**FINANCIAL ASSISTANCE**

**FUNDING OPPORTUNITY ANNOUNCEMENT**

**Office of Energy Efficiency and Renewable Energy**

**Research and Development for Hydrogen Storage**

**Funding Opportunity Announcement (FOA) Number: DE-FOA-0000827**

**FOA Type: Initial**

**CFDA Number: 81.087**

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| **FOA Issue Date:** | 10/28/13 |
| **Submission Deadline for Concept Papers:** | 11/18/13 (5pm ET) |
| **Submission Deadline for Full Applications:** | 1/17/14 (5pm ET) |
| **Submission Deadline for Replies to Reviewer Comments:** | 2/25/14 (5pm ET) |
| **Expected Date for EERE Selection Notifications:** | May 2014 |
| **Expected Timeframe for Award Negotiations:** | June/July 2014 |

* Applicants must submit a Concept Paper by the due date listed above to be eligible to submit a Full Application.
* To apply to this FOA, Applicants must register with and submit application materials through EERE Exchange at <https://eere-Exchange.energy.gov>, EERE’s online application portal. Frequently asked questions for this FOA and the EERE Application process can be found at <https://eere-exchange.energy.gov/FAQ.aspx>.
* Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the Applicant/Selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancellation of further award negotiations and rescission of the Selection.

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Executive Summary

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| **Means of Submission** | Concept Papers, Full Applications, and Replies to Reviewer Comments must be submitted through EERE Exchange at <https://eere-Exchange.energy.gov>, EERE’s online application portal. EERE will not review or consider applications submitted through other means. The Users’ Guide for Applying to the Department of Energy EERE Funding Opportunity Announcements is found at <https://eere-Exchange.energy.gov/Manuals.aspx>. |
| **Total Amount to be Awarded** | At Least $4M |
| **Average Award Amount** | EERE anticipates making awards that range from $800,000 to $2,000,000. |
| **Types of Funding Agreements**  | Cooperative Agreements, Work Authorizations, and Interagency Agreements |
| **Period of Performance** | 24 to 36 months |
| **Eligible Applicants** | Individuals, Domestic Entities, Foreign Entities, Incorporated Consortia, Unincorporated Consortia, subject to the definitions in Section III.A. |
| **Cost Share Requirement** | * Topic 1: 20% of Total Project Cost for All Entities
* Topic 2: 20% of Total Project Cost for All Types of Entities, Except: Institutions of Higher Education, National Laboratories, FFRDCs, and Non-Profit Organizations, which will require 0% Cost Share
* Topic 3: 20% of Total Project Cost for All Types of Entities, Except: Institutions of Higher Education, National Laboratories, FFRDCs, and Non-Profit Organizations, which will require 0% Cost Share
 |
| **Submission of Multiple Applications** | Applicants may submit more than one application to this FOA, provided that each application only covers one specific topic area (approach) and describes a unique, scientifically distinct project.  |
| **Application Forms** | Required forms and templates for Full Applications are available on EERE Exchange at <https://eere-Exchange.energy.gov>. |
| **FOA Summary** | This FOA entitled “Research and Development for Hydrogen Storage,” is aimed at research and development (R&D) for the continued development of advanced hydrogen storage systems and novel hydrogen storage materials supported through the Hydrogen Storage program. The goal is to enable the widespread commercialization of hydrogen and fuel cell technologies and specifically to provide adequate hydrogen storage for onboard vehicle applications that meet the DOE hydrogen storage targets, as well as enabling early market applications such as materials handling equipment and portable power applications. Full commercialization of fuel cell systems using hydrogen will require advances in hydrogen storage technologies. Developing systems to enable lightweight, compact, and inexpensive hydrogen storage will help make hydrogen fuel cell systems competitive in a wide range of portable and stationary applications, and enable longer driving ranges for a wider variety of transportation applications. The FOA includes the following topics:* Reducing the cost of compressed hydrogen storage systems
* Improved materials for fiber composites and balance of plant components
* New hydrogen storage materials discovery
 |

1. Funding Opportunity Description
	1. Background

The Department of Energy’s (DOE) Fuel Cell Technologies Office (FCTO)[[1]](#footnote-1) within the Office of Energy Efficiency and Renewable Energy (EERE) is requesting applications to fund research and development (R&D) activities for the continued development of advanced hydrogen storage systems and novel hydrogen storage materials supported through the Hydrogen Storage program.[[2]](#footnote-2) The goal is to enable the widespread commercialization of hydrogen and fuel cell technologies and specifically to provide adequate hydrogen storage for onboard vehicle, material handling, and portable power applications that meet the DOE hydrogen storage targets. These activities will support the FCTO’s goals to: maintain the rapid pace of progress in fuel cells; expand the markets and applications in which hydrogen-powered fuel cells can compete; enable the use of lower-cost hydrogen from diverse and environmentally friendly sources; enable highly efficient hydrogen production; reduce the cost of hydrogen delivery; reduce the costs of hydrogen storage technologies; and develop novel, advanced hydrogen storage technologies. FCTO is also working to reduce institutional and market barriers that may impede the commercialization of hydrogen fuel cell technologies. To accomplish these goals, the FCTO works with partners in state and federal agencies, industry, academia, non-profit institutions, and the national laboratories. DOE intends to provide financial support for this effort under authority of the Energy Policy Act of 2005, Public Law 109-58, Title VIII – Hydrogen.

Full commercialization of fuel cell systems using hydrogen will require advances in hydrogen storage technologies. Developing systems to enable lightweight, compact, and cost competitive hydrogen storage will help make hydrogen fuel cell systems competitive in a wide range of portable and stationary applications, and enable longer driving ranges for a wider variety of transportation applications. While hydrogen has the highest energy content per unit weight of any fuel, it has very low energy content per unit volume. This poses a challenge as increasing the energy content per unit volume for gaseous hydrogen storage requires either very high pressures or low temperatures. However, materials that bond to, or adsorb hydrogen, enable storage at high density in a compact container and at less severe conditions. While the energy density challenge exists for all fuel cell installations that use hydrogen, the problem is most acute for light-duty vehicles where the storage systems must: operate within stringent size, weight and cost constraints; enable a driving range of more than 300 miles (generally regarded as the minimum for widespread driver acceptance based on the performance of today’s gasoline vehicles); and refuel at ambient temperatures fast enough to meet drivers’ expectations (normally only a few minutes). Most of the hydrogen that is used today is stored as a compressed gas (with pressures typically ranging from 150 to 700 bar) or a liquid (liquid storage requires cryogenic temperatures near 20 K). The majority of the fuel cell vehicles in today’s demonstration fleets use high-pressure tanks rated at 350 or 700 bar for onboard storage of hydrogen gas. These tanks are more expensive, heavier, and require more volume than conventional fuel tanks. While possibly adequate for some stationary applications and vehicle platforms, they may be too expensive and bulky for many non-stationary applications and may not be able to provide a driving range that meets consumer expectations across the full range of light-duty vehicle platforms. In addition, the costs associated with high-pressure fast refueling adds to the overall costs associated with using hydrogen fuel cells. Therefore, to maximize the use of hydrogen as a zero-carbon fuel for fuel cells, advanced storage systems and technologies will be required, especially for automotive applications.

