“RECOVERY ACT”

FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U. S. Department of Energy - Headquarters
Advanced Research Projects Agency – Energy (ARPA-E)

Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS)

Funding Opportunity Number: DE-FOA-0000290
CFDA Number: 81.135

Issue Date:	**3/2/2010**
Concept Paper Submission:	**4/2/2010 at 5:00 PM Eastern**
Full Application Submission Deadline:	**Mid-May 2010**

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A. FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) OVERVIEW

A.1. OVERVIEW

Federal Agency Name: Department of Energy: Advanced Research Projects Agency - Energy
Funding Opportunity Title: Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS)
Funding Opportunity Number: DE-FOA-0000290
Catalog of Federal Domestic Assistance Numbers (CFDA): 81.135
FOA issue date: March 2, 2010
Concept Paper submission deadline: April 2, 2010 at 5:00P M Eastern Time
Full Application submission deadline: mid-May 2010
Anticipated Individual Awards: Awards will be for the Government's share of the allowable project costs to be in the range of $500,000 to $10 million. Multiple awards are anticipated, but not required. The Government reserves the right for one, several, or no awards under this FOA.
Types of Agreements that may be Awarded: Cooperative Agreement or Technology Investment Agreement (TIA)
Cost Sharing Requirements: If an applicant is exclusively a university or other educational institution ("Educational Institution"), a cost share of at least 10% of the total allowable costs will be required. For consortia or teams consisting exclusively of Educational Institutions, cost share of at least 10% is required. If an applicant is not an Educational Institution ("Other Applicant"), a cost share of at least 20% of the total allowable costs will be required. For consortia or teams including one or more Other Applicants, cost share of at least 20% is required. For awards where ARPA-E determines that use of a TIA is appropriate -- when a standard cooperative agreement is not feasible or appropriate -- a cost share of at least 50% of the total allowable costs will be required to the maximum extent practicable. The Government share shall include any costs incurred by Federally Funded Research and Development Centers. Cost sharing beyond the required minimum amount is encouraged and may be considered during the selection process. Monetary cost share is preferred; however, in-kind cost share is permitted and will be considered. Further information can be found in Appendix 4.
Period of Performance: Not to exceed 36 months
Agency Contact:
ARPA-E-CO@hq.doe.gov
Advanced Research Projects Agency - Energy
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

A.2. INTRODUCTION

This Funding Opportunity Announcement (FOA), funded through the American Recovery and Reinvestment Act of 2009[1], is one of three (3) FOAs which are being issued concurrently in the third round of ARPA-E financial assistance awards. The first FOA (DE-FOA-0000065), which closed on August 28, 2009, was narrowly focused on transformational R&D, but intentionally broad on the applications and technologies which could apply. The second round of FOAs, which close on March 15, 2010 (DE-FOA-0000206, 207 and 208) addresses Electrofuels, Batteries for Electrical Energy Storage in Transportation (BEEST), and Innovative Materials and Processes for Advanced Carbon Capture Technology (IMPACCT), respectively. This FOA will seek to further technical objectives related directly to Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS), as outlined in Section I.B. Program Overview.

A.3. AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009 (RECOVERY ACT)

Projects under this FOA will be funded, in whole or in part, with funds appropriated by the Recovery Act. The Act's purposes are to stimulate the economy and to create and retain jobs. The Act gives preference to activities that can be started and completed expeditiously. Accordingly, special consideration will be given to projects that promote and enhance the objectives of the Act, especially job creation, job preservation and economic recovery, in an expeditious manner. Be advised that special terms and conditions apply to projects funded by the Act. (See Section IX)

A.4. ADVANCED RESEARCH PROJECTS AGENCY – ENERGY

The Advanced Research Projects Agency – Energy (ARPA-E) is an agency within the Department of Energy (DOE), chartered by Congress in the America COMPETES Act (P. L. 110-69) to create transformational new energy technologies and systems through funding and managing research and development (R&D) efforts. The mission of ARPA-E is to overcome the long-term and high-risk technological barriers in the development of energy technologies that can achieve the following ARPA-E Mission Areas, with no direct detriment to any of these Mission Areas:

(1) Enhance the economic and energy security of the United States through the development of energy technologies that result in:
   a. reductions of imports of energy from foreign sources;
   b. reductions of energy-related emissions, including greenhouse gases; and
   c. improvement in the energy efficiency of all economic sectors; ***and***

(2) Ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies.

Under this announcement, ARPA-E will achieve these goals by funding energy technology projects that (1) translate scientific discoveries and cutting-edge inventions into technological innovations and (2) accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of high technical or financial risk.

A.5. STRATEGY FOR AMERICAN INNOVATION

ARPA-E contributes to a broader national innovation strategy and will help lay the foundation for

[1] P.L. 111-5 or the Recovery Act or Act. For all projects funded through the Recovery Act, special terms and conditions apply. Details are provided in this announcement.

innovation that leads to quality jobs and shared prosperity.[2] It is expected that energy technologies funded by ARPA-E will help catalyze breakthroughs for national priorities which:

- Harness science and technology to address the "grand challenges" of the 21st century;
- Unleash a clean energy revolution.

Under this FOA, ARPA-E is seeking R&D applications for technologies that, when in wide-spread use, will make substantial, significant, quantitative contributions to these national priorities and ARPA-E Mission Areas. In addition, the proposed technology when in use may not have a negative impact on any of the ARPA-E Mission Areas.

A.6. DESCRIPTION OF FUNDING OPPORTUNITY

Recipients of ARPA-E financial assistance awards may include a full range of R&D entities. ARPA-E encourages collaboration and the mix of complementary expertise to perform the proposed R&D. This may be a single performer or team, may be one or more institutions, and may include operational experts along with the research team.

The result of a successful ARPA-E project will be such that at the end of the project the transformational technology will be sufficiently advanced and well defined in terms of performance and risk to promote next-stage development or transfer of the project to next-stage developers. Projects under this FOA must be aimed at *more than progress toward* identified project goals; the project must be aimed at *actual delivery* of these project goals. The R&D effort on later stage technology development projects must carry the risk reduction process for the technology to the point at which entrepreneurial decisions can be made with confidence.

Concept Paper
Applicants are required to submit a Concept Paper consisting of an abstract, technical section, and cost summary, as outlined in Section IV. The Concept Paper must address the programmatic goals, objectives, and/or performance metrics as stated in Section I.B. Program Overview. Based on the review of Concept Paper submissions, applicants will be Encouraged or Discouraged to submit Full Applications.

Submission of Concept Papers began on March 2, 2010, at 1:00 PM Eastern Time. The Concept Paper submission closing date and time will be April 2, 2010, at 5:00 PM Eastern Time. Instructions for completing the Concept Paper submission are in Section IV of this FOA.

Applicants will be notified by e-mail whether they are Encouraged or Discouraged to submit a Full Application by mid-April 2010. This e-mail shall be considered the “Concept Paper notification”. Applicants must submit a compliant Concept Paper to receive a Concept Paper notification and to be eligible to submit a Full Application.

Full Application
An applicant may submit a Full Application anytime before the closing date established in their Concept Paper notification. The Full Application is due by mid-May 2010, unless ARPA-E elects to establish an alternative deadline. Applicants will be sent notification of the status of their Concept Paper by mid-April 2010 and will have 31 calendar days to prepare and submit a Full Application. In the event that ARPA-E elects to establish an alternative deadline, ARPA-E will notify each applicant (specifically, the Administrative and Technical points of contact) of the new deadline.

[2] http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation/

B. PROGRAM OVERVIEW

This program seeks to develop grid-scale energy storage technologies capable of addressing emerging intermittency and ramping challenges for the transmission of renewable electric energy, through cost-effective storage. Such energy storage should provide full power within 10 minutes for durations over 60 minutes.[3] Ubiquitous, dispatchable and cost-effective grid-scale energy storage technologies are critical for accelerating adoption of renewable generation and reducing CO_2 emissions from the electricity generation sector.

B.1 BACKGROUND

With a U.S. generating capacity 1,100 GW delivering roughly 4.1 million-GWh per year, the electric grid is a critical resource that provides 30% of all energy consumed by American homes and businesses.[4,5] However, our current electric generation system is heavily dependent on fossil fuels. Today nearly 70% of US electricity is made from coal or natural gas, and electricity generation accounts for over 40% of US CO_2 emissions.[6] Addressing the problem of climate change and energy independence will require increased use of low-carbon emitting electric generation, including renewable generation from solar and wind, as well as enhancements in the efficiency and reliability of U.S. electric power distribution.[7]

A key characteristic of renewable energy generation sources is their variability. Figure 1 illustrates the strong variability of power output that occurs from intermittent renewable energy sources (both solar and wind) on the minutes to one hour time scale, with intermittent power changes of over 80%.[8,9] The grid power level deviation spectrum shows over/under variations between generation and transmission dispatch power levels. [10] The time scales for these deviations fall in three categories.

(a) Seconds-to-minutes of power for voltage and frequency support. For this application, power reserve capacity on the order of up to 5-7% of generation on the grid (about 20-50 GW nationally) is necessary, depending on time of day and season of the year.[11]
(b) Minutes-to-hours for smoothing and firming intermittent power from renewable generation. For this application, reserve power for up to one hour duration providing standby support at a power rating on the order of 20% of the power from renewable sources, currently at 25 GW nationally[12], yields a total storage capacity of 5 GWh needed today.
(c) Hours-to-days of power for daily energy peak shifting. For this application power capacity on the order of 200 GW and 1,000 GW-hr would necessary for up to 20% integration of renewables.[13]

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[3] Corresponds to Independent System Operator and Federal Energy Regulatory Commission definition for 10-minute spinning reserves: http://www.caiso.com/2738/2738f17617750.pdf
[4] DOE U.S Energy Information Administration, http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html
[5] Lawrence Livermore National Labs, https://publicaffairs.llnl.gov/news/energy/energy.html#2008
[6] Lawrence Livermore National Labs, https://publicaffairs.llnl.gov/news/energy/carbon.html#2008
[7] Energy Independence and Security Act (EISA, 2007), Title XIII, http://www.ferc.gov/industries/electric/indus-act/smart-grid/eisa.pdf
[8] A. Curtright and J. Apt, *Carnegie Mellon Electricity Industry Center Working Paper* CEIC-07-05 (2007). www.cmu.edu/electricity
[9] DOE Bonneville Power Administration, Wind Generation & Balancing Authority Load Monitoring: http://www.transmission.bpa.gov/business/operations/Wind/default.aspx
[10] Ross Guttromson, "Renewables Integration" Pacific Northwest National Labs, January 29, 2010
[11] ARPA-E Calculation: Regulating reserves criteria following 5% for hydroelectric plus 7% for other generation sources rule, assuming for average to peak loads ranging from 400GW-750GW.
[12] DOE US Energy Information Administration, http://www.eia.doe.gov/cneaf/electricity/epa/epat1p2.html
[13] ARPA-E Calculation: Assumes 200GW generation from renewable resources meeting approximately 40% of average daily load, with 100% load shifting for 5 hours

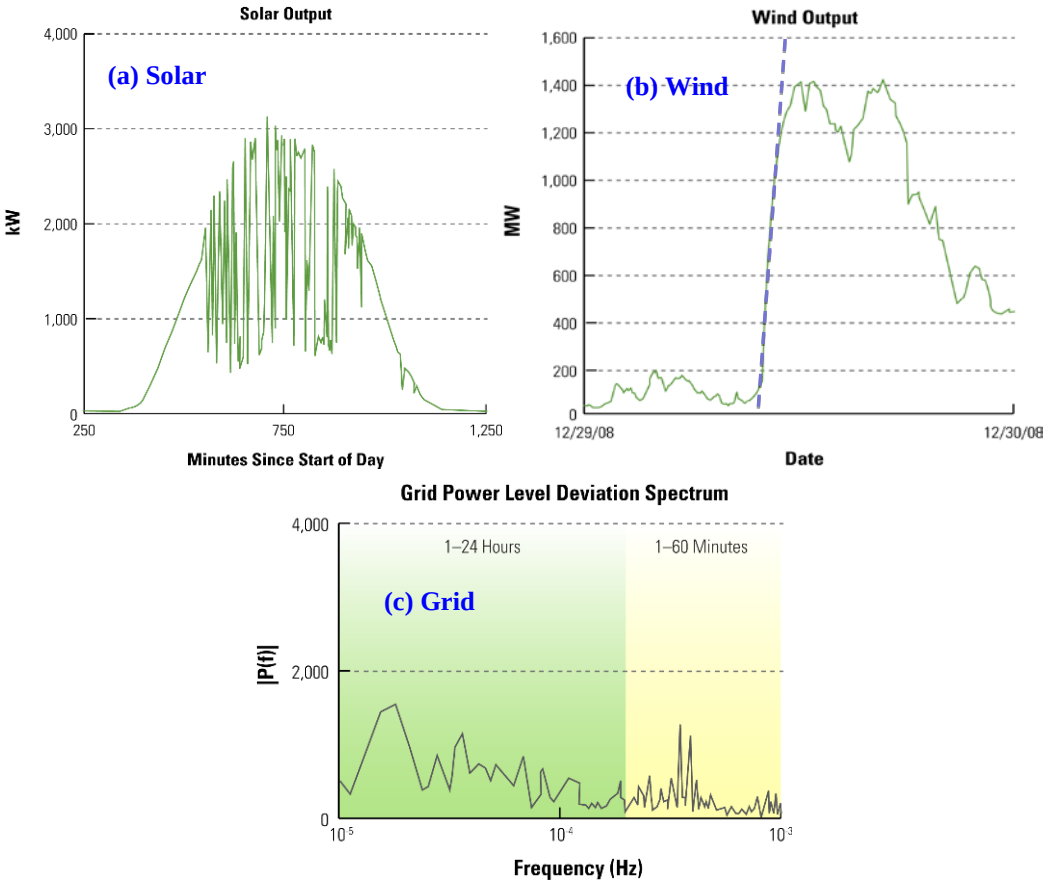

Figure 1: Intermittency within a day with durations of minutes to hours and variation of >80% in power output over these time scales limits the dispatchability of renewable generation due to weather related variations in (a) solar and (b) wind generation. Particularly for wind generation, the rate of change for power ('ramp') is a critical issue for balancing power systems, with high rates of change (MW/min), needing energy storage support for minutes-to-hours, shown as the dashed line on figure 1b. A power spectrum (c) shows the frequency of grid deviation between generation and load in the minutes-to-hours and hours-to-days timeframe on the grid. Added frequency and voltage regulation on the seconds-to-minutes timescale is done with grid ancillary services. Storage capabilities are needed to transform renewable resources into predictable and dispatchable firm power on the grid to enable a simultaneously low carbon and high reliability grid. In the absence of such storage, variations between generation and load are met through the purchase or sale of electricity at economically unfavorable prices, often from carbon emitting sources.[6,7,8]

Of the three categories, minutes-to-hours of electric storage for firming and smoothing of intermittent renewable power generation represents an urgent near-to-medium term application and technology need for our nation. The introduction of minutes-to-hours electricity storage can have two key impacts on CO_2 emissions as well as economics:

a) Enabling full utilization of renewable electricity generation;
b) Reducing the use of fossil fuels that are currently used for balancing the intermittency of renewables.

