposed Hub. This includes identification of the site or sites where the major activities of the Hub will take place and how the site(s) will be acquired (use of space provided by the host institution(s), leased space, or combinations of these and other options) and prepared for use by the Hub. The Hub site, acquisition, design and development plan should describe the proposed size, conceptual layout, and development strategy (including summary-level scope, schedule and cost estimates including alteration and/or renovations for the space, i.e., the estimated cost to build out the space) for the space needed to house and support the research program identified in the narrative. Plans for acquisition of major equipment and instrumentation should also be included.

Appendix 6: Additional Funding Support

Discuss any additional funding and contributions-in-kind for the proposed Hub, including, but not limited to, cost sharing. If there is no additional funding or contributions-in-kind, state "None".

Appendix 7: Project Timetable

This section should outline as a function of time, year by year, all the major activities or phases, deliverables and benchmarks. The successful applicant will be expected to employ standard project management discipline and must use this project timetable to report progress.

Appendix 8: Biographical Sketches

Provide a biographical sketch for the Hub Director, Principal Investigator(s), and each senior/key person listed in Section A on the R&R Budget form, or proposed as a subawardee or consultant, if they are identified as a senior/key person. The designation of multiple Principal Investigators, including Principal Investigators employed by teaming partners is allowed. The biographical information for each person must not exceed three pages when printed on 8.5" by 11" paper with 1" margins (top, bottom, left, and right) and font not smaller than Times New Roman 12 point. Each biographical sketch should include the following information:

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

Research and Professional Experience: In chronological order, beginning with the

current position, list 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 five professional and scholarly activities related to the effort proposed.

Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers: Provide the following information in this section.

Collaborators and Co-editors: In alphabetical order, list all persons outside of your home institution, including their current organizational affiliation, who are or who have been collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper most closely related to the proposed project during the 48 months preceding the submission of this application. Also, list any individuals who are currently or have been co-editors with you on a special issue of a journal, compendium, or conference proceedings most closely related to the proposed project during the 24 months preceding submission of this application. If there are no collaborators or co-editors to report, state "None".

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

Appendix 9A: Hub Director Statement of Employment

For the Hub Director, submit documentation stating that the proposed Hub Director is either currently an employee of the prime applicant, or has committed to accept employment with the prime applicant, if the applicant is selected for this Hub award. The statement of employment, or letter of commitment to accept employment, is limited to one page and must be signed by both the Hub Director and an authorized representative of the prime applicant.

Appendix 9B: Individual Letters of Commitment

For each senior/key person, including the Hub Director and Principal Investigator(s), provide a current signed and dated letter of commitment that confirms their intent to participate on this project, including their individual level of time commitment, for a minimum period of five years. Multiple personnel representing the same institution may sign the same letter of commitment, as applicable. Each letter of commitment is limited to one page.

Appendix 10: Current and Pending Support

Provide a list of all current and pending support (both Federal and non-Federal) for the Hub Director, Principal Investigator(s) and senior/key persons, including subawardees and paid consultants, for ongoing projects and pending applications. For each entry, list the title of the project, source of the support and award number (if applicable), the award period, the total award amount for the entire award period (including indirect costs), the associated portion of funding for the senior/key person's research activities, and the number of person-months per year to be devoted to the project by the senior/key person. A brief description of any synergies or overlaps with this application must be included for each entry. Concurrent submission of an application to other organizations for simultaneous consideration must be acknowledged but will not prejudice the review of this application.

Appendix 11: Facilities & Other Resources

This information is used to assess the capability of the organizational resources, including subawardee resources, available to perform the effort proposed. Identify the facilities to be used (e.g., Laboratory, Animal, Computer, Office, Clinical, and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. **Do not attach this file in field 10.**

Appendix 12: Equipment

List major items of equipment already available for this project and, if appropriate, identify location and pertinent capabilities. **Do not attach this file in field 11.**

Appendix 13: Statement of Conflicts of Interest

At the time of submission, the applicant shall include information identifying potential, apparent, or actual organizational and individual conflicts of interest and proposed mitigation. This shall include the applicant, their team members, and senior/key personnel named in the application. Negative responses are also required. Prior to award, DOE reserves the right to require the submission of a Conflict of Interest Management Plan describing the applicants approach to managing conflicts of interest.