While some hydrogen fuel cell vehicles will soon emerge onto the market which are capable of >300 mile range, this range must be achievable across all light-duty platforms without compromising space and performance and at an acceptable cost in order for hydrogen fuel cell vehicles to be truly competitive with conventionally fueled vehicles and achieve mass market penetration. Similarly, for non-automotive applications, cost competitive, compact, and safe hydrogen storage technologies are needed to enable hydrogen fuel cell systems to compete with incumbent technologies, such as batteries and hydrocarbon fueled generators. Therefore, the FCTO is focused on the R&D of materials and approaches that will enable widespread commercialization of fuel cell systems for diverse applications across stationary, portable, and transportation sectors. R&D is concentrated on low-pressure, materials-based technologies and lower-cost, high pressure tank technologies for hydrogen storage systems to meet performance targets.

**Light-duty Vehicle Applications**

To meet the objectives for light-duty vehicles, DOE has developed a comprehensive set of technical targets for onboard hydrogen storage systems in collaboration with automotive manufacturers, such as through the U.S. DRIVE partnership. The full set of technical targets is included in Appendix D and available online at: <http://www1.eere.energy.gov/hydrogenandfuelcells/storage/pdfs/targets_onboard_hydro_storage.pdf>. Interim 2017 targets will allow some light-duty hydrogen fuel cell vehicle platforms to meet customer expectations. To meet all customer expectations across the full range of light-duty hydrogen fuel cell vehicle platforms, the Ultimate Full Fleet targets will be required.

Three overarching performance targets for onboard hydrogen storage systems noted in Appendix D are: gravimetric capacity; volumetric capacity; and system cost. For 2017, the targets are 1.8 kWh/kg (5.5 wt.% H2), 1.3 kWh/L (40 g H­2/L), and $12/kWh ($400/kg H2 stored) and the Ultimate Full Fleet targets are 2.5 kWh/kg (7.5 wt.% H2), 2.3 kWh/L (70 g H­2/L), and $8/kWh ($267/kg H2 stored). As an example of the challenges these system targets represent, hydrogen gas alone (not including the tank) at 700 bar pressure and ambient temperature has a density of approximately 40 g/L, and thus is theoretically not able to meet the 2017 system level volumetric target when the volume of tank and rest of the system is included. Additionally, liquid hydrogen alone at its normal boiling point of 20 K has a density of 71 g/L, and consequently is theoretically not able to meet the Ultimate Full Fleet volumetric target for the full system. For these reasons, the program has previously focused on the development of advanced materials-based storage technologies which have the theoretical potential to meet all onboard storage system targets simultaneously. The materials discovery efforts have been carried out primarily on three classes of hydrogen storage materials: reversible metal hydrides; hydrogen adsorbents; and chemical hydrogen storage materials. These previous efforts included three material-based “Centers of Excellence,” which operated from 2005 through 2010, each focusing on a specific material class.[[3]](#footnote-3),[[4]](#footnote-4),[[5]](#footnote-5) The program continues to advance the state-of-the-art of hydrogen storage systems, primarily through the Hydrogen Storage Engineering Center of Excellence (HSECoE).[[6]](#footnote-6) These efforts continue to provide a solid foundation for defining the minimum balance-of-plant (BOP) requirements for material-based storage systems, identifying current performance gaps of each type of system, and developing and refining models that enable the hydrogen storage community to determine the basic material properties required for hydrogen storage materials to meet all of the DOE onboard targets simultaneously. Therefore, applied R&D projects that will further develop advanced materials with the necessary thermodynamic, kinetic, and capacity properties are sought to address these requirements.

Compressed hydrogen can offer a near-term pathway for the initial commercialization of hydrogen fuel cell vehicles. While ambient temperature, compressed hydrogen is theoretically not able to meet all system performance targets, it is the most mature hydrogen storage technology and automobile manufacturers have demonstrated that they are able to package sufficient hydrogen onboard some light-duty vehicle platforms to provide acceptable driving ranges. However, a major challenge for this technology is reducing the cost of compressed hydrogen systems to meet the $8-12/kWh target required for the technology to achieve widespread use in light-duty vehicles. The technology currently being pursued for initial introduction of hydrogen fuel cell vehicles is Type IV composite overwrapped pressure vessels (COPV) rated for 700 bar nominal working pressure. These COPVs consist of polymeric liners fully overwrapped by a filament wound composite layer to provide the strength to withstand high gas pressure. High strength (i.e., typically 700 ksi or higher tensile strength) carbon fiber is most commonly used in the composite structure and cost projections have shown that the carbon fiber composite can account for 63% of the total cost for these systems.[[7]](#footnote-7) In addition, the rigid cylindrical shape of high-pressure systems limits convenient packaging onboard vehicles and use of multiple tank configurations to improve packaging convenience increases costs through need for considerable redundancy in BOP. As a result, conformable tanks or tanks with geometries more conducive to packaging onboard vehicles, which do not significantly increase costs or compromise performance, would be beneficial.

**Non-automotive Applications**

Hydrogen fuel cell technologies that enable early market applications and that are aligned with the long term automotive applications are also being developed through the DOE FCTO. These early markets include power for portable, stationary, back-up, and material handling equipment applications. For example, fuel cell systems are poised to supplant battery systems for “man-portable” power as a soldier can reduce his energy burden by a factor of three through use of hydrogen fuel cells.[[8]](#footnote-8) Portable applications like this will require hydrogen storage technologies that are safe, compact, easy to use, and low-cost (i.e., cost competitive with incumbent battery technologies). While rechargeable systems are preferred, it is anticipated, especially during the early stages of commercialization, that both single-use and rechargeable systems will be used. Another example where fuel cell systems are demonstrating performance and economic advantages over incumbent technologies is in material handling equipment. Food handling and storage warehouses require non-polluting service vehicles that operate for a minimum of 8-hour shifts with little down time. Presently hydrogen fuel cells that rely on 350 bar pressure vessels are finding market acceptance for powering lift trucks and are demonstrating economic and performance benefits over battery electric lift trucks. The benefits of these lift trucks include fast refills (i.e., minutes rather than hours), constant power over the full runtime, and longer runtimes (i.e., 8 to 12 hour shifts) as are documented in analyses by the National Renewable Energy Laboratory.[[9]](#footnote-9) These analyses, carried out for an average fleet of about 60 lift trucks, also highlighted a disadvantage that current hydrogen fuel cell powered lift trucks display when compared to battery electric lift trucks - the cost of the 350 bar high pressure refueling infrastructure ($3,700/ hydrogen refueling infrastructure versus $1,400 for the battery recharging infrastructure).9 Therefore, advanced hydrogen storage technologies that can reduce the infrastructure costs while maintaining the advantages of hydrogen fuel cells have the potential to expand the market for hydrogen fuel cell powered lift trucks. With considerable stakeholder input to DOE through workshops and requests for information, along with independent studies, hydrogen storage performance targets were developed for these two application areas and are provided in Appendix D.

* 1. Scope of Announcement

This FCTO Funding Opportunity Announcement (FOA) seeks to fund applied hydrogen storage R&D projects focused on innovative approaches for pressurized and/or low temperature tank cost reduction and advanced hydrogen storage material discovery, characterization, and development efforts to address the critical challenges of hydrogen storage for transportation, material handling, and portable power applications. The goal of this announcement is to foster a dynamic environment of innovation and continuous improvement through results-driven applied research and development. High risk, but technically credible projects with potential for high pay-off are encouraged. The ultimate result of this R&D effort will be the development of hydrogen storage systems that are capable of meeting long-term DOE targets and milestones as reported in the FCTO’s Multi-Year Research, Development, and Demonstration Plan.[[10]](#footnote-10)

The requested topic areas of interest are described below. The work plan for each application should cover a 24 to 36 month period and must include identification of key milestones (at least 1 per quarter). A minimum of two phases of work should be proposed and each phase must be separated by a Go/No-Go milestone (at least 1 Go/No-Go milestone per year). Each phase shall be no longer than 12 months at which time the project will be evaluated against an associated “S.M.A.R.T.” (specific, measurable, attainable, relevant, and timely) Go/No-Go milestone. At the end of each phase, a Go/No-Go milestone with quantitative metrics, must be included in the application and it must not only define success at the end of Phase 1, but also be in line with the DOE targets as presented in Appendix D. Projects that do not meet their Go/No-Go milestone criteria, as determined by DOE, may be terminated, suspended or redirected at the conclusion of the phase.