Utilization of Renewable Electricity: In the absence of widely available and cost-effective grid-scale energy storage, it may be difficult to reliably and cost effectively integrate large quantities of variable renewable generation into the grid. An example of the potential application of new storage technologies comes from the Pacific Northwest, where the Bonneville Power Administration's (BPA) balancing authority control area has the nation's largest penetration of wind generation in the country at nearly 30% of peak load (2800MW of 10,500MW). BPA is facing the undesirable potential of frequent curtailments

of wind generation or equally undesirable disruption of hydro operations in the absence of new grid balancing resources.[14,15] In parallel with renewable generation sources, grid-scale storage with the capacity to provide rated power for at least one hour would provide grid balancing and transform renewable generation resources into dispatchable and firm electric power. This would substantially increase the economic value and use of wind and solar power in the U.S. electric power generation sector.[16] New storage solutions would ultimately need to be scaled to tens of gigawatts of power with tens of gigawatt-hours of energy distributed across the grid, to address the minutes-to-hours power firming and smoothing need for renewable generation nationwide.

Reduction of Fossil-Fuel Based Load Balancing: Since little energy storage exists on today's electricity grid, generation must be constantly adjusted to meet load. In the absence of grid-scale energy storage, the existing power grid is regulated with spinning reserves, commonly in the form of carbon emitting fossil fuel power plants, which are synchronized in stand-by mode, available for full power within 10 minutes, and run in parallel with renewable generating resources. Widespread grid-scale storage functioning as spinning reserves would have immediate impact on CO_2 emissions reductions by displacing fossil fuel powered spinning reserves.

The rate of change (also known as the "ramp") between power levels, shown in Figure 2b, is a major problem for integrating intermittent renewable resources. Ramps are short-term, unsupported losses or additions of power to the grid.[17] These rapid changes in power have a financial impact as replacement power is supported by reserves, which can be an order of magnitude more expensive than base electricity prices.[18] The uncertainty of intermittency is a cost associated with renewable generation.[19,20] For this reason, renewable generation from wind and solar is not considered firm dispatchable power by electric grid operators.

Current State of the Art for Grid-scale Energy Storage: The U.S. Department of Energy's Energy Storage Systems (ESS) Program has provided critical support for energy storage in testing, pilot scale demonstration, as well as authoring the handbook on grid deployment of existing storage technologies. More than 99% of existing grid-scale energy storage of electricity worldwide uses pumped hydroelectric storage.[21] Where suitable geographic and ecological conditions exist, pumped hydroelectric storage is well developed as an economically viable grid-scale storage solution.[22,23] However, many regions with

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[14] DOE Bonneville Power Administration, Wind Generation Capacity http://www.transmission.bpa.gov/business/operations/Wind/WIND_InstalledCapacity_current.xls

[15] E. Mainzer "Solving the Wind Integration Challenge" (Jan 2010) http://www.bpa.gov/corporate/WindPower/docs/2010-01-19_WIND-MainzerPresentation.pdf

[16] B. Lee and D. Gushee "*Massive Electricity Storage*" AIChE White Paper, AIChE/GRC (June 2008)

[17] R. Gramlisch and M. Goggin, "*The Ability of Current U.S. Electric Industry Structure and Transmission Rules to Accommodate High Wind Energy Penetration*" 7th International Workshop on Large Scale Integration of Wind Power and on Transmission Networks for Offshore Wind Farms (2008).

[18] B. Milligan, et.al. "*Impact of Electric Industry Structure on High Wind Penetration Potential*", NREL/TP-550-46273 (July 2009). http://www.nrel.gov/docs/fy09osti/46273.pdf

[19] B. Silverstein, "*Integrating Renewable Resources into the Electrical Grid*" FERC Technical Conference, (March 2, 2009) http://www.bpa.gov/Corporate/WindPower/docs/Silverstein_FERC_slides_March_2009.pdf

[20] Y.V. Makarov, et.al., "*Wide-Area Energy Storage and Management System to Balance Intermittent Resources in the Bonneville Power Administation and California ISO Control Areas*," Pacific Northwest National Labs (PNNL-17574) 2008.

[21] B. Roberts, "Capturing Grid Power," *IEEE Power and Energy Magazine* (July/August 2009), p 32-41.

[22] EPRI-DOE Handbook of Energy Storage for Transmission and Distribution Applications, (Final Report, 2003, Imre Gyuk, Project Manager) http://www.sandia.gov/ess/Publications/pubs.html

[23] *Energy Storage for Grid Connected Wind Generation Applications, EPRI-DOE Handbook Supplement* (Technical Update, 2004, Imre Gyuk, Project Manager) http://www.sandia.gov/ess/Publications/pubs.html

energy storage needs do not have suitable conditions for widespread pumped hydroelectric. Even in regions with significant hydropower resources (such as the Columbia River basin), the widespread deployment of renewable generation resources is causing instability for the existing power grid which limits the continued rapid growth of intermittent renewable power sources such as wind and solar.[9] There is an urgent need for new storage technologies that can provide the dispatchable power duration, low-cost, and life-cycle reliability of pumped hydroelectric, but provide scalability and siting for ubiquitous deployment across the grid.[24,25]

The next largest source of currently deployed grid-scale electric storage is sub-surface compressed air energy storage (CAES), with <500MW installed globally. The US Department of Energy is supporting several CAES pilot-projects through the Energy Storage Demonstration Program,[26] however the expansion of sub-surface CAES is challenged by the availability of sites with the requisite geology.

Figure 2 shows a map of various existing grid-level storage solutions in terms of cost metrics, response time and duration of operation. Hydroelectric and CAES are below a $100/kWh cost as systems. However, these technologies face challenges limiting their potential for ubiquitous and widespread deployment. Existing installations of other advanced grid-scale modular energy storage technologies (batteries, flow batteries, etc) add up to less than 370MW globally. The widespread deployment of these technologies is primarily limited by the high capital cost of energy using existing modular energy storage technologies. Hence, alternative technical approaches providing equivalent energy and power are urgently needed to address the challenge of grid-scale energy storage.

Need for New Technologies: The development of new technologies for the widespread deployment of cost-effective grid-scale energy storage will be critical in enabling the drive toward low-carbon electric power generation. Cost-effective grid scale electrical storage will simultaneously increase grid reliability, reduce CO_2 emissions, and enable widespread penetration of intermittent renewable generation. The development of disruptive new low-cost grid-scale energy storage technologies will also allow the U.S. to assume global technology and manufacturing leadership in the emerging and potentially massive global market for grid-scale energy storage infrastructure.

In this program, ARPA-E seeks the development of revolutionary new technology approaches to grid-scale electrical energy storage which can provide the energy, cost, and cycle life of pumped hydropower (<$100/kWh and >5000 cycles) but which are modular and can be made available for widespread use at any location across the power grid. While many valuable applications for grid storage exist, this program focuses on developing revolutionary new grid-scale energy storage technologies to balance short-duration variability in renewable generation. The required grid-scale storage technology will be able to deliver full power within 10 minutes, provide at least 60 minutes of energy at rated power, and cycle between charge and discharge mode throughout the day with high round trip energy efficiency (>80%).

[24] E. Mainzer "Solving the Wind Integration Challenge" (Jan 2010) http://www.bpa.gov/corporate/WindPower/docs/2010-01-19_WIND-MainzerPresentation.pdf

[25] T. Moore and J. Douglas "Energy Storage: Big Opportunities on a Smaller Scale" *EPRI Journal* (Spring 2006) http://mydocs.epri.com/docs/CorporateDocuments/EPRI_Journal/2006-Spring/1013289_storage.pdf

[26] DOE Office of Energy, ARRA Smart-Grid Demonstration Grant Programs: http://www.energy.gov/news2009/documents2009/SG_Demo_Project_List_11.24.09.pdf

This program will focus on technology prototyping and proof-of-concept R&D efforts, not pilot demonstration projects. Ultimately, technologies developed in this program must be scalable to the GW and GW-hr levels of power and energy capacity, respectively. However, for this program, technology prototypes at a scale of ~20 kW or greater are expected; units of this size are scaled large enough to

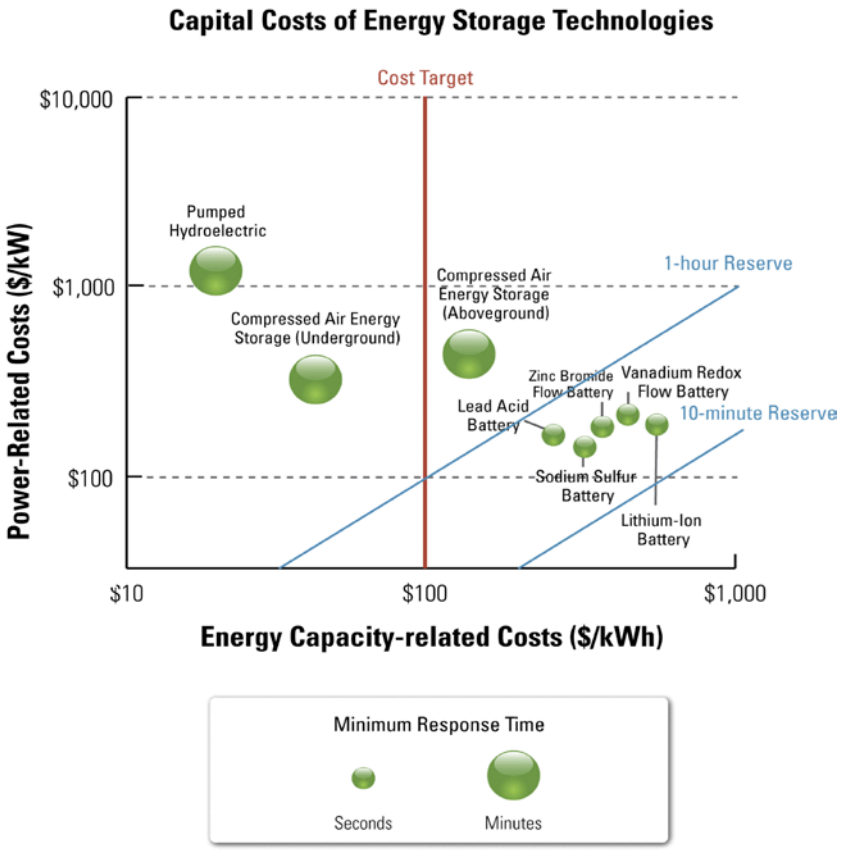

Figure 2: Energy and power costs bound a range of duration for various grid-scale electric storage technologies, with energy cost targets and minimum response time requirements for economically viable, dispatchable electric grid integration. Pumped hydroelectric and underground compressed air-energy storage are economically deployable in suitable locations. New storage technologies are needed to provide broader siting opportunities at economically favorable costs are needed for grid-scale deployment. With new development, such technologies might include advanced lead-acid batteries (PbA), Zinc-Bromide flow batteries (Zn-Br), Sodium-Sulfur (NaS) batteries, Lithium-ion (Li-ion) batteries and Vanadium Redox (VR) flow batteries.

demonstrate the technical concept, yet are small enough to focus on technology development rather than pilot-scale development. The scientific and technical advances through this project are expected to have a transformational impact on grid-scale energy storage.

B.2 OBJECTIVES

The GRIDS program is focused on supporting high-risk, high-impact R&D efforts to develop proof-of-concept technologies and advanced system prototypes with high potential to revolutionize grid-scale electric energy storage. The developed technologies will have potential to achieve the economics of pumped hydroelectric storage yet may be deployed at any location on the grid. Projects must be capable of meeting technical criteria for energy, cost and reserve time of hydroelectric, as it is used for power regulation of large-scale intermittent generation as described below.

The technical requirements in this FOA are based on the economics of hydroelectric storage, which is currently used to provide large scale power firming for renewable intermittency at a capital cost for energy less than $100/ kWh at megawatts of power, with capacity of 100s of MW and 1,000's of MW-hr of power and energy, respectively in specific locations. But hydroelectric storage is not scalable or feasible in all geographic locations. This FOA seeks to support the development of grid-scale electrical energy storage technologies that show strong promise of subsequent scalability to GW of power, GW-hr of energy capacity cumulatively, can deliver for full power (100% of rated power) within 10 minutes, and are capable of operating for durations of at least 60 minutes at their rated power, and with an energy cost below $100/kWh.[27]

While hydropower can operate for up to 20,000 charge and discharge cycles before an overhaul is required, technologies demonstrated under this FOA must operate up to at least 5,000 charge and discharge cycles without degradation in power or storage capacity. This number of cycles represents a useful life of approximately 10 years, a minimum life required for initial use in a utility environment.[28] In order to operate on a cost competitive basis, the round-trip energy efficiency for stored electricity must exceed 80% per cycle, measured as energy from grid-to-grid, with all additional external energy inputs accounted for as electric energy equivalents. Measurement for a minimum of 60-minutes at rated power will be used for evaluation of round-trip efficiency and load duration. The electric energy costs ($/kWh) should be calculated on a total installed cost basis for energy capacity at rated power, not for de-rated operation.