Appendix 14: Organizational Letters of Commitment

An organizational letter of commitment is required from each organization participating as a team member. Each organizational letter of commitment is limited to one page and must be current, signed, and dated by a person authorized to commit the participating organization to a legally binding agreement for this project.

Appendix 15: Commitment Letters from Third Parties Providing Cost Sharing or Contributions-in-kind

If a third party, (i.e., a party other than the organization submitting the application) proposes to provide all or part of any proposed cost sharing, you must provide a letter

from the third party stating that it is committed to providing a specific minimum dollar amount of cost sharing or contributions-in-kind. The letter should also identify the proposed type of contribution (e.g., cash, services, and/or property). Letters must be signed by a person authorized to commit the organization to the contribution and are limited to one-page. If there are no third-party contributions, this must be indicated in this appendix.

Appendix 16: Environmental Evaluation Notification Form (DOE SC-CH F 560)

You must complete and submit this environmental questionnaire as Appendix 16. This form and instructions are available at <http://www.ch.doe.gov/offices/ACQ/docs>.

Appendix 17: Additional Information

If you need to elaborate on your responses to questions 1-5 on the “RESEARCH & RELATED Other Project Information” form, please provide this information as Appendix 17.

5. R&R Subaward Budget (FED/NON-FED) Attachment(s) Form

Budgets for Subawardees. You must provide a separate cumulative R&R budget for each subawardee, including DOE/NNSA National Laboratory Contractors, 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 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. If a subaward is being proposed for a DOE/NNSA National Laboratory Contractor, then you must also submit the appropriate Field Work Proposal and cognizant Federal Contracting Officer authorization as described in “**Budget for DOE/NNSA National Laboratory Contractor**” below.

If a subaward is being proposed for a non-DOE/NNSA FFRDC contractor, the required authorization by the cognizant Contracting Officer for the Federal sponsoring agency, as required in Section III.B., Other Eligibility Requirements, must be submitted.

Budget for DOE/NNSA National Laboratory Contractor, if applicable.

If a DOE/NNSA National Laboratory contractor is to perform any portion of the work, the DOE/NNSA National Laboratory must provide a DOE Field Work Proposal in accordance with the requirements in DOE Order 412.1A, Work Authorization System. This order and a sample of the DOE Field Work Proposal (FWP) form are available at <https://www.directives.doe.gov/directives/412.1-BOrder-a/view>. For purposes of satisfying this requirement, applicants are required to submit the DOE FWP face and budget pages (pages 1 and 2 of the sample form) with the application as part of the Budget for DOE/NNSA National Laboratory Contractor file. Furthermore, the information requested in blocks 1. through 15. and 17. through 19. of the sample FWP must be furnished with the application. The remainder of the information requested in blocks 16., 20., and 21. of the sample form will be required to be submitted through the DOE Work Authorization System by the successful applicant after selection. In addition, include the required cognizant Federal Contracting Officer approval authorizing the participation of

the DOE/NNSA National Laboratory as described in Part III.B. This information is required in addition to the budgetary information requested herein (R&R Budget, R&R Subaward Budget, and Budget Justification, as applicable). Use up to 10 letters of the DOE/NNSA National Laboratory name as the file name and attach to the R&R Other Project Information form in Field 11.

6. Disclosure of Lobbying Activities (SF-LLL)

If applicable, complete SF-LLL. This form is applicable 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 Federal 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 SF-LLL, "Disclosure Form to Report Lobbying".