Projects funded through this announcement will be incorporated into FCTO’s applied hydrogen storage portfolio. Collaborative approaches with teaming across multiple entities including university, industry, and/or national labs with complimentary disciplines and expertise necessary for a holistic approach are highly desirable and encouraged. Informal collaborations will also be encouraged with other FCTO hydrogen storage projects and with complementary basic and applied research programs funded by other entities such as the DOE Office of Science, ARPA-E, the National Science Foundation, and Department of Defense. Finally, annual project updates to U.S. DRIVE Hydrogen Storage Technical Team[[11]](#footnote-11), annual project presentation at the FCTO’s Annual Merit Review and participation at annual DOE hydrogen storage principal investigator meetings will be required for all projects selected from this FOA.

* 1. Topic Areas/Technical Areas of Interest

The technical topics listed below are the only eligible research areas under this announcement; all other technical topics will be considered non-responsive and will not be reviewed. The appropriate topic must be clearly stated on the cover page of the application. Applicants may not submit an application that covers more than one topic (or concept), i.e., separate applications must be submitted for separate topics. Applications are sought for R&D projects addressing one of the following three technical topics:

### Topic 1 – Reducing the Cost of Compressed Hydrogen Storage Systems

Applications for Topic 1 are sought to develop complete, cost competitive, compressed hydrogen storage systems. This will include, but is not limited to, novel tank designs and cost reduction concepts, carbon fiber reduction or elimination, Type III and Type IV tanks with alternative liner materials, conformable tank designs, alternative operating conditions (e.g., different operating pressure, or cold/cryogenic compressed hydrogen), and advanced state-of-the-art compressed tank manufacturing. The goal is to develop lower cost hydrogen storage systems, when compared to current 700 bar ambient temperature Type IV COPV systems, with the potential to achieve the 2017 ($12/kWh) and Ultimate Full Fleet ($8/kWh) hydrogen storage on-board, automotive cost targets, when manufactured at rates of 500,000 systems per year. To put this in perspective, a vehicle that achieves a fuel economy of 60 miles per kilogram of hydrogen (i.e., 60 miles per gallon gasoline equivalent), would require a useable hydrogen storage capacity of 5 kilograms or 167 kWh (at a lower heating value of 33.3 kWh per kilogram H2) to meet the 300 mile driving range goal. This equates to about $2,000 and $1,300 for the complete vehicle hydrogen storage system at the 2017 and Ultimate target levels, respectively, which is approximately an order of magnitude higher than current conventional gasoline systems.

The application should include a detailed technical analysis which would include an analysis comparing the performance (e.g., gravimetric density, volumetric density, conformability, sensitivity to temperature excursions) of the proposed storage system against today’s tank technology (e.g., 700 bar IV high-pressure systems), along with an economic projection that considers all relevant capital, operations, and maintenance costs involved with the proposed system’s production and lifecycle costs. The system BOP should be consistent with current BOP configuration used by the latest compressed hydrogen storage system performance and cost analysis,7 with appropriate revisions for proposed operational conditions and proposed innovative improvements. The scope of work should also include the development and testing of scalable prototypes, a high-volume manufacturing cost estimate, a BOP component list, and when appropriate, the construction of at least one complete tank system for thorough performance testing and validation through an independent party may be requested by the DOE.

Applications may comprise more than one integrated concept, but should focus on concepts and complete system designs able to meet or exceed the performance of current 700 bar Type IV high pressure systems when compared against the full set of DOE 2017 and Ultimate Full Fleet targets. Experimental results should be reproducible and technical data reported to DOE should include, but not be limited to, mechanical properties of tank, cycle life and durability testing, and projections for weight, volume, and costs for a full-scale system with 5.6 kg useable hydrogen capacity.

### Topic 2 – Improved Materials for Fiber Composites and Balance of Plant Components

Inexpensive storage vessels for compressed hydrogen gas are critical to the widespread commercialization of hydrogen fuel cells in non-automotive and light-duty vehicle applications. Currently, high-pressure (i.e., 350 to 700 bar) storage vessels are constructed using expensive high-strength carbon fiber, such as Toray T700S, in a composite matrix as an overwrap to contain the stress. Cost analyses have shown that more than 60% of the cost can be due to the carbon fiber composite overwrap.7

Strategies to lower the cost of high-pressure hydrogen storage COPVs include a reduction in the cost of the fiber composite either through the reduction in the cost of carbon fiber, substitution of the high-cost carbon fiber with lower cost alternatives, reduction in the amount of carbon fiber composite required, or through a combination of the above approaches. Approximately 50% of the cost of carbon fiber production is due to the precursor fiber with the other 50% due to the conversion processing.[[12]](#footnote-12) Low-cost carbon fiber precursors, low-cost carbon fiber manufacturing processes, and/or alternative structural materials such as glass or other inexpensive fibers are all potential solutions to reducing the overall system tank costs to meet the DOE 2017 performance and cost targets for onboard vehicle hydrogen storage. The overall performance of carbon fiber composites may also be improved through the use of fillers added to the composite that, for instance, improves the load sharing between the fiber and the resin matrix, thus reducing the amount of carbon fiber required to produce a composite of specified strength. Another leading contributor to the cost of high-pressure hydrogen storage systems is the required BOP components which are currently specialty components built in low-volumes from primarily 316L stainless steel. Innovative concepts to identify materials for use in BOP components that are compatible for hydrogen service[[13]](#footnote-13),[[14]](#footnote-14) and reduce the cost, weight and volume of the BOP are also sought. Applications under Topic 2 should address the barriers to lowering the cost of composites or BOP for hydrogen storage vessels at the material level through efforts that focus on the areas discussed in Approaches 1 or 2 below. Each application should include Go/No-Go criteria for the initial phase that demonstrates a measureable improvement (e.g., 10% reduction in cost) from the current baseline component status.

Approach 1:

Approach 1 solicits the development of low-cost, high-strength fibers, and composite components. Proposed approaches may include, but are not necessarily limited to, use of less expensive precursor fibers, using low-cost carbon fiber manufacturing processes (including associated pre-treatments, stabilization, oxidation, carbonization, graphitization, sizing, post-treatments, and packaging), development of improved resin matrices including fillers, or developing alternative materials to carbon such as glass or polymers. The goal is to significantly reduce the composite costs for 700 bar pressure systems and achieve the 2017 system cost targets of $12/kWh by:

* Reducing the composites’ contribution to the system costs by 35% from ~$10/kWh to ~$6.5/kWh when manufactured in high volume and
* Lowering the current high strength fiber (i.e., fiber with ultimate tensile strength greater than 650 ksi) cost by at least 50% from approximately $13/lb to $6/lb.