Alternative approaches for grid-scale energy storage include, but are not limited to, those outlined in Figure 2.[29] For electric storage with a 5000 cycle lifetime, round trip efficiency of 80% and $100/kWh storage cost, the premium cost per storage cycle for storage would be $0.025 / KWh_e above the electricity cost, which is within the predicted cost range for technology adoption relative to the cost of alternative approaches to regulation power.[30],[31]

B.3 AREAS OF INTEREST

Innovative technical approaches to grid-scale energy storage technologies able to approach, meet or exceed the "Primary Technical Requirements" and to approach, meet or exceed a majority of the "Secondary Technical Targets" stated below are of high interest. Areas of particular interest include, but are not limited to:

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[27] *Market Driven Distributed Energy Storage Requirements for Load Management Applications* (EPRI Report 1014668) D. Rastler, Project Manager (2007)

[28] *Electric Energy Storage, Primer on Applications, Costs and Benefits, (*EPRI Energy Storage Program, Draft 12/2009, D. Rastler Program Manager) [Report ID: 1020676]

[29] S. Schoenung and W. Hassenzahl "Long- vs. Short-Term Energy Storage Technologies Analysis: A Life-Cycle Cost Study" , Sandia Report: SAND2003-2783 (2003).

[30] ARPA-E calculation using:

$$Cost\ per\ Storage\ Cycle(\$/kWh_e) = \frac{Energy\ Storage\ Cost\ (\$/kWh)}{Cycles(\#) \times Round\ Trip\ Efficiency(\%)}$$

This calculation provides the "cost premium" for storage by allocating storage capital investment costs for energy at rated power ($/kWh) as a cost per storage cycle. This cost premium is in addition to the cost of stored electricity for storage. The cost premium considers only allocation of storage asset cost to the stored electricity, and does not include allocation of operation or maintenance expenses. http://www.electricitystorage.org/site/technologies/

[31] B. Milligan, "Analysis of Sub-Hourly Ramping Impacts of Wind Energy and Balancing Area Size" *Windpower 2009*, NREL/CP-500-43434 (June 2008)
http://www.ornl.gov/sci/ees/pes/pubs/WindPower_2008_Analysis_of_Sub-hourly_Ramping.pdf (Premium for reserve power supporting ramp can be up to $0.90/kWh)

- Novel approaches to batteries, flow-batteries, fuel-cells, compressed air (non-traditional); superconducting-magnetic storage, ultra-high energy density flywheels, localized fluid pumping, high-scale ultracapacitors, or a combination of novel technologies to economically meet grid-scale storage energy and power requirements.

- ARPA-E believes there are particular opportunities for advancing grid-scale storage technologies in areas including, but not limited to:
    - Electrochemical energy storage approaches based upon very low cost materials.
    - Novel approaches to compressed air energy storage (CAES), including systems with unique siting (including above ground and underwater) and systems that offer higher efficiencies and fast start-up times
    - Extremely high energy density, low cost flywheel technologies
    - New approaches to flow batteries that offer lower costs, higher power, and improved roundtrip efficiency through advanced power modules and novel storage chemistries
    - Devices using higher critical current density superconducting storage materials
    - Unique energy storage system designs that may have been unproven and deemed too technically risky for the prior Department of Energy's Office of Electricity Delivery and Energy Reliability led Energy Storage Demonstration Projects of the Smart-Grid Demonstration Grants Program [32].

- Energy storage systems that demonstrate a clear path to grid-scale deployment, providing 1MW - 10MW of power. Particularly for technologies such as flow-batteries for which energy and power costs may be scaled separately, ARPA-E is most interested in supporting technologies which address grid-scale challenges (MW), even though the solutions are being assessed in a downscaled (kW) advanced system prototype.

Areas of Supplemental or Secondary Interest

- Energy storage systems that may reliably operate on an unattended basis for extended periods of time (years) with low requirements for maintenance and low probability of irreparable damage due to conditions expected for grid assets.

- Energy storage systems deployable across a range of geographical (mountain/plains/coastal) or demographic (urban/rural) locations, including deployment which may be constrained by existing substation facilities size and location.

- Energy storage systems that are based on low-cost materials or have a low dependency on strategic/critical resources or materials, specifically such as alkali-metal or rare-earth metals of potentially limited domestic availability.

- Advanced power conditioning systems in "Advanced Systems Prototyping" category projects, based on novel low-loss power electronics which have the potential to significantly improve system functionality such as round trip efficiency or provide multiple mode operation.

- Energy storage solutions that are fault-tolerant to unscheduled disruptions including black-out.

[32] https://www.fedconnect.net/FedConnect/PublicPages/PublicSearch/Public_Opportunities.aspx, Reference # DE-FOA-0000036, (6/27/2009) "Smart Grid Demonstration Grant"

Specifically Not of Interest

- Incremental improvements to, or combinations of, existing products or technologies with no additional advances in understanding or reduction in technical uncertainty.

- Pilot-plant demonstrations, which do not include a significant degree of technical risk or requirement for scientific research.

- Thermal storage, electricity demand response, or distributed generation, unless proposed as a part of an overall MW_e-in to MW_e -out electricity storage system.

- Engineering of repurposed storage materials and devices (including used automotive batteries), unless proposed effort describes a specific high-risk technical challenge being addressed.

- Simulation and control studies of storage assets across the power grid that do not include a specific storage device.

It is assumed that any storage technology being considered by this program must show the capacity to operate unattended under typical environmental conditions and reliability requirements of power grid assets, including operation, maintenance, footprint, or safety considerations, as well as compliance with requirements of State and Federal regulatory organizations.[33] For the purpose of the proposed efforts, technologies relevant to the North American 60Hz AC grid will be assumed, unless otherwise explicitly stated and justified by the proposer.

B.4 TECHNICAL REQUIREMENTS

This FOA is focused around supporting grid-scale electric energy storage technology research and development projects that are able to address the specific quantitative performance targets and cost metrics described below. Proposed technical development plans must have well justified, realistic potential to credibly approach, meet or exceed the stated "Primary Technical Requirements" by the end of the period of performance for the proposed project in order to be considered for award. Proposed technologies will secondarily be evaluated against their potential to approach or meet the "Secondary Technical Targets" by the end of the period of performance for the proposed project. Proposed technologies will still be considered for award if they may fall short of one or more of the Technical Targets, but will be competitively evaluated and compared according to ability to address these targets.

The Primary Technical Requirements and Secondary Technical Targets for this FOA are clearly stated in the two tables below.

PRIMARY TECHNICAL REQUIREMENTS:

Requirement ID Number	***Requirement Category***	***Value (Units)***
1.1	System Capital Cost per Unit of Rated Energy Capacity (for measured capacity at Rated Power)	<$100/kWh
1.2	Minimum Operating Time at Rated Power (time at Rated Power for charge and discharge)	60 minutes

[33] Smart Grid Interoperability Panel, http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIPRecognizedStandards

1.3	Maximum Response Time (time for system to go from 0% to 100% of rated power in discharge and in charge mode)	10 minutes
1.4	Rated Power Capacity for Charge and Discharge in Advanced System Prototypes	≥20kW

SECONDARY TECHNICAL TARGETS:

Target ID Number	***Target Category***	***Description***
2.1	Cycle Life (cycled at rated power between charge and discharge)	5,000 cycle minimum, defined as number of cycles at which >20% reduction in total energy/power capability occurs relative to initial rated values
2.2	Round-Trip Efficiency	80% at rated power for of charge and discharge
2.3	Maximum Dwell Time	Maximum 10 minute response time for reversal between charge and discharge cycles
2.4	Scalability of Storage Technology for Grid-scale Application	Potential for subsequent scaling for grid-scale deployment (1-10MW). Scalability will be assessed at the power/energy ratio of the advanced systems prototype proposed.
2.5	Internal Losses	Less than 5% loss of energy in 24 hours from fully charged state.
2.6	Safety	Consistent with transmission and distribution grid deployment at unattended locations
2.7	Calendar Life	10 years minimum

ARPA-E will not consider selecting projects for award that do not clearly demonstrate realistic, well-justified potential to approach, meet or exceed the Primary Technical Requirements stated above by the end of the period of performance. With regard to Primary Technical Requirement 1.1, the system level cost requirement, ARPA-E understands that not all applicants will have access to sophisticated energy storage systems cost modeling. It is expected that all applicants will make a strong effort to justify how the technology holds promise to meet this FOA's $100/kWh cost target. The cost target is intended to be a forward looking consideration of energy storage system costs, including power conditioning system and balance of plant, assuming successful technology development as an advanced prototype, and subsequent scaling of manufacturing for grid-scale deployment.

ARPA-E expects that all novel energy storage approaches with the potential to achieve the aggressive cost and storage duration targets of the Primary Technical Requirements will likely have unique technology challenges in meeting the Secondary Technical Targets. ARPA-E will expect that each proposal will have strengths and weaknesses as it relates to Secondary Technical Targets. End of project performance target shortcomings relative to one or more Secondary Technical Targets will not preclude consideration for selection for award. However, it is expected that all proposed energy storage research and development plans will result in at least approaching the stated Secondary Technical Targets by the end of the project period of performance and proposals will be evaluated against the proposed technology research and development plan's ability to do so.

ARPA-E will set aggressive intermediate "go-no go" metrics for each project selected for award under this FOA and will use independent external partners to validate the demonstrated performance of all proof of concept storage components / advanced system prototypes developed under this FOA, including standard tests of safety and reliability as well as accelerated testing to determine calendar life. For the

purposes of this FOA, energy capacity (kWh) will be determined as the product of rated power (kW) and measured duration (hours) at rated power.

Other Technical Requirements:

In addition to the Primary Technical Requirements and the Secondary Technical Targets detailed above, applicants must address the following key technical requirements:

A.) Manufacturability of Proposed Technology at Scale
The applicant must describe the manufacturing approach(es) that will most likely be used to ultimately scale-up the proposed energy storage technology from the kW scale advanced prototype in the proposed effort to the MW scale for subsequent grid-scale deployment. This description must discuss the ability of this/these manufacturing approach(es) to scale at sufficiently low cost to address the $100/kWh Primary Technical Requirement. Applicants are also encourages to describe whether or not the proposed energy storage technology offers an opportunity for the U.S. to take a leadership role in grid-scale energy storage manufacturing and to provide a justification.

B.) Technical Strength of the Performance Team
The applicant should describe the unique elements/background/skills of the proposed technical team that makes the team uniquely suited to successfully execute the proposed energy storage research and development plan.

B.5 CONCEPT PAPER STRUCTURE

Applicants are required to first submit a Concept Paper describing the essence and novelty of their new technology concept in order to be considered for award under this FOA. The purpose of the Concept Paper phase of this FOA is to allow applicants to communicate their grid-scale energy storage technology concept to ARPA-E, with a minimal level of investment in time and resources, and receive feedback on ARPA-E's level of interest in the concept before ARPA-E requests the submission of a more time and resource intensive Full Application.

General Concept Paper requirements can be found in Section IV.B.2 of this FOA. Specific requirements and key elements that each Concept Paper must address are found in this section (Section I.B.5) and in the rest of Section I.B.

As stated in Section IV.B.2, Concept Paper will consist of a body not exceeding five (5) pages in length containing the following sections: 1.) Abstract and 2.) Technical Section. The Concept Paper will also include a one page "Cost Summary" (described in Section IV.B.2) and a one page completed "End of Project Targets" table that should be included in a single Concept Paper file, but will not count toward the five (5) page Concept Paper body limit. The End of Project Targets table will include the end of project target for the scale and form factor of the prototype device deliverable, as well as the end of project targets for all Primary Technical Requirements and Secondary Technical Targets. The "End of Project Targets" template can be found in Appendix 1 in Section X.

TECHNICAL SECTION

Specific issues/questions that should be considered and addressed in the Technical Section include the following:

- Identification of whether the applicant is applying for an award under the "Proof of Concept Seedling" category or the "Advanced Systems Prototyping" category. Please see definitions on Page

18 of this document.

- A detailed description of the novel technology approach to be developed in the proposed project, including a description of its basic operating principles and how the proposed approach is unique and innovative. To the degree possible, preliminary data supporting any novel technology claims should be included.
- A description of the current state-of-the-art in the proposed technology area, including key shortcomings/limitations/challenges, and how the proposed project will seek to significantly improve upon the current state-of-the-art performance and overcome current key shortcomings/limitations.
- The applicant should provide a brief paragraph addressing the following issues for each of the Primary Technical Requirements (1.1-1.3) and Secondary Technical Targets (2.1-2.5)
    - What is the current state-of-the-art performance level for the proposed technology area for the specified requirement/target?
    - What level of performance will the project proposed target for the specified requirement/target? What are the specific technical issues that have limited performance of this technology to date for the specified requirement or target?
    - How does the project proposed address these specific technical issues to provide enhanced performance relative to the specified requirement or target? The applicant should provide technical justification and preferably preliminary data for why this proposed target can credibly be met.
    - What are the key technical risks/issues associated with the technology development plan related to the specified requirement or target?
- A brief description of the subsequent manufacturing or pilot-design approach by which the proposed energy storage technology would be scaled to grid-scale integration and the scalability/cost issues related to this approach.
- A brief description of how the project, if successful, would impact U.S. leadership in grid-scale energy storage technology development and manufacturing.
- A brief description of the project team and why they are uniquely suited to successfully execute the proposed battery research and development plan.
- A brief description of the impact ARPA-E funding on the proposed project relative to other previous or existing funding sources the project team has secured.