D. SUMMARY OF REQUIRED FORMS AND FILES

Your application must include the following documents:

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
RESEARCH & RELATED BUDGET (TOTAL FED + NON-FED)	Form	N/A
Budget Justification	PDF	Field K
PROJECT/PERFORMANCE SITE LOCATION(S)	Form	N/A
RESEARCH & RELATED Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 7
Project Narrative	PDF	Field 8
Project Narrative Appendices 1-17	PDF	Field 12
R&R SUBAWARD BUDGET (FED/NON-FED) Attachment(s) Form, if applicable	Form	N/A
Budget for Subawardees	PDF	N/A
Budget for DOE/NNSA National Laboratory Contractor, if applicable	PDF	N/A
SF-LLL DISCLOSURE OF LOBBYING ACTIVITIES, if applicable	Form	N/A

E. SUBMISSION FROM SUCCESSFUL APPLICANT

The successful applicant must submit the information listed below no later than 15 calendar days after notification of selection. Failure to provide the information within the required time period may eliminate the successful applicant from further consideration.

What to submit	Required Form or Format
Designated Responsible Employee for complying with national policies prohibiting discrimination. Provide organization name, project title, DOE application tracking number and	No special format. E-mail information no later than 15 calendar days after notification of

the name, title, and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (see 10 CFR Part 1040.5).	selection to tonja.stokes@ch.doe.gov .
Representation of Limited Rights Data and Restricted Computer Software	Use form on DOE Financial Assistance Forms page at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Representations. E-mail this representation no later than 15 calendar days after notification of selection to tonja.stokes@ch.doe.gov .

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

- Indirect cost information
- Other budget information
- Additional/revised Commitment Letters from Third Parties

F. APPLICATION SUBMISSION DATE AND TIME

Applications must be received in Grants.gov by **Thursday, May 31, 2012**, no later than 11:59 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.**

G. INTERGOVERNMENTAL REVIEW

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

H. FUNDING RESTRICTIONS

Cost Principles. Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600 or the cost principles in FAR Part 31 and DEAR Parts 931 and 970.31.

Pre-award Costs. Recipients, other than DOE/NNSA FFRDC contractors, may charge for pre-award costs incurred within the 90 calendar day period immediately preceding the effective date of the award, if such costs would be reimbursable under the agreement if incurred after award. Pre-award expenditures are made at the recipient's risk and do not impose an obligation on DOE: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the recipient anticipated. Recipients must obtain written prior approval from the contracting officer for any pre-award costs that are for periods greater than this 90 calendar day period.

In the event a TIA is awarded, pre-award costs may be charged to the agreement only with the specific approval of the Contracting Officer, in accordance with 10 CFR 603.830.

I. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. WHERE TO SUBMIT

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

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

2. REGISTRATION PROCESS

You must complete the one-time registration process (all steps) before you can submit your first application through Grants.gov. It is recommended that you start this process at least three weeks before the application due date. It may take up to 21 calendar days or more to complete the entire process. Use the Grants.gov Organization Registration Checklist at <http://www.grants.gov/assets/OrganizationRegCheck.pdf> to guide you through the process.

IMPORTANT: During the CCR registration process, you will be asked to designate an E-Business Point of Contact (EBIZ POC). The EBIZ POC must obtain a special password called a “Marketing Partner Identification Number” (MPIN). When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed all the steps in the registration process.

3. APPLICATION RECEIPT NOTICES

After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of e-mails from Grants.gov. It is extremely important that the AOR watch for and save each of the e-mails. All e-mail notifications will occur over a period of two business days. Additional information regarding tracking your application package is available at <http://www07.grants.gov/assets/TrackingYourApplicationPackage.pdf>.

Section V - APPLICATION REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 CFR Part 605.10(b). DOE will perform an initial review to determine that (1) the applicant is eligible for an award, (2) the information required by this announcement has been submitted, (3) all mandatory requirements are satisfied, and (4) the proposed project is responsive to the objectives of this FOA.

2. Merit Review Criteria

Applications that pass the initial review will be evaluated by a Merit Review Panel using the criteria outlined below. Following completion of the merit review, a team composed of Federal officials will review the applications and the Merit Review Panel evaluations; summarize the Merit Review Panel's independent evaluations and recommendations regarding the applications submitted; and recommend the application of the program policy factors, as appropriate.