Applications addressing Approach 1 should include a detailed technical analysis and cost projection of proposed synthesis methods and overall fiber production methods to yield the desired high-strength fibers required to meet low, medium and high manufactured volumes of COPVs (e.g., 500, 4000 and 25,000 metric tons of carbon fiber per year). If proposing alternative fibers or significantly different strength carbon fibers, the applications should also include consideration of how their use will impact the overall system performance (e.g., changes in the projected gravimetric capacity due to modifications in the mass of the pressure vessel). The work scope should include fabrication of fibers from the most promising low-cost precursor materials identified and characterization of the mechanical properties and durability of these resultant fibers for use in high-pressure compressed hydrogen cylinder applications. Development of improved resins and resin additives that result in high performing composites that can potentially reduce the amount of carbon fiber required to achieve the strength needed in 350 and 700 bar pressure vessels will also be considered.

Approach 2:

Approach 2 solicits the development of improved, lower-cost materials for BOP. Applications are sought for identification and characterization of materials that can be used to reduce the cost and mass of the BOP for compressed hydrogen systems. Seals and non-metallic materials are two items of specific interest.

For 350 and 700 bar systems, at annual manufacturing volumes of 10,000 systems per year, the BOP is projected to account for 57% of the total system cost. Even at volumes of 500,000 systems per year, the BOP can constitute 30% of the total system costs. For single tank configurations, the BOP is estimated to contribute 15-20% of the total system mass. A schematic that includes the BOP for compressed hydrogen systems can be found in [7]. The BOP materials must be suitable for operation over the range of pressure and temperature regimes envisioned in SAE J2601 refueling protocols for fast refueling of 700 bar systems with precooling of hydrogen to -40 °C. All seals and other component surfaces in contact with hydrogen must therefore be compatible for hydrogen service over the minimum temperature range of -40 to 85 °C and pressures up to 875 bar (i.e., refueling pressure of 1.25 times the nominal working pressure of 700 bar). Also to reduce weight and costs, BOP constructed of lightweight, low-cost metallic and non-metallic materials would be preferable when possible. Material evaluation should include consideration of the full range of operating conditions, including temperature, pressure and cycling, that the BOP will be exposed to, as well as suitability for hydrogen service. Applications are sought for the identification and evaluation of lightweight, low-cost materials for use in BOP, including seals, but not for the design and construction of BOP components.

### Topic 3 – New Hydrogen Storage Materials Discovery

FCTO remains committed to the discovery, characterization, and development of advanced hydrogen storage materials. Through advanced modeling of complete materials-based hydrogen storage systems, a better understanding of the specific material-level performance properties necessary to meet the DOE 2017 system level targets for onboard vehicle storage is being achieved. [[15]](#footnote-15),[[16]](#footnote-16),[[17]](#footnote-17) While the DOE targets are for full systems, these analyses provide insight into the specific material thermodynamic, kinetic, gravimetric, and volumetric properties that will be needed for a complete material-based system to be able to meet the 2017 DOE targets. For instance, analyses has shown that a reversible metal hydride with an enthalpy of hydrogen release of around 27 kJ/mol of H2 and sufficient release kinetics at a temperature that waste heat from the fuel cell (i.e., 80 °C or less) can be used to provide the heat of desorption, must have a useable material gravimetric capacity of at least 11 wt.%. If either the hydrogen release thermodynamics is greater, or the kinetics are slower (such that additional heat or temperature must be provided, thus requiring consuming some of the stored hydrogen), then even higher gravimetric capacities are required.[[18]](#footnote-18) At a minimum, any applications relating to the material discovery for automotive applications must include targeted material property metrics for volumetric and gravimetric capacity, kinetics, and thermodynamics in addition to other key performance targets, regardless of material type. Similarly, applications for materials discovery for material handling equipment and portable power applications must include a set of appropriate targeted material property metrics. Applications focused on a single material property (e.g., material’s gravimetric capacity) will be deemed unresponsive.

Furthermore, to stress the importance of reliable material property measurement techniques to facilitate the development of hydrogen storage materials, researchers are referred to DOE’s “Recommended Best Practices for the Characterization of Storage Properties of Hydrogen Storage Materials” document.[[19]](#footnote-19) This document provides an introduction and overview of the recommended best practices in making measurements of hydrogen storage material properties and is suggested reading prior to initiating hydrogen storage materials development activities.

In addition, applications awarded under Topic 3 will be required to submit their resulting material properties to the Hydrogen Storage Materials Database.[[20]](#footnote-20) This website has been established by DOE as repository for the comprehensive collection of hydrogen storage material properties and is part of the President’s Materials Genome Initiative.[[21]](#footnote-21)

Approach 1:

Approach 1 solicits applications for the discovery of novel, advanced hydrogen storage materials for onboard vehicle storage of hydrogen that have the potential to meet the DOE 2017 and Ultimate Full Fleet targets specified in Appendix D. While the performance targets are for the complete system, recent complete system modeling efforts provide an understanding of the “acceptable” material properties, such as thermodynamic, kinetic, and volumetric and gravimetric capacities. Efforts proposed for off-board regenerable materials must include consideration of spent fuel regeneration processes and have potential pathways to meet the targets for well-to-powerplant efficiency and fuel costs. Applications under this approach must specify quantitative metrics for a range of material properties that need to be met for the material to operate.

The first phase of the project must include synthesis and characterization of materials and demonstrate potential to meet several of the specified metrics and to have the potential to meet the overall set of material property metrics. DOE may require that materials developed under Approach 1 be sent to a third party laboratory specified by DOE for independent material evaluation and testing.

The following technologies will not be accepted under Approach 1 based on previous No-Go decisions by FCTO: hydrolysis of sodium borohydride[[22]](#footnote-22); pure, undoped single-walled carbon nanotubes[[23]](#footnote-23); and onboard fuel processing (hydrocarbon fuels that are reformed onboard to produce hydrogen and carbon dioxide).[[24]](#footnote-24) In addition, DOE is not interested in concepts relying solely on hydrogen storage enhancement via the weak-chemisorption or “spillover” mechanism. [[25]](#footnote-25) Applications in these areas will be deemed non-responsive and will not be reviewed. Systems that were discontinued for investigation by the three DOE Hydrogen Storage Material Centers of Excellence (final reports referenced above) are also not solicited under Approach 1 unless a new approach has been developed that addresses the reasons why the subject material was discontinued for R&D.

Approach 2:

Approach 2 solicits applications for the development of materials-based advanced hydrogen storage technologies for material handling equipment or portable power systems (up to 150 watts) that have the potential to meet the DOE 2015 and 2020 performance targets (see Appendix D). Materials that also have potential for use in automotive applications are preferable. Under Approach 2, applications must either incorporate the proposed material into a complete prototype hydrogen storage system or address identified material issues, such as low-cost material synthesis or regeneration, for existing prototype systems. Applications should describe the specific application being addressed, as related to either material handling or portable power, and provide sufficient information for evaluation on how the proposed work will result in a system meeting the performance targets listed in Appendix D. Experimental results should be reproducible and technical data that is reported to DOE should include, but not be limited to, all properties of the material including thermodynamics, kinetics, gravimetric and volumetric capacities, and system level performance evaluated against appropriate targets. Prime Applicants under Approach 2 who are not commercial entities must include a letter of support from at least one commercial partner interested in commercializing hydrogen fuel cell products in the application area. The commercialization partner can either formally or informally participate in the project. The scope of work for system development should include development and testing of scalable prototypes, a high-volume manufacturing cost estimate, BOP component list, and when appropriate, the construction of one complete system for thorough performance testing by an independent party specified by the DOE. The scope of work for applications addressing material issues should also include production of sufficient quantity of material for thorough characterization and validation of the material properties by an independent party specified by the DOE.

* 1. Additional Information

Applicants are required to submit an initial “Concept Paper” that briefly describes the proposed project. DOE will then review each Concept Paper and provide feedback to encourage or discourage each applicant from applying to the full application based on DOE’s view of the merit of the proposed concept and the likelihood the proposed concept would be favorably viewed during the full application stage. This saves the applicant from having to complete a full application if the brief concept description is not well received by DOE.