B.6 CONCEPT PAPER EVALUATION CRITERIA

General Concept Paper Evaluation Criteria are found in Section V.A. of this FOA. More specific Concept Paper Evaluation Criteria are described in this section.

Concept Papers will be evaluated against the following evaluation criteria in decreasing order of importance:

- To what degree does the Concept Paper present a grid-scale energy storage technology development plan that demonstrates credible and well-justified technical potential to approach, meet or exceed each of the Primary Technical Requirements of this FOA. Technology approaches will be evaluated in a quantitative fashion, with technology approaches rated according to the degree to which they fall short of, meet, or exceed each Primary Technical Requirement.

- To what degree does the Concept Paper present a grid-scale energy storage technology development plan that demonstrates credible and well-justified technical potential to approach, meet or exceed each of the Secondary Technical Targets of this FOA. Technology approaches will be evaluated in a quantitative fashion, with technology approaches rated according to the degree to which they fall short of, meet, or exceed each Secondary Technical Target.

- To what degree does the Concept Paper present a unique and innovative technical approach to significantly improve grid-scale energy storage performance over the current state-of-the-art.

- To what degree does the Concept Paper present a clearly demonstrated understanding of the current state-of-the-art and technical limitations of the current state-of-the-art in the relevant technology area.

- To what degree does the grid-scale energy storage technology proposed in the Concept Paper hold potential to enable U.S. technology, manufacturing, and deployment leadership in grid-scale energy storage systems markets.

- To what degree does the proposed technical team have the skills and knowledge to successfully execute the project plan

- To what degree will ARPA-E funding have a leveraged impact on the development of the proposed technology relative to other funding sources for the project team.

B.7 AWARD CATEGORIES AND AWARD INFORMATION

This FOA will expect to fund up to $30M in grid-scale energy storage technology research and development projects. Project durations will be from 24-36 months. ARPA-E will accept Concept Papers and Full Applications in two award categories: 1.) "Proof of Concept Seedling" category and 2.) "Advanced Systems Prototyping" category.

Storage Component 'Proof of Concept Seedling' Category
The "Proof of Concept Seedling" category for this FOA will focus on supporting early stage proof-of-concept level research and development efforts. This category of the FOA will seek to support particularly high-risk, high reward, highly speculative new electrical energy storage technology concepts that have yet to achieve a definitive "proof of concept". By the end of the period of performance, projects in this category will be expected to provide proof-of-concept performance that address the Primary Technical Requirements and Secondary Technical Targets of this FOA based on testing at the energy storage component scale or larger. ARPA-E expects to select 5-15 projects for award under this category with awards expected to be in the range of $500k-$2M over 24-36 month project durations.

Systems Level 'Advanced Systems Prototyping' Category
The "Advanced Systems Prototyping" category of this FOA will focus on supporting early stage prototypes of grid-scale energy storage systems technology concepts for which some initial proof-of-concept component demonstration already exists. Projects in this category will be expected to focus on the development and demonstration of energy storage system prototypes that address the critical shortcoming of existing grid-scale energy storage technologies. Projects which are primarily pilot-scale demonstration of already proven systems prototypes will not be considered under this award category. However proposals that include investigation of technical issues related to manufacturing scale-up feasibility will be considered under this award category. By the end of the period of performance, projects in this category will be expected to deliver proof-of-principle grid-scale storage systems prototypes, in form factors and sizes relevant to demonstrate the potential for grid applications. ARPA-E expects to select 5-10 projects for award under this category with awards expected to be in the range of $3-$5M (with projects up to $10M considered in exceptional cases) over 24-36 month project durations.

Section II - AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

ARPA-E anticipates awarding Cooperative Agreements or Technology Investment Agreements (TIAs) under this FOA. Cooperative Agreements are the most likely instruments to be used because of the need for substantial government interaction to review and assess technical progress and determine continuation of funding during the performance of research and development (R&D) projects.

A TIA may offer more flexibility for tailoring requirements than standard financial assistance awards in certain areas, including financial management systems that comply with Generally Accepted Accounting Principals for for-profit applicants; cost accounting systems; and intellectual property terms. Any applicant considering a TIA should contact ARPA-E's IP attorney before they submit their Full Application to discuss the Intellectual Property (IP) details and restrictions associated with a TIA. Please see Section VIII for contact details. While a TIA would typically offer flexibility in terms of audit provisions, ARPA-E's flexibility for these provisions is limited under this FOA. The funds for this FOA have been appropriated by the Recovery Act, which includes express requirements with respect to audit provisions. ARPA-E is also limited in its flexibility regarding tangible property management, including, for example, real property and equipment. Otherwise, it is ARPA-E's general policy to avoid requirements that would force participants to use different financial management, property management, and purchasing systems than those currently in use.

An applicant may request a TIA if the applicant believes that using a TIA could benefit the objectives of the program and can document these benefits. After an applicant is selected for negotiations, the Contracting Officer and the ARPA-E Program Director will determine if awarding a TIA would benefit the objectives of the program in ways that likely would not happen with a typical financial assistance agreement.

Before deciding that a TIA is appropriate, the contracting officer also must judge that using a TIA could benefit the RD&D objectives in ways that likely would not happen if another type of assistance instrument were used (e.g., a cooperative agreement subject to all of the requirements of 10 CFR part 600).

Considerations:

- Will the use of a TIA permit the involvement of any commercial firms or business units of firms that would not otherwise participate in the project?
- If so: What are the expected benefits of those firms' or divisions' participation (e.g., is there a specific technology that could be better, more readily available, or less expensive)?
- What precludes participation if an instrument other than a TIA were used? For example, if the RD&D effort is based substantially on a for-profit firm's privately developed technology a for-profit firm may not participate unless the Government's intellectual property rights in the technology are modified.
- Will the use of a TIA allow firms or business units of firms that traditionally accept Government awards to use new business practices in the execution of the RD&D project that will foster better technology, new technology more quickly or less expensively, or facilitate partnering with commercial firms?
- Are there any other benefits of the use of a TIA that could help DOE meet its objectives in carrying out the project?

B. ESTIMATED FUNDING

Awards will be for the Government's share of the allowable project costs in the range USD $500,000 to $10 million. Multiple awards are anticipated, but not required. The government reserves the right to make one or more, or no awards on this FOA. The applicant should propose a funding level that is appropriate to the work, without introducing additional risk by either underfunding or adding extraneous tasks or large management reserves that will drive up the R&D cost.

ARPA-E anticipates awarding agreements totaling up to USD $30 million for this FOA. However, the amount of resources made available under this announcement will depend on the quality of the proposed R&D projects and other programmatic considerations.

C. MAXIMUM AND MINIMUM AWARD SIZE

Ceiling for the Federal Government's share of allowable project costs (i.e., the maximum amount for an individual award made under this announcement):

USD $ 10,000,000

Floor for the Federal Government's share of allowable project costs (i.e., the minimum amount for an individual award made under this announcement):

USD $ 500,000

D. EXPECTED NUMBER OF AWARDS

Multiple awards are anticipated, but not required. The government reserves the right to make one or more, or no awards on this FOA; however, it is anticipated that between 5 and 15 awards will be made under this FOA.

E. ANTICIPATED AWARD SIZE

The award size will reflect the level of effort expected to achieve the project objectives. ARPA-E anticipates an average award size between USD $1 million and $5 million for the Federal Government's share of allowable project costs.

F. PERIOD OF PERFORMANCE

The period of performance may be no more than 36 months. ARPA-E anticipates that the majority of awards will have a period of performance between 24 and 36 months.

Section III - ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

ARPA-E welcomes submissions from any type of capable technology research and development entity. This includes, but is not limited to, for-profit entities, academic institutions, research foundations, not-for-profit entities, collaborations, and consortia. A Federally Funded Research and Development Center (FFRDC) may submit a proposal as a project lead entity only if the FFRDC is the lead for a consortium, collaboration, or other teaming arrangement. The FFRDC may not submit a proposal as a stand alone entity. A minimum of 90% of the work, as defined by total project costs, must be performed on U.S. soil, which includes the United States proper, its territories, and territorial waters.

A.1. PARTICIPATION BY FOREIGN ENTITIES

Foreign-owned entities may participate under this FOA as a recipient or sub-recipient if the foreign-owned entity is incorporated within the United States. A minimum of 90% of the work, as defined by total project costs, must be performed on U.S. soil, which includes the United States proper and its territories. U.S. preference and manufacturing requirements under the Bayh-Dole Act, 35 U.S.C. 200-212, and DOE regulations and policies will apply to all recipients and sub-recipients. Agreements resulting from the FOA will require recipients to promote manufacturing within the U.S. of products that embody the technology(ies) developed with ARPA-E funding.

A.2. ORGANIZATIONAL CONFLICTS OF INTEREST

ARPA-E may elect to utilize contractor services to support program creation, administration, and testing. To avoid both real and perceived conflicts of interest, ARPA-E only allows a company or other entity to be a R&D performer if the company is not a support contractor to ARPA-E, because support contractors may be involved in the program creation, administration, and testing phases. By submitting a Concept Paper or Full Application, the applicant and all subcontractors or team members on that application are stating that they are not performing support contractor services for ARPA-E, either as a prime contractor or subcontractor. If it is found that a lead applicant or any of the other entities on the application are support contractors to ARPA-E, the application may be rejected by ARPA-E without further review.

If a prospective applicant believes that any conflict of interest exists or may exist (whether organizational or otherwise), the applicant should promptly raise the issue with ARPA-E by sending the applicant's contact information and a summary of the potential conflict by email to ARPA-E-CO@hq.doe.gov, before time and effort are expended in preparing an application.

B. COST SHARING

If an applicant is exclusively a university or other educational institution ("Educational Institution"), a cost share of at least 10% of the total allowable costs will be required. For consortia or teams consisting exclusively of Educational Institutions, cost share of at least 10% is required. If an applicant is not an Educational Institution ("Other Applicant"), a cost share of at least 20% of the total allowable costs will be required. For consortia or teams including one or more Other Applicants, cost share of at least 20% is required. For awards where ARPA-E determines that use of a TIA is appropriate -- when a standard cooperative agreement is not feasible or appropriate -- a cost share of at least 50% of the total allowable costs will be required to the maximum extent practicable. The Government share shall include any costs incurred by Federally Funded Research and Development Centers. Cost sharing beyond the required minimum amount is encouraged and may be considered during the selection process. Monetary cost share is preferred; however, in-kind cost share is permitted and will be considered. Further information

can be found in Appendix 4.

C. OTHER ELIGIBILITY REQUIREMENTS

Federally Funded Research and Development Center (FFRDC) Contractors

A FFRDC contractor may not submit a proposal as a standalone entity. FFRDC contractors may submit a proposal as a project lead entity for a consortium, collaboration, or other teaming arrangement, subject to the following guidelines:

Authorization for non-DOE/NNSA FFRDCs.
The Federal agency sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project. This authorization is not required for the concept paper submission, but is required for the Full Applications. The use of a FFRDC contractor must be consistent with the contractor's authority under its award and must not place the FFRDC contractor in direct competition with the private sector.

Authorization for DOE/NNSA FFRDCs.
The cognizant contracting officer for the FFRDC must authorize in writing the use of a DOE/NNSA FFRDC contractor on the proposed project. This authorization is not required for the concept paper submission, but is required for the Full Applications. The following wording is acceptable for this authorization.

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

For Full Applications where an FFRDC is on the team, but not the lead entity:

- Value/Funding - The value of, and funding for, the FFRDC contractor portion of the work will not normally be included in the award to a successful applicant.
- Responsibility - The applicant, if successful, will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and the FFRDC contractor.

Section IV - APPLICATION AND SUBMISSION INFORMATION

A. REGISTRATION REQUIREMENTS

There are several one-time actions the applicant must complete in order to submit a Full Application in response to this FOA. The applicant must:

- Register with ARPA-E through the ARPA-E eXCHANGE (please see Section IV.B. for details)
- Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number at http://fedgov.dnb.com/webform
- Register with the Central Contractor Registry (CCR) at https://www.ccr.gov/

Beside the eXCHANGE registration system, which does not have a delay, these registration requirements could take several weeks to process and are necessary in order for a potential applicant to submit a Full Application. Therefore, although not required in order to submit a Concept Paper, all potential applicants lacking any of the registration requirements above should complete them as soon as possible.

ARPA-E Web-Based Submission Information

All Concept Paper and Full Application submissions are to be made via the ARPA-E eXCHANGE at https://arpa-e-foa.energy.gov/. In order to gain access to the ARPA-E eXCHANGE, the applicant must first register and create an account on the main ARPA-E eXCHANGE site. This account will then allow the user to register new Concept Papers for any open ARPA-E FOAs, to submit Full Applications for any responsive Concept Paper, and to submit Responses to Reviewer Feedback. It is recommended that each organization or business unit, whether acting as a team or a single entity, utilize one account as the appropriate contact information for each submission will be entered later.

The applicant will receive an automated response when the Concept Paper, Full Application, or Response to Reviewer Feedback is received; this will serve as a confirmation of ARPA-E receipt – please do not reply to the automated response. The applicant will have the opportunity to re-submit a revised Concept Paper, Full Application, or Response to Reviewer Feedback for any reason so as long as the relevant submission is submitted by the specified deadline. A "User Guide" for the ARPA-E eXCHANGE can be found on the ARPA-E website https://arpa-e-foa.energy.gov/Manuals.aspx after logging in to the system. Any other questions which arise during the application process should be sent to ARPA-E-CO@hq.doe.gov.

ARPA-E will not accept any submissions through FedConnect.

Letters of Intent

Letters of Intent are not requested nor required.

B. CONCEPT PAPER STRUCTURE AND SUBMISSION INFORMATION

The typical Concept Paper should express a consolidated effort in support of one or more related technical concepts or ideas. Disjointed or unrelated efforts should not be consolidated into a single Concept Paper. No facsimile or hard copy submissions will be accepted; Concept Paper submissions are to be made via the ARPA-E eXCHANGE at https://arpa-e-foa.energy.gov/.