Applications will be subjected to formal merit review and will be evaluated against the following criteria. Included within each criterion are the detailed questions that reviewers will consider.

- a. Scientific, engineering, and/or technical merit of the project:
 - Will the proposed R&D (and D&D as applicable) program be at the forefront of the research area pertinent to the Hub?
 - Is the proposed program appropriately focused and responsive to the FOA?
 - Is the proposed program likely to have a real impact on the energy technology within the Hub's purview?
 - Is the proposed program well-balanced and comprehensive and does it, as needed, support experimental, theoretical/computational efforts and develop new capabilities and approaches?
 - Does the program proposed adequately address research needs/gaps in the Hub topical area and is the R&D (and D&D as applicable) program likely to contribute to reaching the proposed short, intermediate, and long term goals?
 - Are the deliverables and benchmarks appropriate to ensure the research remains focused on the stated goals?
 - Is the applicant likely to overcome the key scientific and technical challenges and be able to shift research directions in response to promising developments?
- b. Appropriateness of the proposed method or approach:
 - Is the strategy and plan for the development and operation of the proposed Hub, including plans for external oversight and guidance for the scientific, engineering, and technical direction and approval of the research program, scientifically and technically appropriate?

- Does the proposed approach allow rapid reconfiguration of R&D thrusts to respond to key scientific, engineering, and technical challenges and promising developments?
 - Are the plans for external collaborations and partnerships reasonable and appropriate, including utilization of DOE user facilities?
 - Does the applicant's program provide opportunities to inspire, train, and support leading scientists and engineers of the future and/or provide outreach to the technical community?
 - Is the approach to measuring performance against the stated benchmarks and deliverables adequate and appropriate?
 - Is the plan for quality assurance appropriate?
 - Is the planned approach to information sharing and data management appropriate?
- c. Competency of the applicant's personnel and adequacy of the proposed resources:
- Is the proposed access to existing research space, instrumentation and facilities at the host institution and its partners likely to meet the needs of the proposed Hub?
 - Are the applicant's performance monitoring systems adequate to ensure that the Hub is established and operated within the proposed scope, cost, and schedule?
 - Do the applicant's senior/key personnel have a proven record of R&D (and D&D as applicable) productivity and experience in the disciplines needed for success in this project?
 - Do the applicant and the applicant's senior leadership team members for the Hub have proven records of success in project, program, and personnel management of diverse teams of science, engineering, and technical professionals and for projects of comparable magnitude and breadth?
 - Is the plan for recruiting additional scientific, engineering, and technical personnel reasonable and appropriate?
- d. Reasonableness and appropriateness of the proposed budget:
- Is the requested operating budget reasonable for the planned program?
 - Is the requested budget for establishing the proposed Hub appropriate and cost effective, including the costs of acquiring and preparing the space to house the Hub and any required equipment and instrumentation?
 - Are the resources adequately distributed to address the scope and ensure sufficient engagement of key personnel?
- e. Integration of research and development (R&D) and, as needed, demonstration and deployment (D&D):
- Does the project have a clear plan to coordinate multiple R&D efforts, integrating subsystems into a prototype energy technology system?
 - Does the project present a coherent plan for the integration of basic research and engineering development that will lead to prototype-scale application of energy technology that would be developed by the Hub?
 - As applicable, does the applicant present a coherent plan for transitioning Hub R&D into technology D&D?