It is expected that the efforts funded under Topic 1, “Reducing the Cost of Compressed Hydrogen Storage Systems” and Topic 2, “Improved Materials for Fiber Composites and Balance of Plant Components”, of this announcement will serve to address the immediate needs of the hydrogen community leading up to the anticipated widespread deployment of hydrogen vehicles starting in 2015. While work funded under Topic 3, “New Hydrogen Storage Materials Discovery”, may cover transportation, materials handling, and/or portable applications that address longer term approaches or applications that will serve to build a supply chain for advanced hydrogen storage concepts. It is expected that work under all three topics will complement, but not duplicate, current and previous work funded by DOE. For more information on previous and existing projects within the hydrogen storage portfolio, please review the following links:

* DOE Hydrogen and Fuel Cells Program Annual Progress Reports: <http://www1.eere.energy.gov/hydrogenandfuelcells/annual_reports.html>;
* DOE Hydrogen and Fuel Cells Program Annual Program Merit Review and Peer Evaluation Reports: <http://www1.eere.energy.gov/hydrogenandfuelcells/merit_review.html>;
* DOE Office of Basic Energy Sciences: <http://science.energy.gov/bes/>.

Finally, a pre-solicitation meeting concerning this FOA was held on May 14, 2013 in conjunction with the 2013 Hydrogen and Fuel Cells Program Annual Merit Review and Peer Evaluation Meeting (AMR). During the pre-solicitation meeting, FCTO representatives presented the initial plans and answered questions from the public on draft FOA topic areas which resulted in this FOA. The complete set of questions and answers from that meeting are posted at: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/st_foa_mtg_q_and_a.pdf>. Also, the slides presented by DOE at that meeting are posted at: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/st_foa_pre-solicit_mtg_slides.pdf>. These documents may help applicants solidify the goals and objectives of this FOA; however, these documents should only be considered preliminary. This FOA, any subsequent amendments or modifications to this FOA, and any questions and answers posted on the EERE Exchange website concerning this FOA (see Section VII) supersedes any of the information contained in the documents noted above.

* 1. Applications Specifically Not of Interest

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

* Applications that fall outside the technical parameters specified in Section I.C of the FOA, including but not limited to hydrolysis of sodium borohydride[[26]](#footnote-26); pure, undoped single-walled carbon nanotubes[[27]](#footnote-27); and onboard fuel processing (hydrocarbon fuels that are reformed onboard to produce hydrogen and carbon dioxide).[[28]](#footnote-28) In addition, DOE is not interested in concepts relying solely on hydrogen storage enhancement via the weak-chemisorption or “spillover” mechanism.[[29]](#footnote-29)
* Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the law of thermodynamics).
1. Award Information
	1. Award Overview
		1. Estimated Funding

EERE expects to make at least $4 million of Federal funding available for 2 to 4 new awards in FY14 under this FOA subject to the availability of appropriated funds. Additional projects may be selected from an alternates list should funding become available. EERE may issue one, multiple, or no awards.

Individual awards may vary between $800,000 and $2,000,000.

EERE may issue awards in one, multiple, or none of the following topic areas:

* Topic Area 1: Reducing the Cost of Compressed Hydrogen Storage Systems
* Topic Area 2: Improved Materials for Fiber Composites and Balance of Plant Components
* Topic Area 3: New Hydrogen Storage Materials Discovery

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods, including the initial budget period, is not guaranteed. Before the expiration of the initial budget period(s), EERE may perform a down-select among different recipients and provide additional funding only to a subset of recipients.

* + 1. Period of Performance

EERE anticipates making awards that will run up to 36 months in length. Project continuation will be contingent upon satisfactory performance and annual go/no-go decision reviews. At the go/no-go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE will make a determination to continue the project, re-direct the project, or discontinue funding the project. Only those projects demonstrating a high probability of successfully meeting the program targets will be continued.

* + 1. New Applications Only

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

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| --- | --- | --- | --- | --- | --- |
| **Topic Area Number** | **Topic Area** | **Anticipated Award Size for Any One Individual Award (Fed Share)** | **Anticipated Number of Awards to be Funded in FY14** | **Period of Performance** | **Number of Budget Periods and Length of Each Budget Period** |
| 1 | Reducing the Cost of Compressed Hydrogen Storage Systems | $1.33M to $2M | Up to 2 | 24 to 36 months | 2 to 3 Budget Periods each 1 Year in Length |
| 2 | Improved Materials for Fiber Composites and Balance of Plant Components | $800K to $1.2M | Up to 4 | 24 to 36 months | 2 to 3 Budget Periods each 1 Year in Length |
| 3 | New Hydrogen Storage Materials Discovery | $800K to $1.2M | Up to 4 | 24 to 36 months | 2 to 3 Budget Periods each 1 Year in Length |

* 1. EERE Funding Agreements

Through Cooperative Agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States Government.

* + 1. Cooperative Agreements

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

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

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

* + 1. Funding Agreements with FFRDCs, GOGOs, Federal Agencies and Federal Instrumentalities

In most cases, Federally Funded Research and Development Centers (FFRDC) or Government-owned, Government-operated laboratories (GOGO) are funded independently of the remainder of the Project Team. The FFRDC or GOGO then executes an agreement with any non-FFRDC/GOGO Project Team members to arrange work structure, project execution, and any other matters. Regardless of these arrangements, the entity that applied as the Prime Recipient for the project will remain the Prime Recipient for the project.

1. Eligibility Information
	1. Eligible Applicants
		1. Individuals

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

* + 1. Domestic Entities

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

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

DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) and DOE Government-Owned, Government-Operated laboratories (GOGOs) are eligible to apply for funding as a Prime Recipient or Subrecipient.

Non-DOE/NNSA FFRDCs and non-DOE GOGOs are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient.

* + 1. Foreign Entities

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

Other than as provided in the “Individuals” or “Domestic Entities” sections above, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. If a foreign entity applies for funding as a Prime Recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a State or territory of the United States to be the Prime Recipient. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

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

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

In the waiver request, the Applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the interests of EERE to have a foreign entity serve as the Prime Recipient. The Contracting Officer may require additional information before considering the waiver request. Save the waiver request(s) in a single PDF file titled “ControlNumber\_LeadOrganization\_Waiver”.

A foreign entity may receive funding as a Subrecipient.

* + 1. Incorporated Consortia

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

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

* + 1. Unincorporated Consortia

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

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

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

Topic 1: 20% Cost Share Required for all Entities:

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

Topics 2 and 3: 20% Cost Share Required for All Types of Entities, Except: Institutions of Higher Education, National Laboratories, FFRDCs, and Non-Profit Organizations, which will require 0% Cost Share

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

* + 1. Legal Responsibility

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

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

* + 1. Cost Share Allocation

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

* + 1. Cost Share Types and Allowability

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

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

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

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

* Revenues or royalties from the prospective operation of an activity beyond the project period;
* Proceeds from the prospective sale of an asset of an activity;
* Federal funding or property (e.g., Federal grants, equipment owned by the Federal Government); or
* Expenditures that were reimbursed under a separate Federal Technology Office.

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

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

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

* + 1. Cost Share Contributions by FFRDCs and GOGOs

Because FFRDCs and GOGOs are funded by the Federal Government, costs incurred by FFRDCs and GOGOs generally may not be used to meet the cost share requirement. FFRDCs may contribute cost share only if the contributions are paid directly from the contractor’s Management Fee or another non-Federal source.