The Concept Paper must be submitted through the web based submission system discussed in Section IV.B. The body of the Concept Paper is limited to five (5) pages, including a cost summary page. If a

Concept Paper exceeds the page limitation, only the first five (5) pages will be reviewed. All pages must be formatted to fit on 8-1/2 by 11 inch paper with type not smaller than 12 point font and margins not less than one inch on every side. The Concept Paper must be submitted as a PDF file. The page limitation for Concept Papers includes all figures, tables, and charts. The submission of other supporting materials is strongly discouraged unless specifically called for in Section I.B. Program Overview. Concept Papers must contain all pertinent information – no external data sources (e.g., websites) should be required for Concept Paper review. All applications must be written in English.

A Concept Paper may contain proprietary data. The Concept Paper will be held in confidence by DOE and ARPA-E and will not be shared outside of DOE unless review by a non-government subject matter relevant expert is required. Non-governmental reviewers will be selected based upon outstanding technical credentials, will be screened for any conflict-of-interest, and will be required to sign a non-disclosure agreement.

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, the disclosure of which may harm the applicant, should not be included in a concept paper or Full Application, unless such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the project narrative and specifies the pages of the application which are to be restricted:

> "The data contained in pages [APPLICANT MUST IDENTIFY PAGES] of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for review and evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. Any disclosure outside the Government shall be made only to a party subject to an appropriate obligation to the Government to protect the confidentiality of the application. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

Applicants are required to identify in the bracketed space above the page numbers on which the patentable ideas, trade secrets, proprietary or confidential commercial or financial information appears. Failure to comply with this requirement will result in the waiver of any right to restricted treatment.

Further, each line or paragraph on the pages containing patentable ideas, trade secrets, proprietary or confidential commercial or financial information must be specifically identified and marked with a legend similar to the following:

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

Failure to comply with this requirement will result in the waiver of any right to restricted treatment.

Concept Paper Structure

The body of the concept paper is limited to five (5) pages for the Abstract Section and Technical Section, with one (1) additional page allotted for the Cost Summary and one (1) additional page allotted for the End of Project Targets Table:

- ***Abstract*** (limited to 150 words or less) - The abstract should summarize the Concept Paper, providing the essence of the transformative concept, how the proposed research plan will develop this concept and what the potential impact of this applied research is likely to be to the relevant field and application.
- ***Technical Section*** - In this section, describe the proposed technology as it relates to the Concept Paper evaluation criteria stated in Section V.A. The Technical Section must also address the programmatic goals, objectives, and/or performance metrics as stated in Section I.B. Program Overview. This section must also identify the current technology readiness level (TRL, described in Appendix 2) of the technology and the anticipated TRL at project completion. Preliminary technical data is highly desirable. This section should focus on what is new and innovative about the concept and proposed R&D. It is important the Technical Section also distinguish the proposed work from other R&D in substantively similar areas.
- ***Cost Summary*** - Include a one (1) page summary of costs. The Cost Summary should identify the general amount of time in hours anticipated on this project for every person funded under the project (people may be identified by role, such as "technician" rather than by name in the Concept Paper). It is important that the Cost Summary identify any major equipment purchases which will need to be made using ARPA-E funding. If multiple team members are proposed, include a top-level break-down of costs by team member. Note that the Cost Summary is not binding.
- ***The End of Project Targets Tabl***e- include the end of project target for the scale and form factor of the prototype device deliverable, as well as the end of project targets for all Primary Technical Requirements and Secondary Technical Targets. The "End of Project Targets" template can be found in Appendix 1 in Section X.

C. FULL APPLICATION STRUCTURE AND SUBMISSION INFORMATION

ARPA-E will issue the structure, requirements, and submission information of the Full Application by an amendment to this FOA no later that the Encourage/Discourage Concept Paper notification. Only Full Applications which received a control number and are deemed compliant by ARPA-E in the Concept Paper phase will be considered for selection.

D. SUBMISSION DATES AND TIMES

It is the responsibility of the applicant to complete and submit their submissions before the established deadlines. **Applicants are urged not to wait until the closing dates for the Concept Papers, but instead should submit as soon as possible. Because internet and data server traffic can be heavy on the ultimate due dates, and especially in the last several hours, applicants are urged to submit in a timely manner so as not to have difficulties meeting the deadlines.**

ARPA-E was created to be a catalyst for the next Industrial Revolution in clean energy technologies, and to pursue this transformation with fierce urgency. To foster rapid technological innovations, it is the policy of ARPA-E to establish and observe strict deadlines for all applicants.

Concept Paper Due Date

Concept Papers must be received by ARPA-E by April 2, 2010 at 5:00 PM Eastern Time. CONCEPT PAPERS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.

Full Application Due Date

Full Applications must be received by mid-May 2010, 31 calendar days from Concept Paper notification. **You are encouraged to transmit your Full Application well before the deadline.** FULL APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.

E. INTERGOVERNMENTAL REVIEW

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

F. FUNDING RESTRICTIONS

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

Patent costs are allowable to the extent they are incurred as a requirement under the award. The costs enumerated in subparagraphs (1), (2) and (3) below are deemed to be required by the award, and therefore are allowable, subject to the limits set forth therein.

(1) Costs of preparing invention disclosures of subject inventions that are submitted to DOE, and related reports and other documents in accordance with the Patent Rights Clause;

(2) Costs for searching the art to the extent reasonable and necessary to make the invention disclosures submitted to DOE in accordance with the Patent Rights Clause; and

(3) Other costs in connection with the filing and prosecution of U.S. patent applications on subject inventions disclosed to DOE in accordance with the Patent Rights clause, subject to a limitation of $15,000 of allowability for all such filed U.S. patent applications.

Patent costs, including the cost of filing any foreign patent applications, not required by the award as set forth above are unallowable.

Section V - APPLICATION REVIEW INFORMATION

Merit Review Criteria

Applications that pass the initial review will be subject to a merit review in accordance with the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance and Unsolicited Proposals." This guide is available under Financial Assistance, Regulations and Guidance at http://www.management.energy.gov/documents/meritrev.pdf.

Mandatory Requirements

- Total cost to ARPA-E does not exceed $10 million;
- Period of performance does not exceed 36 months;
- No less than 90% of total project costs (exclusive of equipment not available in the U.S.) performed on U.S. soil.

A. CONCEPT PAPER EVALUATION CRITERIA

General Concept Paper Evaluation Criteria are found below. More specific Concept Paper Evaluation Criteria are described in Section I.B of this FOA.

ARPA-E will perform an initial Concept Paper review to determine that (1) the applicant is eligible for an award; (2) the information required by the announcement has been submitted; (3) all mandatory requirements are satisfied; and (4) the proposed project is responsive to the objectives of the funding opportunity announcement.

Evaluation of Concept Papers will be performed using the following criteria: (1) Impact of the Proposed Technology Relative to State of the Art and (2) Overall Scientific and Technical Merit. Concept Papers will not be evaluated against each other since they are not submitted in accordance with a common work statement. The following are descriptions of the above listed criteria:

1. **Impact of the Proposed Technology Relative to State of the Art**
   The proposed technology must directly address one or more ARPA-E Mission Areas. Quantitative material and/or technology metrics must be proposed that demonstrate the potential for a transformational (not incremental) advancement in one or more energy-related fields. The applicant must demonstrate an awareness of competing commercial and emerging technologies and identify how its proposed concept/technology provides significant improvement over these other solutions. The applicant must have a strong and convincing transition strategy, including a feasible pathway to transition the program results to the next logical stage of R&D or directly into industrial development and deployment. The applicant must address the program-specific requirements identified for the Concept Paper phase in Section I.B. Program Overview.

2. **Overall Scientific and Technical Merit**
   The work must be unique and innovative. The proposed work should be high risk, but must be feasible. The applicant must demonstrate a sound technical approach to accomplish the proposed R&D objectives. The outcome and deliverables of the program, if successful, should be clearly defined. The applicant must address the program-specific requirements identified for the Concept Paper phase in Section I.B. Program Overview.

B. FULL APPLICATION EVALUATION CRITERIA

Evaluation of Full Applications will be accomplished using the following criteria: (1) Impact of the Proposed Technology Relative to State of the Art; (2) Overall Scientific and Technical Merit; (3) Qualifications, Experience, and Capabilities; and (4) Sound Management Plan. Full Proposals will not be evaluated against each other since they are not submitted in accordance with a common work statement. The following are descriptions of the above listed criteria:

1. **Impact of the Proposed Technology Relative to State of the Art**
   The proposed technology must directly address one or more ARPA-E Mission Areas. Quantitative material and/or technology metrics must be proposed that demonstrate the potential for a transformational (not incremental) advancement in one or more energy-related fields. The applicant must demonstrate an awareness of competing commercial and emerging technologies and identify how its proposed concept/technology provides significant improvement over these other solutions. The applicant must have a strong and convincing transition strategy, including a feasible pathway to transition the program results to the next logical stage of R&D or directly into industrial development and deployment. The applicant must address the program-specific requirements identified for the Full Application phase as described in Section II of this FOA.

2. **Overall Scientific and Technical Merit**
   The work must be unique and innovative. The proposed work should be high risk, but must be feasible. The applicant must demonstrate a sound technical approach to accomplish the proposed R&D objectives. The outcome and deliverables of the program, if successful, should be clearly defined. The applicant must address the program-specific requirements identified for the Full Application phase as described in Section II of this FOA.

3. **Qualifications, Experience, and Capabilities**
   The proposed Principal Investigator or technical team should have the expertise and experience needed to accomplish the proposed project. In addition, the applicant should have access to all facilities required to accomplish the R&D effort or has proposed the necessary missing equipment as part of the effort. The applicant's prior experience must demonstrate an ability to perform R&D of similar risk and complexity.

4. **Sound Management Plan**
   The proposed effort must have a workable plan to manage people and resources. Appropriate levels or people and resources should be allocated to tasks. The application should identify major technical R&D risks and have adequately planned mitigation efforts that are clearly defined and feasible. The proposed schedule should be reasonable. The applicant's prior experience in similar efforts must clearly demonstrate an ability to manage an R&D project of the same proposed complexity that meets the proposed technical performance within the proposed budget schedule.

Awards(s) will be made to applicants whose applications are determined to be the most advantageous to the objectives of ARPA-E to support transformational energy R&D efforts, all factors considered, including the evaluation of the applications against the criteria listed above and programmatic considerations. ARPA-E will consider the programmatic balance of the awards; the distribution across ARPA-E mission impact areas; the application areas and scientific disciplines; the match to national energy priorities; the economic benefits under the Recover Act; and other programmatic specifics.

C. OTHER SELECTION FACTORS – PROGRAM POLICY FACTORS

ARPA-E may consider specific program policy factors during the selection process. In reviewing Concept Papers and Full Applications, the Selection Official may consider the following program policy

factors in the evaluation:

a. Preference for Full Applications that promote and enhance the objectives of the American Recovery and Reinvestment Act of 2009, P.L. 111-5, especially job creation and retention, especially those with small and local businesses, and/or preservation and economic recovery in an expeditious manner.
b. Programmatic balance of risk and application areas
c. Degree to which proposed projects optimize use of available ARPA-E funding to achieve ARPA-E goals and objectives
d. Cost/budget considerations, including cost share beyond the required minimum
e. Whether the award would serve the economic interest of the United States, including but not limited to:
    - Proposed transition path is likely to lead to significant increased employment in the United States; and
    - Agreement by the applicant with respect to technology arising from or further developed under the award to promote manufacturing within the U.S. of products that embody the technology.
f. Regarding consortia, collaborations, or other teaming arrangements, consideration will be given to:
    - Technical and management qualifications of members of the consortium, and of the members as a team; and
    - Demonstrated ability to commercialize the technology; and
    - Balance of financial/technical/management contributions provided by each member of the consortium.

D. REVIEW AND SELECTION PROCESS

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

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

E. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

Applicants will be notified whether they are Encouraged or Discouraged to submit a Full Application by mid-April 2010. Selections for this FOA expect to be announced in July 2010.

Section VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

Selected Applicants Notification
ARPA-E will notify applicants selected for negotiations; this notice is not an authorization to begin performance.

Negotiations of cooperative agreements/TIA's: Rapid negotiations and execution of the legal instrument for the proposed effort are essential to meeting the goals of the Recovery Act. Reasonable requests to modify standard government instruments – cooperative agreements, and TIA's – will be considered, within the guidelines of applicable statues and regulations. However, impasses caused by unreasonable requests can delay implementation of a project. Upon careful consideration, ARPA-E may decide there is a need to set-aside a proposal due to such a delay. Proposers may familiarize themselves with standard provisions in legal instruments at the following web pages. In addition, after selection of finalists, ARPA-E intends to conduct a public seminar (webinar or similar) on APRA-E legal instruments.

For standard provisions in Cooperative agreements, including standard intellectual property provisions for assistance transactions, see under "awards terms" at:
http://www.management.energy.gov/business_doe/business_forms.htm. The ARPA-E Special Terms and Conditions for Use In Cooperative Agreements are located in the ARPA-E Model Agreements at http://arpa-e.energy.gov/About/KeyDocuments.aspx

TIA's: http://management.energy.gov/policy_guidance/715.htm

Non-Selected Notification
Respondents whose applications have not been selected will be advised as promptly as practicable.

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

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

Administrative Requirements
The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR Part 600 and for TIAs, in 10 CFR Part 603 (See: http://ecfr.gpoaccess.gov). Grants and cooperative agreements made to universities, non-profits and other entities subject to OMB Circular A-110 are subject to the Research Terms and Conditions located on the National Science Foundation website at http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp.

Recovery Act Award Administration Information
Special Provisions relating to work funded under the American Recovery and Reinvestment Act of 2009, P. L. 111-5 shall apply. These special provisions are in Section IX.