- Is the plan to accelerate technological innovation and reduce the barriers to movement of new technologies to the marketplace adequate?
 - Does the project include a clear plan for coordinating (and not duplicating) other research activities supported by the Department and others?
- f. Hub management plan:
- Does the applicant present a comprehensive management plan for a world-leading program that encourages high-risk, high-reward R&D (and D&D as applicable) and encourages synergy and cohesion among investigators by infusing a culture of empowered central research management throughout the Hub?
 - Is there a clear lead institution?
 - Is there a clear commitment to the use of state-of-the-art technology and frequent virtual meetings to enable meaningful long distance collaboration as needed?
 - Does the applicant present an organizational structure that delineates the roles and responsibilities of senior/key personnel and describes the means of providing external oversight and guidance for scientific, engineering, and technical direction and approval of the research program?
 - Is the role of the external advisory committee adequately described and is the committee appropriately staffed (industry, academia, and federal laboratory representation)?
 - Does the applicant present a plan that defines how it will manage its work across the complete spectrum from basic research through engineering development and how it will enable commercialization of innovative energy technology, including institutional experience/expertise in these activities and how industry will be engaged if not a partner in the application?
- g. Environment, safety and health and security considerations:
- Is the approach for handling environmental, safety, health, and security issues appropriate?
 - Does the approach assure comprehensive environmental compliance during Hub establishment and R&D (and D&D as applicable) activities?
 - Do the lead and partner institutions have a strong history of compliance with ES&H requirements?

3. Other Selection Factors

The Selection Official will consider the following program policy and management factors in the selection process:

- Diversity of research activities that will lead to new and expanded options for energy technology within the Hub's purview;
- Integration of the proposed Hub with the other research and development programs in DOE;
- Strategy for developing synergies between this new Hub and existing institutional infrastructure and science and engineering activities;
- Potential to be an internationally recognized enterprise for research excellence;

- Potential to attract the preeminent scientists and managers required to accelerate the solutions needed to create a new research and development paradigm while demonstrating sound financial stewardship;
- Total amount of DOE funds available; and
- Applicant's approach to intellectual property and technology transfer as described in its IP Management Plan.

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"; 10 CFR Part 605.10(d); and, the criteria set forth in Section V.A.2. of this FOA. The Guide is available under Financial Assistance, Regulations and Guidance at <http://energy.gov/management/downloads/merit-review-guide>.

DOE may, as part of the merit review process, schedule face-to-face meetings between representatives of one or more applicants and the Merit Review Panel to allow Merit Review Panel members to obtain answers to their questions or additional information about the contents of the most meritorious applications. Applicants may be required to travel, at their own expense, to a designated location for a presentation to the Merit Review Panel.

2. Selection

The Selection Official will consider the merit review recommendation, Federal official's review, program policy factors, and the amount of funds available. As part of the selection process, DOE reserves the right to seek clarifications in writing from those applications deemed to have the highest scientific merit in order to facilitate the selection process.

3. Negotiations and Award

The Government may enter into negotiations with a selected applicant for any reason deemed necessary, including but not limited to: (1) the proposed 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 satisfactorily resolve the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

Selection and Award Date

DOE anticipates notifying the applicant selected for award in August 2012 and making an award in September 2012 or earlier.

Section VI – AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. Notice of Selection

- **Selected Applicant Notification**

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

- **Non-selected Applicant Notification**

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

2. Notice of Award

If the selected applicant is a non-FFRDC, an Assistance Agreement issued by the Contracting Officer is the authorizing award document. It normally includes either as an attachment or by reference: (1) Special Terms and Conditions; (2) applicable program regulations, if any; (3) application as approved by DOE/NNSA; (4) DOE assistance regulations at 10 CFR Part 600 and, if applicable, the Government wide Research Terms and Conditions, and DOE Agency Specific Requirements; (5) National Policy Assurances To Be Incorporated As Award Terms; (6) Budget Summary; and (7) Federal Assistance Reporting Checklist and Instructions, which identifies the reporting requirements.

If the selected applicant is a DOE/NNSA FFRDC contractor, DOE/NNSA will fund the DOE/NNSA contractor through the DOE field work authorization system.

DOE/NNSA FFRDC contractors participating as team members will be funded directly by DOE/NNSA through the DOE field work authorization system. Non-DOE/NNSA FFRDC contractors and other Federal agencies will be funded under an interagency agreement.

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 at <http://ecfr.gpoaccess.gov/cqi/t/text/text-idx?c=ecfr&sid=81797e1ec7488f6886b4e335d7cace34&rqn=div5&view=text&node=10:4.0.1.3.9&idno=10>. Grants and cooperative agreements made to universities, non-profits and other entities subject to OMB Circular A-110 are subject to the DOE Research Terms and Conditions located on the National Science Foundation website at <http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp>.