* + 1. Cost Share Verification

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

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

* + 1. Cost Share Payment

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

EERE requires Prime Recipients to contribute the cost share amount incrementally over the life of the award. Specifically, every Prime Recipient is required to contribute, at a minimum, the cost share percentage of total expenditures incurred during each billing period. For example, a Prime Recipient is required to contribute at least 31% of the total expenditures incurred during each billing period if the award states that the cost share percentage is 31%.

In limited circumstances, and where it is in the government’s interest, the EERE Contracting Officer may approve a request by the Prime Recipient to meet its cost share requirements on a less frequent basis, such as monthly or quarterly. Regardless of the interval requested, the Prime Recipient must be up-to-date on cost share at each interval. Such requests must be sent by email to the Contracting Officer during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to demonstrate that the Prime Recipient has complied with its cost share obligations to date. The Contracting Officer must approve all such requests before they may go into effect.

* 1. Compliance Criteria

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

* + 1. Compliance Criteria
			1. Concept Papers

Concept Papers are deemed compliant if:

* The Applicant successfully uploaded all required documents in Section IV.C and clicked the “Submit” button in EERE Exchange by the deadline stated in this FOA.
	+ - 1. Full Applications

Full Applications are deemed compliant if:

* The Applicant submitted a compliant and responsive Concept Paper;
* The Full Application complies with the content and form requirements in Section IV.D of the FOA; and
* The Applicant entered all required information necessary for a meaningful review, successfully uploaded all required documents, and clicked the “Submit” button in EERE Exchange by the deadline stated in the FOA.
	+ - 1. Replies to Reviewer Comments

Replies to Reviewer Comments are deemed compliant if:

* The Reply to Reviewer Comments complies with the content and form requirements in Section IV.F of the FOA; and
* The Applicant successfully uploaded all required documents and clicked the “Submit” button to EERE Exchange by the deadline stated in the FOA.
	1. Responsiveness Criteria

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

* 1. Other Eligibility Requirements
		1. Requirements for DOE/NNSA Federally Funded Research and Development Centers (FFRDC) Listed as the Applicant

A DOE/NNSA FFRDC is eligible to apply for funding under this FOA if its cognizant Contracting Officer provides written authorization and this authorization is submitted with the application. If a DOE/NNSA FFRDC is selected for award, the proposed work will be authorized under the DOE work authorization process and performed under the laboratory’s Management and Operating (M&O) contract.

The following wording is acceptable for the authorization:

Authorization is granted for the \_\_\_\_\_\_\_ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, and will not adversely impact execution of the DOE assigned programs at the laboratory.

* + 1. Requirements for DOE/NNSA and non-DOE/NNSA Federally Funded Research and Development Centers Included as a Subrecipient

DOE/NNSA and non-DOE/NNSA FFRDCs may be proposed as a Subrecipient on another entity’s application subject to the following guidelines:

* + - 1. Authorization for non-DOE/NNSA FFRDCs

The Federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with its authority under its award.

* + - 1. Authorization for DOE/NNSA FFRDCs

The cognizant Contracting Officer for the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization:

Authorization is granted for the \_\_\_\_\_ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, and will not adversely impact execution of the DOE assigned programs at the laboratory.

* + - 1. Value/Funding

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

* + - 1. Cost Share

Although the FFRDC portion of the work is usually excluded from the award to a successful applicant, the applicant’s cost share requirement will be based on the total cost of the project, including the applicant’s and the FFRDC’s portions of the project.

Note this doesn’t apply to Topics 2 and 3 due to the Cost Share Waiver – see Section III.B.

* + - 1. Limit on FFRDC Effort

The FFRDC effort, in aggregate, shall not exceed 50% of the total estimated cost of the project, including the applicant’s and the FFRDC’s portions of the effort.

* + - 1. Responsibility

The Prime Recipient 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 Prime Recipient and the FFRDC contractor.

* 1. Limitation on Number of Concept Papers and Full Applications Eligible for Review

Applicants may submit more than one Full Application to this FOA, provided that each application only covers one specific topic area (approach) and describes a unique, scientifically distinct project.

* 1. Questions Regarding Eligibility

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

1. Application and Submission Information
	1. Application Process

The application process will include two phases: a Concept Paper phase and a Full Application phase. **Only applicants who have submitted a compliant Concept Paper will be eligible to submit a Full Application**. At each phase, EERE performs an initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III of the FOA. EERE will not review or consider noncompliant and/or nonresponsive submissions. All submissions must conform to the following form and content requirements, including maximum page lengths, described below and must be submitted via EERE Exchange at <https://eere-exchange.energy.gov/>, unless specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than EERE Exchange, submissions submitted after the applicable deadline, and incomplete submissions**. EERE will not extend deadlines for Applicants who fail to submit required information and documents due to server/connection congestion. A control number will be issued when an Applicant begins the Exchange application process. This control number must be included with all Application documents, as described below.

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

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

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

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

* 1. Application Forms

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

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

**ControlNumber\_LeadOrganization\_Project\_Part\_1**

**ControlNumber\_LeadOrganization\_Project\_Part\_2**, etc.

* 1. Content and Form of the Concept Paper

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

Each Concept Paper must be limited to one topic area or approach per Concept Paper. Unrelated concepts and technologies should not be consolidated into a single Concept Paper.

* + 1. Concept Paper Content Requirements

The Concept Paper must conform to the following content requirements:

|  |  |  |
| --- | --- | --- |
| **SECTION** | **PAGE LIMIT** | **DESCRIPTION** |
| **Technology Description****Technology Description** continued | 3 pages maximum | Applicants are required to describe succinctly:* The proposed technology, including its basic technical principles and how it is unique and innovative;
* The proposed technology’s target level of performance (Applicants should provide technical data or other support to show how the proposed target could be met);
* The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges;
* How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application;
* The potential impact that the proposed project would have on the relevant field and application;
* The key technical risks/issues associated with the proposed technology development plan;
* The impact that EERE funding would have on the proposed project; and
* Very brief synopsis of the intended budget and project team.
 |
| **Addendum** | 1 page maximum | Applicants may provide graphs, charts, or other data to supplement their Technology Description. |

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

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

Due to the expected volume of submissions, EERE will not provide technical feedback on Concept Papers.

* 1. Content and Form of the Full Application

Applicants must submit a Full Application by the specified due date to be considered for funding under this FOA. Applicants must complete the following application forms in accordance with the instructions.

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

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

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

Each Full Application should be limited to one topic area or approach per Full Application. Unrelated concepts and technologies will not be consolidated in a single Full Application.