Special Terms and Conditions and National Policy Requirements
The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located

at http://management.energy.gov/business_doe/business_forms.htm and the ARPA-E Model Agreements are located at http://arpa-e.energy.gov/About/KeyDocuments.aspx.

The National Policy Assurances to be incorporated as award terms are located at DOE http://management.energy.gov/business_doe/business_forms.htm .

Intellectual Property Provisions
The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://www.gc.doe.gov/financial_assistance_awards.htm and the ARPA-E Model Agreements located at: http://arpa-e.energy.gov/About/KeyDocuments.aspx.

Statement of Substantial Involvement
If ARPA-E selects your application as a cooperative agreement or TIA, a Statement of Substantial Involvement will be negotiated to implement the project and included as an Attachment to the award.

C. REPORTING

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. For a sample Checklist, see http://management.energy.gov/business_doe/business_forms.htm

ARPA-E will do its best to make all reporting as non-burdensome as possible.

Reports may include:
(1) Monthly and Quarterly Reports.
- A monthly and quarterly technical and financial report must be sent to the ARPA-E Program Director. The report is meant to be a short summary of technical progress and financial status. Any significant deviations from the plan should be identified and discussed.

(2) Annual Milestone Report.
- A report must be submitted to ARPA-E once a year in the month following the end of each full year of the performance period. The annual report should include a description of the achievements of "Go-No Go" milestones as described in the applicant's proposal.

(3) Final Report
- At the conclusion of the performance period, a report must be submitted which includes a description of the progress of the project since the last annual report. The annual report should also include a comparison of the final performance results with the milestones described in the proposal.

(4) Recovery Act Reporting
- ARPA-E will assist all awardees on fulfilling ARRA requirements, including quarterly reports.

FOR RECOVERY ACT REPORTING REQUIREMENTS, SEE SECTION IX - SPECIAL PROVISIONS RELATING TO WORK FUNDED UNDER THE AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009 (March 2009)

Section VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS AND AGENCY CONTACT

ARPA-E will endeavor to respond to all questions submitted by March 30, 2010, in an expeditious and timely manner. Please submit your questions early; even though ARPA-E will make an effort to answer questions quickly, it is the applicants responsibly to meet all submission deadlines stated in this announcement. In all correspondence with ARPA-E please include the control number assigned to your submission.

Questions regarding program requirements must be directed to:

Program: Advanced Research Projects Agency - Energy
E-mail address: ARPA-E-CO@hq.doe.gov

Section VIII - OTHER INFORMATION

Modifications
Notices of any modifications to this announcement will be posted on the following websites, www.fedbizopps.gov, www.grants.gov, www.fedconnect.net, as well as the ARPA-E website www.arpa-e.energy.gov and ARPA-E eXCHANGE site.

Government Right to Reject or Negotiate
ARPA-E 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.

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.

Intellectual Property Developed Under This Program
Patent Rights (IP)
In a grant or cooperative agreement, the government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. For a grant or cooperative agreement, the Bayh-Dole Act (35 U.S.C. 202) assures that a domestic small business, university or a non-profit awardees will have the option to retain title to their own inventions, subject to the Government retaining a government purpose license, march-in rights and a U.S. preference in licensing. The patent clause that will apply these provisions can be found at 10 C.F.R. Part 600 Appendix A to Subpart D, PATENT RIGHTS-SMALL BUSINESS FIRMS AND NONPROFIT ORGANIZATIONS. For awardees that are not subject to the Bayh-Dole Act (e.g., large businesses, foreign universities, and foreign companies), 42 U.S.C. 5908 provides that title to such inventions vests in the United States, unless a "waiver" is granted. For this FOA, ARPA-E intends to issue a "class waiver" which will assure that those awardees who are not subject to the Bayh-Dole Act will also have the option to retain title to their own inventions, subject to the same government retained rights identified above and provided they are cost sharing at least 20% and they agree to manufacture new technology created under an award resulting from this FOA in the U.S. or provide other net economic benefits to the U.S. The patent clause that will apply these provisions can be found at http://www.gc.doe.gov/documents/patwaivclau.pdf. The class waiver will allow for the negotiation of the requirement to manufacture new technology in the U.S. For those who are not subject to Bayh-Dole or do not meet the criteria of the class waiver, they may still 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 the title to identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any individual patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784; http://www.gc.doe.gov/documents/patwaivclau.pdf.

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 ARPA-E determines it is appropriate to award a TIA, patent rights will be negotiated pursuant to

the guidance set out in 10 C.F.R. 603.840 through 10 C.F.R. 603.875.

Rights in Technical Data
DOE normally retains unlimited rights in technical data first produced under the Agreement. Proprietary software or data developed solely at private expense will not normally be required to be delivered to the Government except as specifically negotiated in a particular agreement to satisfy ARPA-E's own needs to monitor work progress. For this FOA, ARPA-E has determined that special protected data rights may apply. The provisions 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, (10 C.F.R. 600 Appendix A to Subpart D), would apply, but will be modified 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, and will identify data that will be recognized by the parties as protected data.

To assist in understanding how IP rights will be addressed the applicant may contact:

Linda Field
DOE IP Attorney
(202) 586-3440, Linda.Field@hq.doe.gov

The DOE IP Attorney is available to respond to questions regarding IP rights, but will not engage in any negotiations.

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.

Section IX - SPECIAL PROVISIONS RELATING TO WORK FUNDED UNDER THE AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009 (March 2009)

Preamble

The American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, (Recovery Act) was enacted to preserve and create jobs and promote economic recovery, assist those most impacted by the recession, provide investments needed to increase economic efficiency by spurring technological advances in science and health, invest in transportation, environmental protection, and other infrastructure that will provide long-term economic benefits, stabilize State and local government budgets, in order to minimize and avoid reductions in essential services and counterproductive State and local tax increases. Recipients shall use grant funds in a manner that maximizes job creation and economic benefit.

The Recipient shall comply with all terms and conditions in the Recovery Act relating generally to governance, accountability, transparency, data collection and resources as specified in Act itself and as discussed below.

Recipients should begin planning activities for their first tier subrecipients, including obtaining a DUNS number (or updating the existing DUNS record), and registering with the Central Contractor Registration (CCR).

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

The Government has not fully developed the implementing instructions of the Recovery Act, particularly concerning specific procedural requirements for the new reporting requirements. The Recipient will be provided these details as they become available. The Recipient must comply with all requirements of the Act. If the recipient believes there is any inconsistency between ARRA requirements and current award terms and conditions, the issues will be referred to the Contracting Officer for reconciliation.

Definitions

For purposes of this clause, Covered Funds means funds expended or obligated from appropriations under the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5. Covered Funds will have special accounting codes and will be identified as Recovery Act funds in the grant, cooperative agreement or TIA and/or modification using Recovery Act funds. Covered Funds must be reimbursed by September 30, 2015.

Non-Federal employer means any employer with respect to covered funds -- the contractor, subcontractor, grantee, or recipient, as the case may be, if the contractor, subcontractor, grantee, or recipient is an employer; and any professional membership organization, certification of other professional body, any agent or licensee of the Federal government, or any person acting directly or indirectly in the interest of an employer receiving covered funds; or with respect to covered funds received by a State or local government, the State or local government receiving the funds and any contractor or subcontractor receiving the funds and any contractor or subcontractor of the State or local government; and does not mean any department, agency, or other entity of the

federal government.

Recipient means any entity that receives Recovery Act funds directly from the Federal government (including Recovery Act funds received through grant, loan, or contract) other than an individual and includes a State that receives Recovery Act Funds.

Special Provisions

A. Flow Down Requirement

Recipients must include these special terms and conditions in any subaward.

B. Segregation of Costs

Recipients must segregate the obligations and expenditures related to funding under the Recovery Act. Financial and accounting systems should be revised as necessary to segregate, track and maintain these funds apart and separate from other revenue streams. No part of the funds from the Recovery Act shall be commingled with any other funds or used for a purpose other than that of making payments for costs allowable for Recovery Act projects.

C. Prohibition on Use of Funds

None of the funds provided under this agreement derived from the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, may be used by any State or local government, or any private entity, for any casino or other gambling establishment, aquarium, zoo, golf course, or swimming pool.

D. Access to Records

With respect to each financial assistance agreement awarded utilizing at least some of the funds appropriated or otherwise made available by the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, any representative of an appropriate inspector general appointed under section 3 or 8G of the Inspector General Act of 1988 (5 U.S.C. App.) or of the Comptroller General is authorized --

(1) to examine any records of the contractor or grantee, any of its subcontractors or subgrantees, or any State or local agency administering such contract that pertain to, and involve transactions that relate to, the subcontract, subcontract, grant, or subgrant; and

(2) to interview any officer or employee of the contractor, grantee, subgrantee, or agency regarding such transactions.

E. Publication

An application may contain technical data and other data, including trade secrets and/or privileged or confidential information, which the applicant does not want disclosed to the public or used by the Government for any purpose other than the application. To protect such data, the applicant should specifically identify each page including each line or paragraph thereof containing the data to be protected and mark the cover sheet of the application with the following Notice as well as referring to the Notice on each page to which the Notice applies:

Notice of Restriction on Disclosure and Use of Data
The data contained in pages ---- of this application have been submitted in confidence and contain

trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data here to the extent provided in the award. This restriction does not limit the Government's right to use or disclose data obtained without restriction from any source, including the applicant.

Information about this agreement will be published on the Internet and linked to the website www.recovery.gov, maintained by the Accountability and Transparency Board. The Board may exclude posting contractual or other information on the website on a case-by-case basis when necessary to protect national security or to protect information that is not subject to disclosure under sections 552 and 552a of title 5, United States Code.

F. Protecting State and Local Government and Contractor Whistleblowers.

The requirements of Section 1553 of the Act are summarized below. They include, but are not limited to:

Prohibition on Reprisals: An employee of any non-Federal employer receiving covered funds under the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, may not be discharged, demoted, or otherwise discriminated against as a reprisal for disclosing, including a disclosure made in the ordinary course of an employee's duties, to the Accountability and Transparency Board, an inspector general, the Comptroller General, a member of Congress, a State or Federal regulatory or law enforcement agency, a person with supervisory authority over the employee (or other person working for the employer who has the authority to investigate, discover or terminate misconduct), a court or grant jury, the head of a Federal agency, or their representatives information that the employee believes is evidence of:

- gross management of an agency contract or grant relating to covered funds;
- a gross waste of covered funds;
- a substantial and specific danger to public health or safety related to the implementation or use of covered funds;
- an abuse of authority related to the implementation or use of covered funds; or
- as violation of law, rule, or regulation related to an agency contract (including the competition for or negotiation of a contract) or grant, awarded or issued relating to covered funds.

Agency Action: Not later than 30 days after receiving an inspector general report of an alleged reprisal, the head of the agency shall determine whether there is sufficient basis to conclude that the non-Federal employer has subjected the employee to a prohibited reprisal. The agency shall either issue an order denying relief in whole or in part or shall take one or more of the following actions:

- Order the employer to take affirmative action to abate the reprisal.
- Order the employer to reinstate the person to the position that the person held before the reprisal, together with compensation including back pay, compensatory damages, employment benefits, and other terms and conditions of employment that would apply to the person in that position if the reprisal had not been taken.
- Order the employer to pay the employee an amount equal to the aggregate amount of all costs and expenses (including attorneys' fees and expert witnesses' fees) that were reasonably incurred by the employee for or in connection with, bringing the complaint regarding the reprisal, as determined by the head of a court of competent jurisdiction.

Nonenforceablity of Certain Provisions Waiving Rights and remedies or Requiring Arbitration: Except as provided in a collective bargaining agreement, the rights and remedies provided to

aggrieved employees by this section may not be waived by any agreement, policy, form, or condition of employment, including any predispute arbitration agreement. No predispute arbitration agreement shall be valid or enforceable if it requires arbitration of a dispute arising out of this section.

Requirement to Post Notice of Rights and Remedies: Any employer receiving covered funds under the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, shall post notice of the rights and remedies as required therein. (Refer to section 1553 of the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, www.Recovery.gov, for specific requirements of this section and prescribed language for the notices.).

G. Reserved

H. False Claims Act

Recipient and sub-recipients shall promptly refer to the DOE or other appropriate Inspector General any credible evidence that a principal, employee, agent, contractor, sub-grantee, subcontractor or other person has submitted a false claim under the False Claims Act or has committed a criminal or civil violation of laws pertaining to fraud, conflict of interest, bribery, gratuity or similar misconduct involving those funds.

I. Information in Support of Recovery Act Reporting

Recipient may be required to submit backup documentation for expenditures of funds under the Recovery Act including such items as timecards and invoices. Recipient shall provide copies of backup documentation at the request of the Contracting Officer or designee.

J. Availability of Funds

Funds appropriated under the Recovery Act and obligated to this award are available for reimbursement of costs until September 30, 2015.

REPORTING AND REGISTRATION REQUIREMENTS UNDER SECTION 1512 OF THE RECOVERY ACT

(a) This award requires the recipient to complete projects or activities which are funded under the American Recovery and Reinvestment Act of 2009 (Recovery Act) and to report on use of Recovery Act funds provided through this award. Information from these reports will be made available to the public.

(b) The reports are due no later than ten calendar days after each calendar quarter in which the recipient receives the assistance award funded in whole or in part by the Recovery Act.

(c) Recipients and their first-tier recipients must maintain current registrations in the Central Contractor Registration (http://www.ccr.gov) at all times during which they have active federal awards funded with Recovery Act funds. A Dun and Bradstreet Data Universal Numbering System (DUNS) Number (http://www.dnb.com) is one of the requirements for registration in the Central Contractor Registration.

(d) The recipient shall report the information described in section 1512(c) of the Recovery Act using the reporting instructions and data elements that will be provided online at

http://www.FederalReporting.gov and ensure that any information that is pre-filled is corrected or updated as needed.