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 and the National Policy Assurances To Be Incorporated As Award Terms are located at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>.

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

Statement of Substantial Involvement: Either a cooperative agreement or DOE Field Work Authorization may be awarded under this announcement. If the award is a cooperative agreement, the DOE Contract Specialist and DOE Program Manager will negotiate a Statement of Substantial Involvement prior to award. DOE may also consider awarding a Technology Investment Agreement (TIA). A TIA, like a cooperative agreement, also requires substantial Federal involvement in the technical or management aspects of the project and a Statement of Substantial Involvement will also be negotiated prior to the award of a TIA (see 10 CFR Part 603.105(a)).

DOE Subcontract Consent: DOE reserves the right to require the awardee to obtain written approval of the Contracting Officer prior to placement of any subcontracts(s).

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

Corporate Felony Conviction and Federal Tax Liability Representations (March 2012): In submitting an application in response to this FOA the applicant represents that:

- (1) It is **not** a corporation that has been convicted (or had an officer or agent of such corporation acting on behalf of the corporation convicted) of a felony criminal violation under any Federal law within the preceding 24 months,
- (2) **No** officer or agent of the corporation has been convicted of a felony criminal violation for an offense arising out of actions for or on behalf of the corporation under Federal law in the past 24 months,
- (3) It is **not** a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply: A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States (but not foreign corporations). It includes both for-profit and non-profit organizations.

C. REPORTING

Reporting requirements are identified on the Federal Assistance Reporting Checklist and Instructions, DOE F 4600.2, attached to the award agreement. A sample checklist can be found at <http://energy.gov/management/downloads/federal-assistance-reporting-checklist-and-instructions-projects>.

Section VII – QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions regarding the content of this FOA **must** be submitted through the FedConnect portal. You must register with FedConnect and 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 <https://www.fedconnect.net>.

Due to the time required to provide complete and accurate answers to questions, all questions **must** be submitted through FedConnect no later than **12:00 Noon Eastern Time on 05/10/2012**. DOE will not respond to questions submitted after the designated time on 05/10/2012.

DOE will try to respond to questions within 3 business days, unless a similar question and answer have already been posted.

B. AGENCY CONTACT

Name: Tonja Stokes
E-mail: tonja.stokes@ch.doe.gov

Section 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 e-mail 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 <https://www.fedconnect.net>.

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

D. PROPRIETARY APPLICATION INFORMATION – TRADE SECRETS, COMMERCIAL, OR FINANCIAL INFORMATION

An application may include technical data and other data, including trade secrets and commercial or financial information that is privileged or confidential, which the applicant does not want disclosed to the public or used by the Government for any purpose other than application evaluation. To protect such data, the submitter must mark the cover sheet of the application with the following Notice:

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

To further protect such data, each page containing trade secrets or commercial or financial information that is privileged or confidential must be specifically identified and marked with text similar to the following:

"May contain trade secrets or commercial or financial information that is privileged or confidential and exempt from public disclosure."

In addition, each line or paragraph containing trade secrets or commercial or financial information that is privileged must be marked with brackets or other clear identification, such as highlighting.

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 non-profit 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 terms and conditions as set forth in 10 CFR Part 784 (see Section VII.G. below). If teaming arrangements are created among the prime recipient and other team members, title to inventions among the Hub members will be addressed in the required Intellectual Property Management Plan (see Appendix 4 in Section IV.C.4.). If DOE determines it is appropriate to award a TIA, patent rights will be negotiated pursuant to the guidance set forth in 10 CFR Part 603.840 through 10 CFR Part 603.875.