Full Applications must conform to the following requirements (details for each specific requirement can be found below the table):

|  |  |  |
| --- | --- | --- |
| **SUBMISSION** | **COMPONENTS** | **FILE NAME (IF NECESSARY)** |
| **Full Application (PDF format and no page limit unless stated otherwise)** | 1. Technical Volume (15 pages max)
 | ControlNumber\_LeadOrganization\_TechnicalVolume |
| 1. Milestones and Deliverables Table (Microsoft Excel format)
 | ControlNumber\_LeadOrganization\_MilestonesAndDeliverablesTable |
| 1. Resumes (single file, 2 pages per resume max)
 | ControlNumber\_LeadOrganization\_Resumes |
| 1. Application for Federal Assistance (SF-424)
 | ControlNumber\_LeadOrganization\_App424 |
| 1. Budget Justification Workbook (PMC 123.1); (Microsoft Excel format, applicants must use the template available in EERE Exchange)
 | ControlNumber\_LeadOrganization\_Budget\_Justification |
| 1. Budget Information (SF-424A)
 | ControlNumber\_LeadOrganization\_SF424A |
| 1. Statement of Project Objectives (SOPO)
 | ControlNumber\_LeadOrganization\_SOPO |
| 1. Summary (Abstract) for Public Release (1 page max)
 | ControlNumber\_LeadOrganization\_Summary |
| 1. Summary Slide (1 page limit, Microsoft PowerPoint format)
 | ControlNumber\_LeadOrganization\_Slide |
| 1. Letters of Commitment (signed letters of cost share commitment), if applicable
 | ControlNumber\_LeadOrganization\_Commitments |
| 1. Subaward Budget Justification Workbook (PMC 123.1); (Microsoft Excel format, applicants must use the template available in EERE Exchange), if applicable
 | ControlNumber\_LeadOrganization\_Subawardee\_Budget\_Justification |
| 1. Budget for FFFRDCs (FWP), if applicable
 | ControlNumber\_LeadOrganization\_FWP |
| 1. Authorization from cognizant Contracting Officer for FFRDCs, if applicable
 | ControlNumber\_LeadOrganization\_FFRDCAuth |
| 1. SF-LLL Disclosure of Lobbying Activities
 | ControlNumber\_LeadOrganization\_SF-LLL |
| 1. Waiver Requests: Foreign Entities and Performance of Work in the United States, if applicable
 | ControlNumber\_PerformanceofWork\_Waiver |

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

**ControlNumber\_LeadOrganization\_Project\_Part\_1**

**ControlNumber\_LeadOrganization\_Project\_Part\_2**, etc.

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

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

* + 1. Technical Volume

The Technical Volume must be submitted in Adobe PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If Applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. **This volume must address the Merit Review Criteria as discussed in Section V.A.2 of the FOA.** Save the Technical Volume in a single file titled “ControlNumber\_LeadOrganization\_TechnicalVolume”.

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

The Technical Volume portion of the Full Application may not be more than 15 pages, and must include all of the information in the table below:

|  |  |
| --- | --- |
| **SECTION/PAGE LIMIT** | **DESCRIPTION** |
| **Cover Page (1 page max)** | The cover page must indicate the name and type of organization; the announcement number; the project title; the Topic under which the application is being proposed; both technical and business points of contact (include name, title, address, phone number, and email address); and all of the project participants (subcontractors, consultants, team members, etc.). |
| **Project Overview** (Approximately 10% of the Technical Volume) | * The Project Overview is the portion of the Full Application that an applicant must demonstrate the viability of their scientific approach, and should contain the following information:

Background* The Applicant should discuss the history, successes, and current development status (i.e., the baseline) of the technology proposed in the Full Application. This section should explicitly identify targeted improvements to the baseline and critical success factors.
* DOE Impact:
* The impact that DOE funding would have on the proposed project.  Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.
 |
| **Technical Overview** (Approximately 40% of the Technical Volume) | Overview* A high-level narrative discussion introducing the scientific principles and objectives that will be pursued under this effort through its duration. This section should discuss the technical concept in detail, including a description of the state of the art in the applicable field, the impact the proposed project will have in that field, the impact the proposed project will have on the goals of this FOA, and a discussion of the primary technical barriers of the proposed approach along with strategies to overcome those barriers. Applicants should provide information and specific preliminary data to sufficiently demonstrate the viability of their technical concept and the need for the innovation.

Feasibility – Describe and justify:* The feasibility of the proposed technology solution, and capability of achieving the cost and performance targets at scale (i.e., large-volume/high-throughput scenario)
* Identification of the key risks and a risk mitigation plan.
 |
| **Work Plan** (Approximately 40% of the Technical Volume)**Work Plan** continued | The Work Plan should fully describe how the applicant will achieve the milestones, final project goal(s), and produce all deliverables. The Plan should complement the Milestones and Deliverables Table that will be included as a separate file (see Section IV.D2). A complete Plan will contain the following information:* Project Objective: Provide a high-level overview of the projected final result of this project. Explain the final objective, outcome, milestone and/or deliverable that are to be produced and the rationale for why the applicant has organized the tasks in the way they have.
* All of the activities/tasks required to perform the project including:
	+ Task Summary: Task summaries shall explicitly identify the project objectives/outcomes being addressed and a concise statement of the objectives of that task.
	+ Task Details: Include a summary of subtasks which details the work efforts that go into achieving the higher-level tasks as necessary. Describe the evaluation techniques that will be used and the expected result that will be generated from the effort.
	+ Quarterly project milestones and deliverables as related to the project tasks and specific proposed yearly “Go/No-Go” milestones. Milestones should be concrete, objective, and quantitative. EERE evaluates the progress of a project by comparing actual progress to predetermined technical milestones and deliverables.
* A description of how changes will be handled
* A Quality Assurance/Control Plan, if applicable
* A Team Communications Plan, if applicable

*A complete Work Plan adheres to the following guidelines:** Provide a concise detailed description of the specific activities to be conducted over the proposed period of performance. “Detailed” is defined as a full explanation and disclosure of the project being proposed (i.e., statements such as “we will then complete a proprietary process” are unacceptable). It is the Applicant’s responsibility to prepare an adequately detailed task plan to convince reviewers that the proposed project can meet the goals of this FOA.
* It is critical that the overall project objective is broken into separate Task sections that are clearly linked to, and combine to result in, the project deliverable(s) and final objective(s).
* Each Task must be broken out into component Subtask sections as necessary, to specify the activities that will be conducted to accomplish the task.

*A Milestones and Deliverables Table based on the proposed work plan is a required deliverable (see Section IV.D.2) to be submitted separately from the Technical Volume. The Work Plan portion of the Technical Volume should complement the Milestones and Deliverables Table.* |
| **Technical Qualifications and Resources** (Approximately 10% of the Technical Volume) | Please describe the Project Team’s unique qualifications, expertise, equipment, or facilities that will facilitate the successful completion of the proposed project.* Clearly and succinctly describe the Applicant’s and Subrecipients’ (if applicable) resources and credentials.  This section should also include previous work efforts, demonstrated innovations, and how these enable the Applicant to achieve the project objectives. Include sufficient labor details to support the project development effort.
* Discuss your team’s proposed management plan, including:
	+ The roles of each Project Team member;
	+ Any critical handoffs/interdependencies between Project Team members;
	+ The technical (i.e., the decision-making based on technical understanding of the problem) and management (i.e., monitoring different elements of the project and technology to ensure that it is well-integrated) aspects of the Management Plan and the role of the Principal Investigator;
* Describe the technical services to be provided by FFRDCs and GOGOs, if applicable.
 |

* + 1. Milestones and Deliverables Table

Applicants are required to complete the Milestones and Deliverables Table that covers the entire proposed project. This table should be based off of the Work Plan included in the Technical Volume and should include all tasks, milestones, deliverables, and Go/No-Go milestones. An example is provided in Appendix E. Save the Milestones and Deliverables Table in a single file titled “ControlNumber\_LeadOrganization\_MilestonesAndDeliverablesTable”.

* + 1. Resumes

Applicants are required to submit resumes (2-pages max) for each of the key members of the proposed team. Attach all resumes into a single PDF file titled “ControlNumber\_LeadOrganization\_Resumes”.

* + 1. Application for Federal Assistance (SF-424)

Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period. Save the SF-424 in a single file titled “ControlNumber\_LeadOrganization\_App424”.

* + 1. Budget Justification Workbook (PMC 123.1)

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

* + 1. Budget Information (SF-424A)

Applicants must provide a separate budget for each project year (budget period) of support requested and a cumulative budget for the total project period. Use the SF-424A “Budget Information – Non Construction Programs” form on the DOE Financial Assistance Forms Page at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>. The SF-424A provides columns for each individual budget-year as well as the cumulative project budget.