REQUIRED USE OF AMERICAN IRON, STEEL, AND MANUFACTURED GOODS -- SECTION 1605 OF THE AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009

(a) Definitions. As used in this award term and condition--

(1) Manufactured good means a good brought to the construction site for incorporation into the building or work that has been--

(i) Processed into a specific form and shape; or

(ii) Combined with other raw material to create a material that has different properties than the properties of the individual raw materials.

(2) Public building and public work means a public building of, and a public work of, a governmental entity (the United States; the District of Columbia; commonwealths, territories, and minor outlying islands of the United States; State and local governments; and multi-State, regional, or interstate entities which have governmental functions). These buildings and works may include, without limitation, bridges, dams, plants, highways, parkways, streets, subways, tunnels, sewers, mains, power lines, pumping stations, heavy generators, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, and canals, and the construction, alteration, maintenance, or repair of such buildings and works.

(3) Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements.

(b) Domestic preference. (1) This award term and condition implements Section 1605 of the American Recovery and Reinvestment Act of 2009 (Recovery Act) (Pub. L. 111--5), by requiring that all iron, steel, and manufactured goods used in the project are produced in the United States except as provided in paragraph (b)(3) and (b)(4) of this section and condition.

(2) This requirement does not apply to the material listed by the Federal Government as follows:

_____

[Award official to list applicable excepted materials or indicate "none"]

(3) The award official may add other iron, steel, and/or manufactured goods to the list in paragraph (b)(2) of this section and condition if the Federal Government determines that--

(i) The cost of the domestic iron, steel, and/or manufactured goods would be unreasonable. The cost of domestic iron, steel, or manufactured goods used in the project is unreasonable when the cumulative cost of such material will increase the cost of the overall project by more than 25 percent;

(ii) The iron, steel, and/or manufactured good is not produced, or manufactured in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(iii) The application of the restriction of section 1605 of the Recovery Act would be inconsistent with the public interest.

(c) Request for determination of inapplicability of Section 1605 of the Recovery Act . (1)(i) Any recipient request to use foreign iron, steel, and/or manufactured goods in accordance with paragraph (b)(3) of this section shall include adequate information for Federal Government evaluation of the request, including--

(A) A description of the foreign and domestic iron, steel, and/or manufactured goods;

(B) Unit of measure;

(C) Quantity;

(D) Cost;

(E) Time of delivery or availability;

(F) Location of the project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign iron, steel, and/or manufactured goods cited in accordance with paragraph (b)(3) of this section.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed cost comparison table in the format in paragraph (d) of this section.

(iii) The cost of iron, steel, and/or manufactured goods material shall include all delivery costs to the construction site and any applicable duty.

(iv) Any recipient request for a determination submitted after Recovery Act funds have been obligated for a project for construction, alteration, maintenance, or repair shall explain why the recipient could not reasonably foresee the need for such determination and could not have requested the determination before the funds were obligated. If the recipient does not submit a satisfactory explanation, the award official need not make a determination.

(2) If the Federal Government determines after funds have been obligated for a project for construction, alteration, maintenance, or repair that an exception to section 1605 of the Recovery Act applies, the award official will amend the award to allow use of the foreign iron, steel, and/or relevant manufactured goods. When the basis for the exception is nonavailability or public interest, the amended award shall reflect adjustment of the award amount, redistribution of budgeted funds, and/or other actions taken to cover costs associated with acquiring or using the foreign iron, steel, and/or relevant manufactured goods. When the basis for the exception is the unreasonable cost of the domestic iron, steel, or manufactured goods, the award official shall adjust the award amount or redistribute budgeted funds by at least the differential established in 2 CFR 176.110(a).

(3) Unless the Federal Government determines that an exception to section 1605 of the Recovery Act applies, use of foreign iron, steel, and/or manufactured goods is noncompliant with section 1605 of the American Recovery and Reinvestment Act.

(d) Data. To permit evaluation of requests under paragraph (b) of this section based on unreasonable cost, the Recipient shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Items Cost Comparison

Description	Unit of measure	Quantity	Cost (dollars)*
Item 1:			
Foreign steel, iron, or manufactured good	_____	_____	_____
Domestic steel, iron, or manufactured good	_____	_____	_____
Item 2:			
Foreign steel, iron, or manufactured good	_____	_____	_____
Domestic steel, iron, or manufactured good	_____	_____	_____

[List name, address, telephone number, email address, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]

[Include other applicable supporting information.]
[*Include all delivery costs to the construction site.]

REQUIRED USE OF AMERICAN IRON, STEEL, AND MANUFACTURED GOODS (COVERED UNDER INTERNATIONAL AGREEMENTS)--SECTION 1605 OF THE AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009

(a) Definitions. As used in this award term and condition--

Designated country --(1) A World Trade Organization Government Procurement Agreement country (Aruba, Austria, Belgium, Bulgaria, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea (Republic of), Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and United Kingdom;

(2) A Free Trade Agreement (FTA) country (Australia, Bahrain, Canada, Chile, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Mexico, Morocco, Nicaragua, Oman, Peru, or Singapore); or

(3) A United States-European Communities Exchange of Letters (May 15, 1995) country: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, and United Kingdom. Designated country iron, steel, and/or manufactured goods --(1) Is wholly the growth, product, or manufacture of a designated country; or

(2) In the case of a manufactured good that consist in whole or in part of materials from another country, has been substantially transformed in a designated country into a new and different manufactured good distinct from the materials from which it was transformed.

Domestic iron, steel, and/or manufactured good --(1) Is wholly the growth, product, or manufacture of the United States; or

(2) In the case of a manufactured good that consists in whole or in part of materials from another country, has been substantially transformed in the United States into a new and different manufactured good distinct from the materials from which it was transformed. There is no requirement with regard to the origin of components or subcomponents in manufactured goods or products, as long as the manufacture of the goods occurs in the United States.

Foreign iron, steel, and/or manufactured good means iron, steel and/or manufactured good that is not domestic or designated country iron, steel, and/or manufactured good.

Manufactured good means a good brought to the construction site for incorporation into the building or work that has been--

(1) Processed into a specific form and shape; or

(2) Combined with other raw material to create a material that has different properties than the properties of the individual raw materials.

Public building and public work means a public building of, and a public work of, a governmental entity (the United States; the District of Columbia; commonwealths, territories, and minor outlying islands of the United States; State and local governments; and multi-State, regional, or interstate entities which have governmental functions). These buildings and works may include, without limitation, bridges, dams, plants, highways, parkways, streets, subways, tunnels, sewers, mains, power lines, pumping stations, heavy generators, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, and canals, and the construction, alteration, maintenance, or repair of such buildings and works.

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements.

(b) Iron, steel, and manufactured goods. (1) The award term and condition described in this section implements--

(i) Section 1605(a) of the American Recovery and Reinvestment Act of 2009 (Pub. L. 111--5) (Recovery Act), by requiring that all iron, steel, and manufactured goods used in the project are produced in the United States; and

(ii) Section 1605(d), which requires application of the Buy American requirement in a manner consistent with U.S. obligations under international agreements. The restrictions of section 1605 of the Recovery Act do not apply to designated country iron, steel, and/or manufactured goods. The Buy American requirement in section 1605 shall not be applied where the iron, steel or manufactured goods used in the project are from a Party to an international agreement that obligates the recipient to treat the goods and services of that Party the same as domestic goods and services. This obligation shall only apply to projects with an estimated value of $7,443,000 or more.

(2) The recipient shall use only domestic or designated country iron, steel, and manufactured goods in performing the work funded in whole or part with this award, except as provided in paragraphs (b)(3) and (b)(4) of this section.

(3) The requirement in paragraph (b)(2) of this section does not apply to the iron, steel, and

manufactured goods listed by the Federal Government as follows:

_____

[Award official to list applicable excepted materials or indicate "none"]

(4) The award official may add other iron, steel, and manufactured goods to the list in paragraph (b)(3) of this section if the Federal Government determines that--

(i) The cost of domestic iron, steel, and/or manufactured goods would be unreasonable. The cost of domestic iron, steel, and/or manufactured goods used in the project is unreasonable when the cumulative cost of such material will increase the overall cost of the project by more than 25 percent;

(ii) The iron, steel, and/or manufactured good is not produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality; or

(iii) The application of the restriction of section 1605 of the Recovery Act would be inconsistent with the public interest.

(c) Request for determination of inapplicability of section 1605 of the Recovery Act or the Buy American Act. (1)(i) Any recipient request to use foreign iron, steel, and/or manufactured goods in accordance with paragraph (b)(4) of this section shall include adequate information for Federal Government evaluation of the request, including--

(A) A description of the foreign and domestic iron, steel, and/or manufactured goods;

(B) Unit of measure;

(C) Quantity;

(D) Cost;

(E) Time of delivery or availability;

(F) Location of the project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign iron, steel, and/or manufactured goods cited in accordance with paragraph (b)(4) of this section.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed cost comparison table in the format in paragraph (d) of this section.

(iii) The cost of iron, steel, or manufactured goods shall include all delivery costs to the construction site and any applicable duty.

(iv) Any recipient request for a determination submitted after Recovery Act funds have been obligated for a project for construction, alteration, maintenance, or repair shall explain why the recipient could not reasonably foresee the need for such determination and could not have

requested the determination before the funds were obligated. If the recipient does not submit a satisfactory explanation, the award official need not make a determination.

(2) If the Federal Government determines after funds have been obligated for a project for construction, alteration, maintenance, or repair that an exception to section 1605 of the Recovery Act applies, the award official will amend the award to allow use of the foreign iron, steel, and/or relevant manufactured goods. When the basis for the exception is nonavailability or public interest, the amended award shall reflect adjustment of the award amount, redistribution of budgeted funds, and/or other appropriate actions taken to cover costs associated with acquiring or using the foreign iron, steel, and/or relevant manufactured goods.. When the basis for the exception is the unreasonable cost of the domestic iron, steel, or manufactured goods, the award official shall adjust the award amount or redistribute budgeted funds, as appropriate, by at least the differential established in 2 CFR 176.110(a).

(3) Unless the Federal Government determines that an exception to section 1605 of the Recovery Act applies, use of foreign iron, steel, and/or manufactured goods other than designated country iron, steel, and/or manufactured goods is noncompliant with the applicable Act.

(d) Data. To permit evaluation of requests under paragraph (b) of this section based on unreasonable cost, the applicant shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign and Domestic Items Cost Comparison

Description	Unit of measure	Quantity	Cost (dollars)*	
Item 1:				
Foreign steel, iron, or manufactured good	_____	_____	_____	
Domestic steel, iron, or manufactured good	_____	_____	_____	
Item 2:				
Foreign steel, iron, or manufactured good	_____	_____	_____	
Domestic steel, iron, or manufactured good	_____	_____	_____	

[List name, address, telephone number, email address, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]

[Include other applicable supporting information.]

[*Include all delivery costs to the construction site.]

WAGE RATE REQUIREMENTS UNDER SECTION 1606 OF THE RECOVERY ACT

(a) Section 1606 of the Recovery Act requires that all laborers and mechanics employed by contractors and subcontractors on projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to the Recovery Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code.

Pursuant to Reorganization Plan No. 14 and the Copeland Act, 40 U.S.C. 3145, the Department of Labor has issued regulations at 29 CFR parts 1, 3, and 5 to implement the Davis-Bacon and related Acts. Regulations in 29 CFR 5.5 instruct agencies concerning application of the standard

Davis-Bacon contract clauses set forth in that section. Federal agencies providing grants, cooperative agreements, and loans under the Recovery Act shall ensure that the standard Davis-Bacon contract clauses found in 29 CFR 5.5(a) are incorporated in any resultant covered contracts that are in excess of $2,000 for construction, alteration or repair (including painting and decorating).

(b) For additional guidance on the wage rate requirements of section 1606, contact your awarding agency. Recipients of grants, cooperative agreements and loans should direct their initial inquiries concerning the application of Davis-Bacon requirements to a particular federally assisted project to the Federal agency funding the project. The Secretary of Labor retains final coverage authority under Reorganization Plan Number 14.

RECOVERY ACT TRANSACTIONS LISTED IN SCHEDULE OF EXPENDITURES OF FEDERAL AWARDS AND RECIPIENT RESPONSIBILITIES FOR INFORMING SUBRECIPIENTS

(a) To maximize the transparency and accountability of funds authorized under the American Recovery and Reinvestment Act of 2009 (Pub. L. 111--5) (Recovery Act) as required by Congress and in accordance with 2 CFR 215.21 "Uniform Administrative Requirements for Grants and Agreements" and OMB Circular A--102 Common Rules provisions, recipients agree to maintain records that identify adequately the source and application of Recovery Act funds. OMB Circular A--102 is available at http://www.whitehouse.gov/omb/circulars/a102/a102.html.

(b) For recipients covered by the Single Audit Act Amendments of 1996 and OMB Circular A--133, "Audits of States, Local Governments, and Non-Profit Organizations," recipients agree to separately identify the expenditures for Federal awards under the Recovery Act on the Schedule of Expenditures of Federal Awards (SEFA) and the Data Collection Form (SF--SAC) required by OMB Circular A--133. OMB Circular A--133 is available at http://www.whitehouse.gov/omb/circulars/a133/a133.html. This shall be accomplished by identifying expenditures for Federal awards made under the Recovery Act separately on the SEFA, and as separate rows under Item 9 of Part III on the SF--SAC by CFDA number, and inclusion of the prefix "ARRA-" in identifying the name of the Federal program on the SEFA and as the first characters in Item 9d of Part III on the SF--SAC.

(c) Recipients agree to separately identify to each subrecipient, and document at the time of subaward and at the time of disbursement of funds, the Federal award number, CFDA number, and amount of Recovery Act funds. When a recipient awards Recovery Act funds for an existing program, the information furnished to subrecipients shall distinguish the subawards of incremental Recovery Act funds from regular subawards under the existing program.