Rights in Technical Data – Special Protected Data Statutes: Since the anticipated award term is up to five years, DOE must have appropriate rights in data to ensure long term access to generated data under this award to provide full dissemination in accordance with the U.S. Government regulations and statutes. Except for the special data protection discussed below, this can be accomplished, either through DOE ownership of and/or unlimited rights in technical data, so that DOE will have access to and the ability to direct delivery of a copy of such data first produced under the Agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as necessary to operate the Hub or as specifically negotiated in a particular agreement to satisfy DOE's own needs or to ensure the commercialization of technology developed under a DOE agreement. This program is covered by a special protected data statute. The provisions of the statute provide for the protection from public disclosure, for a period of up to five (5) years from the development of the information, of data that would be trade secret, or commercial or financial information that is privileged or confidential, if the information had been obtained from a non-Federal party. Generally, the provision entitled Rights in Data—Programs Covered Under Special Protected Data Statutes (see 10 CFR Part 600, Appendix A to Subpart D—Patent and Data Provisions) would apply, but may be modified to accommodate particular circumstances (e.g., access to or expanded use rights in protected data among consortium or team members), or to list and identify data or categories of data first produced in the performance of the award that will be made available to the public, notwithstanding the statutory authority to withhold data from public dissemination for up to five years, and may also identify data that will be recognized by the parties as protected data. The same approach to data rights will apply if DOE determines it is appropriate to award a TIA.

G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER

DOE may issue a class waiver for awards associated with the Energy Innovation Hubs, which DOE expects will cover most large business recipients and team members of this award. This patent waiver would provide those awardees not subject to the Bayh-Dole Act the option to retain title to their own inventions, subject to the same Government retained rights identified above, provided there is cost-sharing of at least 20%, and agreement to substantially manufacture new technology created under an award resulting from this FOA in the U.S., or provide other economic benefits to the U.S. If DOE does not issue a class waiver or if applicants do not meet the criteria of the class waiver, applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions (i.e., individual inventions conceived or first actually reduced to practice in performance of the award). Any patent waiver that may be granted is subject to certain terms and conditions set forth in 10 CFR Part 784 at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title10/10cfr784_main_02.tpl.

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

H. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

I. PROPERTY

REAL PROPERTY: With respect to the use, management, and disposition of all real property, 10 CFR Part 600.132 shall be applicable to cooperative agreements with institutions of higher education, hospitals, and other non-profit organizations; and 10 CFR Part 600.321 shall be applicable to cooperative agreements with for-profit organizations. For DOE/NNSA contractors, the terms and conditions of the respective Management and Operating contract will apply. For non-DOE/NNSA FFRDC contractors and other Federal agencies, the terms and conditions of the interagency agreement will apply.

PERSONAL PROPERTY: Federally Owned and Exempt, Equipment, and Supplies and Other Expendable Property

With respect to the use, management and disposition of all personal property, 10 CFR

Parts 600.133, 134 and 135 shall be applicable to cooperative agreements, with institutions of higher education, hospitals, and other non-profit organizations; and 10 CFR Parts 600.321, 322, 323 and 324 shall be applicable to cooperative agreements with for-profit organizations. For DOE/NNSA contractors, the terms and conditions of the respective Management and Operating contract will apply. For non-DOE/NNSA FFRDC contractors and other Federal agencies, the terms and conditions of the interagency agreement will apply.

J. ENVIRONMENTAL AND REGULATORY REQUIREMENTS

The DOE expects Hub establishment and R&D activities to have the same integrity and to be as state-of-the-art as the science that is expected to result from the research supported by DOE that is conducted in the Hubs. Therefore, applications should demonstrate that consideration of ES&H risks and issues is an integral component of the early planning for the Hub. Early identification of ES&H risks and issues can alleviate problems that can affect people and the environment, as well as affect the cost, schedule and management of the Hubs from establishment through research operations. DOE, therefore, will consider ES&H criteria, as described in Section V.A.2.g., among its merit review criteria to support demonstration of early ES&H planning. This will provide an early screening of potential issues and problems, as well as provide a measure of the capability of the applicant in providing for sound ES&H planning as part of the project. DOE requires that its state-of-the-art research facilities “start clean and stay clean” with respect to ES&H.

K. ENVIRONMENTAL, SAFETY AND HEALTH (ES&H) PERFORMANCE OF WORK AT DOE FACILITIES

With respect to the performance of any portion of the work under this award which is performed at a DOE-owned or controlled site, the recipient agrees to comply with all state and Federal ES&H regulations, and with all other ES&H requirements of the operator of such site. The recipient shall apply this provision to all subawardees at any tier.

L. COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

DOE will comply with the requirements of NEPA and its implementing regulations (10 CFR Part 1021 and 40 CFR Parts 1500-1508) prior to taking any action on the proposed project that could have adverse environmental effects or that would limit the choice of reasonable alternatives. After receipt of applications, an environmental critique may be prepared in accordance with 10 CFR Part 1021.216. A synopsis of the environmental critique will be incorporated, as appropriate, into any future site-specific NEPA documentation that may be prepared to evaluate the potential environmental consequences of the proposed Hub at the preferred site provided by the host institution. Should an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) be required, the successful applicant will be required to fund its preparation and to interact with DOE and provide up-to-date technical details on the project and its associated impacts during the NEPA process.

M. AVAILABILITY OF FUNDS

Funding for all awards and future budget periods is contingent upon the availability of

funds appropriated by Congress for the purpose of this program and the availability of future year budget authority.

Section IX – APPENDICES/REFERENCE MATERIAL

REFERENCE MATERIAL

U.S. Department of Energy, 2011. Energy Innovation Hubs website:
<http://energy.gov/hubs>

Basic Energy Sciences:

U.S. Department of Energy, 2003. *Basic Research Needs for a Secure Energy Future* http://science.energy.gov/~media/bes/pdf/reports/files/sef_rpt.pdf

U.S. Department of Energy, 2007. *Basic Research Needs for Electrical Energy Storage* http://science.energy.gov/~media/bes/pdf/reports/files/ees_rpt.pdf

U.S. Department of Energy, 2007. *Directing Matter and Energy: Five Grand Challenges for Science and the Imagination* http://science.energy.gov/~media/bes/pdf/reports/files/gc_rpt.pdf

U.S. Department of Energy, 2008. *New Science for a Secure and Sustainable Energy Future* http://science.energy.gov/~media/bes/pdf/reports/files/nsssef_rpt.pdf

U.S. Department of Energy, 2010. *Science for Energy Technology: Strengthening the Link between Basic Research and Industry*
http://science.energy.gov/~media/bes/pdf/reports/files/set_rpt.pdf

Advanced Research Projects Agency – Energy

Batteries for Electrical Energy Storage in Transportation (BEEST) Program:
<http://arpa-e.energy.gov/ProgramsProjects/BEEST.aspx>

Gridscale Rampable Intermittent Dispatchable Storage (GRIDS) Program: <http://arpa-e.energy.gov/ProgramsProjects/GRIDS.aspx>

Energy Efficiency and Renewable Energy:

Energy Storage System Goals at the United States Council for Automotive Research LLC (<http://www.uscar.org/quest/teams/11/Electrochemical-Energy-Storage-Tech-Team>)

Vehicle Technologies Program, Energy Storage R&D FY 2010 Annual Progress Report
(http://www1.eere.energy.gov/vehiclesandfuels/pdfs/program/2010_energy_storage.pdf)

Vehicle Technologies Program Multi-Year Program Plan
(http://www1.eere.energy.gov/vehiclesandfuels/pdfs/program/vt_mypp_2011-2015.pdf), Energy Storage Section

Office of Electricity Delivery and Energy Reliability:

Advanced Materials and Devices for Stationary Electrical Energy Storage Applications
<http://energy.gov/oe/downloads/advanced-materials-and-devices-stationary-electrical-energy-storage-applications>

Electric Power Industry Needs for Grid-scale Storage Applications

<http://energy.gov/oe/downloads/electric-power-industry-needs-grid-scale-storage-applications>

Office of Electricity Delivery and Energy Reliability Energy Storage Planning Document

<http://energy.gov/oe/downloads/energy-storage-program-planning-document>