(d) Recipients agree to require their subrecipients to include on their SEFA information to specifically identify Recovery Act funding similar to the requirements for the recipient SEFA described above. This information is needed to allow the recipient to properly monitor subrecipient expenditure of ARRA funds as well as oversight by the Federal awarding agencies, Offices of Inspector General and the Government Accountability Office.

Applicable for ARRA awards when WAGE RATE REQUIREMENTS UNDER SECTION 1606 OF THE RECOVERY ACT article is used.

DAVIS BACON ACT REQUIREMENTS

Note: Where necessary to make the context of these articles applicable to this award, the term "Contractor" shall mean "Recipient" and the term "Subcontractor" shall mean "Subrecipient or Subcontractor" per the following definitions.

Recipient means the organization, individual, or other entity that receives an award from DOE and is financially accountable for the use of any DOE funds or property provided for the performance of the project, and is legally responsible for carrying out the terms and conditions of the award.

Subrecipient means the legal entity to which a subaward is made and which is accountable to the recipient for the use of the funds provided. The term may include foreign or international organizations (such as agencies of the United Nations).

Davis-Bacon Act

(a) Definition.--"Site of the work"--

(1) Means--

(i) The primary site of the work. The physical place or places where the construction called for in the award will remain when work on it is completed; and

(ii) The secondary site of the work, if any. Any other site where a significant portion of the building or work is constructed, provided that such site is--

(A) Located in the United States; and

(B) Established specifically for the performance of the award or project;

(2) Except as provided in paragraph (3) of this definition, includes any fabrication plants, mobile factories, batch plants, borrow pits, job headquarters, tool yards, etc., provided--

(i) They are dedicated exclusively, or nearly so, to performance of the award or project; and

(ii) They are adjacent or virtually adjacent to the "primary site of the work" as defined in paragraph (a)(1)(i), or the "secondary site of the work" as defined in paragraph (a)(1)(ii) of this definition;

(3) Does not include permanent home offices, branch plant establishments, fabrication plants, or tool yards of a Contractor or subcontractor whose locations and continuance in operation are determined wholly without regard to a particular Federal award or project. In addition, fabrication plants, batch plants, borrow pits, job headquarters, yards, etc., of a commercial or material supplier which are established by a supplier of materials for the project before opening of bids and not on the Project site, are not included in the "site of the work." Such permanent, previously established facilities are not a part of the "site of the work" even if the operations for a period of time may be dedicated exclusively or nearly so, to the performance of a award.

(b) (1) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the

Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, or as may be incorporated for a secondary site of the work, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Any wage determination incorporated for a secondary site of the work shall be effective from the first day on which work under the award was performed at that site and shall be incorporated without any adjustment in award price or estimated cost. Laborers employed by the construction Contractor or construction subcontractor that are transporting portions of the building or work between the secondary site of the work and the primary site of the work shall be paid in accordance with the wage determination applicable to the primary site of the work.

(2) Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (e) of this article; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period.

(3) Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the article entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

(4) The wage determination (including any additional classifications and wage rates conformed under paragraph (c) of this article) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(c) (1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the award shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefore only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the:

Wage and Hour Division
Employment Standards Administration
U.S. Department of Labor
Washington, DC 20210

The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (c)(2) and (c)(3) of this article shall be paid to all workers performing work in the classification under this award from the first day on which work is performed in the classification.

(d) Whenever the minimum wage rate prescribed in the award for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(e) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

Rates of Wages [Note to Specialist -- Include the DOL Wage Determination as an attachment to the award.]

The minimum wages to be paid laborers and mechanics under this award involved in performance of work at the project site, as determined by the Secretary of Labor to be prevailing for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the pertinent locality, are included as an attachment to this award. These wage rates are minimum rates and are not intended to represent the actual wage rates that the Contractor may have to pay.
Payrolls and Basic Records

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid

(including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the article entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any award work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this article. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the --

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the award and shall certify --

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this article and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the award during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the award.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this article.

(4) The falsification of any of the certifications in this article may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of

Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this article available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

Withholding of Funds

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this award or any other Federal award with the same Prime Contractor, or any other federally assisted award subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the award. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the award, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

Apprentices and Trainees

(a) Apprentices.

(1) An apprentice will be permitted to work at less than the predetermined rate for the work they performed when they are employed--

(i) Pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship and Training, Employer, and Labor Services (OATELS) or with a State Apprenticeship Agency recognized by the OATELS; or

(ii) In the first 90 days of probationary employment as an apprentice in such an apprenticeship program, even though not individually registered in the program, if certified by the OATELS or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

(2) The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program.

(3) Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph (a)(1) of this article, shall be paid not less than the applicable

wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination.

(5) Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

(6) In the event OATELS, or a State Apprenticeship Agency recognized by OATELS, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees.

(1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer, and Labor Services (OATELS). The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by OATELS.

(2) Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the OATELS shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed.

(3) In the event OATELS withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this article shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

Compliance with Copeland Act Requirements

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this award.
Subcontracts (Labor Standards)

(a) Definition. "Construction, alteration or repair," as used in this article means all types of work done by laborers and mechanics employed by the construction Contractor or construction subcontractor on a particular building or work at the site thereof, including without limitation--

(1) Altering, remodeling, installation (if appropriate) on the site of the work of items fabricated off-site;

(2) Painting and decorating;

(3) Manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the building or work;

(4) Transportation of materials and supplies between the site of the work within the meaning of paragraphs (a)(1)(i) and (ii) of the "site of the work" as defined in the article entitled Davis Bacon Act of this award, and a facility which is dedicated to the construction of the building or work and is deemed part of the site of the work within the meaning of paragraph (2) of the "site of work" definition; and

(5) Transportation of portions of the building or work between a secondary site where a significant portion of the building or work is constructed, which is part of the "site of the work" definition in paragraph (a)(1)(ii) of the Davis-Bacon Act article, and the physical place or places where the building or work will remain (paragraph (a)(1)(i) of the Davis Bacon Act article, in the "site of the work" definition).

(b) The Contractor or subcontractor shall insert in any subcontracts for construction, alterations and repairs within the United States the articles entitled--

(1) Davis-Bacon Act;

(2) Contract Work Hours and Safety Standards Act -- Overtime Compensation (if the article is included in this award);

(3) Apprentices and Trainees;

(4) Payrolls and Basic Records;

(5) Compliance with Copeland Act Requirements;

(6) Withholding of Funds;

(7) Subcontracts (Labor Standards);

(8) Contract Termination -- Debarment;

(9) Disputes Concerning Labor Standards;

(10) Compliance with Davis-Bacon and Related Act Regulations; and

(11) Certification of Eligibility.

(c) The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor performing construction within the United States with all the award articles cited in paragraph (b).

(d)(1) Within 14 days after issuance of the award, the Contractor shall deliver to the Contracting Officer a completed Standard Form (SF) 1413, Statement and Acknowledgment, for each subcontract for construction within the United States, including the subcontractor's signed and dated acknowledgment that the articles set forth in paragraph (b) of this article have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(e) The Contractor shall insert the substance of this article, including this paragraph (e) in all subcontracts for construction within the United States.

Contract Termination -- Debarment

A breach of the award articles entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act -- Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the whole award or in part for the Recovery Act covered work only, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

Compliance with Davis-Bacon and Related Act Regulations

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this award.

Disputes Concerning Labor Standards

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes and Appeals as defined in 10 CFR 600.22. Disputes within the meaning of this article include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

Certification of Eligibility

(a) By entering into this award, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government awards by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this award shall be subcontracted to any person or firm ineligible for award of a Government award by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

Approval of Wage Rates

All straight time wage rates, and overtime rates based thereon, for laborers and mechanics engaged in work under this award must be submitted for approval in writing by the head of the contracting activity or a representative expressly designated for this purpose, if the straight time wages exceed the rates for corresponding classifications contained in the applicable Davis-Bacon Act minimum wage determination included in the award. Any amount paid by the Contractor to any laborer or mechanic in excess of the agency approved wage rate shall be at the expense of the Contractor and shall not be reimbursed by the Government. If the Government refuses to authorize the use of the overtime, the Contractor is not released from the obligation to pay employees at the required overtime rates for any overtime actually worked.

Section X - APPENDICES/REFERENCE MATERIAL

APPENDIX 1: END OF GRIDS PROJECT TARGETS TEMPLATE

Final Deliverable Prototype Scale and Approach / Form Factor

End of GRIDS Project Deliverable

PRIMARY TECHNICAL REQUIREMENTS:

1.1	System Capital Cost per Unit of Rated Energy Capacity (for measured capacity at Rated Power)
1.2	Minimum Operating Time at Rated Power (time at Rated Power for charge and discharge)
1.3	Maximum Response Time (time for system to go from 0% to 100% of Rated Power in discharge and in charge mode)
1.4	Rated Power Capacity for Charge and Discharge

SECONDARY TECHNICAL TARGETS:

2.1	Cycle Life (cycled at rated power between charge and discharge)
2.2	Round-Trip Efficiency
2.3	Maximum Dwell Time
2.4	Scalability of Storage Technology for Grid-scale Application
2.5	Internal Losses
2.6	Safety
2.7	Calendar Life

APPENDIX 2: CONCEPT PAPER DATA

The following information will be required by the ARPA-E eXCHANGE (for details please see Section IV.B) for each Concept Paper submitted.

- Project Title
- Abstract
- Lead Organization
- Organization Type
- Team Members
- Total Cost to ARPA-E
- Proposed Cost Share
- Period of Performance
- Technical Point of Contact
- Administrative Point of Contact
- Technology Readiness Level (Current)
- Technology Readiness Level (Project End)
- Concept Paper

APPENDIX 3: TECHNOLOGY READINESS LEVEL

TRL-1. **Basic principles observed and reported**
This is lowest level of technology readiness. Scientific research begins with a systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications or products in mind. The knowledge or understanding will later be translated into applied research and development. Example might include studies of a technology's basic properties.

TRL-2. **Technology concept and/or application formulated**
Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions.

TRL-3. **Analytical and experimental critical function and/or characteristic proof of concept**
Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.

TRL-4. **Component and/or breadboard validation in laboratory environment**
Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.

TRL-5. **Component and/or breadboard validation in relevant environment**
Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.

TRL-6. **System/subsystem model or prototype demonstration in a relevant environment**
Representative model or prototype system, which is well beyond that of RL-5, is tested in a relevant environment. This represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment.

TRL-7. **System prototype demonstration in a operational environment**
This represents a major step up from RL-6. It requires the demonstration of an actual system prototype in an operational environment, such as in a light duty vehicle on the road. Examples include testing a prototype battery in an operational hybrid gas-electric vehicle.

TRL-8. **Actual system completed and qualified through test and demonstration**
Technology has been proven to work in its final form and under expected conditions. In almost all cases, this RL-8 represents the end of true system development. Examples include developmental test and evaluation of the system in its intended parent system to determine if it meets design specifications.

TRL-9. **Actual system proven through successful mission operations**

The technology is applied and operated in its final form and under real life conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under various real life conditions.

DEFINITIONS (for Appendix 3)

"BREADBOARD": Integrated components that provide a representation of a system/subsystem and that can be used to determine concept feasibility and to develop technical data. These tools are typically configured for laboratory use to demonstrate technical principles of immediate interest. These may resemble final system/subsystem in function only.

"HIGH FIDELITY": Addresses form, fit and function. High-fidelity laboratory environment would involve testing with equipment that can simulate and validate all system specifications within a laboratory setting.

"LOW FIDELITY": A representative of the component or system that has limited ability to provide anything but first order information about the end product. Low-fidelity assessments are used to provide trend analysis.

"MODEL": A functional form of a system generally reduced in scale, near or at operational specification. Models will be sufficiently developed to allow demonstration of the technical and operational capabilities required of the final system.

"OPERATIONAL ENVIRONMENT": Environment that addresses all of the operational requirements and specifications required of the final system to include platform/packaging.

"PROTOTYPE": The first early representation of the system that offers the expected functionality and performance expected of the final implementation. Prototypes will be sufficiently developed to allow demonstration of the technical and operational capabilities required of the final system.

"RELEVANT ENVIRONMENT": Testing environment that simulates the key aspects of the operational environment.

"SIMULATED OPERATIONAL ENVIRONMENTAL": Either 1) a real environment that can simulate all of the operational requirements and specifications required of the final system, or 2) a simulated environment that allows for testing of a virtual prototype; used in either case to determine whether a developmental system meets the operational requirements and specifications of the final system.

APPENDIX 4: COST SHARE INFORMATION

The regulations that govern Federal Financial Assistance for DOE are found at 10 Code of Federal Regulations (CFR) Part 600 and 603. Specifically, Sections 600.123, 600.224, 600.313, "Cost sharing and matching", and 603.525 through 603.555, "Cost Sharing" provide guidance on acceptable contributions toward cost share requirements, as well as guidance on the valuation and documentation of contributions, for "for profit" organizations. These requirements, as contained in the regulations, are summarized below.

Acceptable contributions, including cash contributions and third party contributions, must be accepted as part of the recipient's cost sharing or matching if such contributions meet all of the following criteria:

- They are verifiable from the recipient's records.
- They are not included as contributions for any other federally-assisted project or program.
- They are necessary and reasonable for proper and efficient accomplishment of the project.
- They are allowable under the applicable cost principles for the applicant.
- They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.
- They are provided for in the approved budget.
- They conform to other provisions of this part, as applicable.

Cost sharing may include in-kind contributions. General examples of potentially allowable cost share are shown below. However, applicants must confirm with DOE upon selection that the cost share proposed in response to this FOA is allowable.

- Cash provided directly by the recipient, or a sub-recipient;
- State or local government funds provided to support the proposed project, which were not provided to the State by the federal Government;
- Employees' salaries included in the budget, if paid by the employer (recipient or sub-recipient), and not reimbursed by the federal funding of the project;
- Rental value of buildings or equipment necessary to the success of the proposed project and the value of which is included in the budget for the project;
- Monetary value of SOPO activities to be performed by a third party which are included in the project budget and will not be reimbursed by federal funds.