Applicants may request funds under any of the Object Class Categories as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement (see Section IV.I.1). Save the information in a single file titled “ControlNumber\_LeadOrganization\_SF424A”.

* + 1. Statement of Project Objectives (SOPO)

The SOPO must address how the project objectives will be met and should be included using the template provided. It must contain a clear, concise description of all activities to be completed during the project performance and follow the requirements in the template. This file is essentially a condensed version of the Technical Proposal and all information contained in this document should also be provided in the Technical Proposal. The SOPO may be released to the public by DOE, in whole or in part, at any time. Therefore, it is required that it shall not contain proprietary or confidential business information. Save the SOPO in a single file named “ControlNumber\_LeadOrganization\_SOPO”.

* + 1. Summary (Abstract) for Public Release

Applicants are required to submit a one-page summary/abstract of their project. The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the Department may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1” margins (top, bottom, left, and right) with font not smaller than 11 point. Save the Summary for Public Release in a single file titled “ControlNumber\_LeadOrganization\_Summary”.

* + 1. Summary Slide

Applicants are required to provide a single PowerPoint slide summarizing the proposed project. The slide must be submitted in Microsoft PowerPoint format. This slide is used during the evaluation process, but it should not contain proprietary information as it may be used for dissemination to the public. Save the Summary Slide in a single file titled “ControlNumber\_LeadOrganization\_Slide”.

The Summary Slide template requires the following information:

* A technology summary;
* A description of the technology’s impact;
* Proposed project goals;
* Any key graphics (illustrations, charts and/or tables);
* The project’s key idea/takeaway;
* Project title, prime recipient, principal investigator, and key participants; and
* Requested EERE funds and proposed applicant cost share.
	+ 1. Letters of Commitment (if applicable)

You must have a letter from each third party contributing cost share (i.e., a party other than the organization submitting the application) stating that the third party is committed to providing a specific minimum dollar amount of cost share. The letter should also identify the proposed cost sharing (e.g., cash, services, and/or property) to be contributed. Letters must be signed by the person authorized to commit the expenditure of funds by the entity. Letters of Commitment from parties participating in the project, exclusive of vendors, who will not be contributing cost share, but will be integral to the success of the project should be included as well. Save the Letter of Commitment in a single file titled “ControlNumber\_LeadOrganization\_Commitments”.

* + 1. Subaward Budget Justification PMC 123.1 (if applicable)

Applicants must provide a separate budget justification, PMC 123.1 (i.e., budget justification for each budget year and a cumulative budget) for each subawardee that is expected to perform work estimated to be more than $250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the “Budget Justification Workbook” section, above. Save each subaward budget justification in a single file titled “ControlNumber\_LeadOrganization\_Subawardee\_Budget\_Justification”.

* + 1. Budget for DOE/NNSA FFRDC (FWP) (if applicable)

If a DOE/NNSA FFRDC contractor is to perform a portion of the work, the Applicant must provide a DOE Field Work Proposal (FWP) in accordance with the requirements in DOE Order 412.1, Work Authorization System. DOE Order 412.1 and DOE O 412.1 (Field Work Proposal form) area available at the following link, under “DOE Budget Forms”: <https://www.directives.doe.gov/directives/0412.1-BOrder-a/view>. Save the FWP in a single file titled “ControlNumber\_LeadOrganization\_FWP”.

* + 1. Authorization for non-DOE/NNSA or DOE/NNSA FFRDCs (if applicable)

The Federal agency sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of a FFRDC contractor must be consistent with the contractor’s authority under its award. Save the Authorization in a single file titled “ControlNumber\_LeadOrganization\_FFRDCAuth”.

* + 1. SF-LLL: Disclosure of Lobbying Activities

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

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

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

Save the SF-LLL in a single file titled “ControlNumber\_LeadOrganization\_SF-LLL”.

* + 1. Waiver Requests: Foreign Entities and Performance of Work in the United States (if applicable)
			1. Foreign Entity Participation:

As set forth in Section III.A.3, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, the Applicant must submit an explicit waiver request in the Full Application. Waiver information is provided in Section III.A.3 of the FOA.

* + - 1. Performance of Work in the United States

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

* 1. Post-Award Information Requests

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

* Indirect cost information
* Other budget information
* Name and phone number of the Designated Responsible Employee for comply with national policies prohibiting discrimination (See 10 CFR 1040.5)
* Representation of Limited Rights Data and Restricted Software, if applicable
* Environmental Questionnaire

	1. Content and Form of Replies to Reviewer Comments

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

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

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

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

* 1. Submission Dates and Times

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

* 1. Intergovernmental Review

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

* 1. Funding Restrictions
		1. Allowable Costs

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

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

* 2 CFR 220 for Educational Institutions;
* 2 CFR 225 for State, Local, and Indian Tribal Governments;
* 2 CFR 230 for Non Profit Organizations; and
* FAR Part 31 for For-Profit entities.
	+ 1. Pre-Award Costs

Recipients must obtain written Contracting Officer approval prior to incurring pre-award costs. Upon approval, Recipients may charge to an award resulting from this FOA pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award and no earlier than the selection date, if the costs are allowable in accordance with the applicable Federal cost principles reference in 10 CFR Part 600. Recipients must obtain the prior approval of the Contracting Office for any pre-award costs that are for periods greater than this 90 day calendar period.

* + - 1. Pre-Award Costs Related to National Environmental Policy Act (NEPA) Requirements

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

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

* + 1. Performance of Work in the United States

EERE requires all work under EERE financial assistance agreements to be performed in the United States. This requirement does not apply to the purchase of supplies and equipment; however, the Prime Recipient should make every effort to purchase domestically produced supplies and equipment. If a recipient fails to comply with the Performance of Work in the United States requirement, the EERE Contracting Officer may deny reimbursement for the work conducted outside the United States.

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

* The countries in which the work will be performed;
* A description of the work to be performed outside the U.S.; and
* The rationale for performing the work outside the U.S.

For the rationale, the Applicant must demonstrate to the satisfaction of the EERE Contracting Officer that a waiver would further the purposes of this FOA and is otherwise in the interests of EERE and the United States. For example, an Applicant may seek to demonstrate the United States economic interest will be better served by having certain work performed outside the United States (e.g., demonstrate the expertise to develop the technology exists only outside the United States, but the technology’s ultimate commercialization will result in substantial benefits to the United States such as improved electricity reliability or creating domestic jobs). The Contracting Officer may require additional information before considering the waiver request. Save the waiver request(s) in a single PDF file titled “ControlNumber\_PerformanceofWork\_Waiver”.

* + 1. Construction

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

* + 1. Foreign Travel

If international travel is proposed for your project, please note that your organization must comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 USC 40118), commonly referred to as the “Fly America Act,” and implementing regulations at 41 CFR 301-10.131 through 301-10.143. The law and regulations require air transport of people or property to, from, between, or within a country other than the United States, the cost of which is supported under this award, to be performed by or under a cost-sharing arrangement with a U.S. flag carrier, if service is available.

* + 1. Equipment and Supplies

To the greatest extent practicable, all equipment and products purchased with funds made available under this award should be American-made. Property disposition will be required at the end of a project if the property is no longer used by the Prime Recipient for the objectives of the project, and the fair market value of property exceeds $5,000. The rules for property disposition are set forth in the following sections of 10 CFR Part 600:

* 10 CFR 600.130 to 600.137 for Universities, Hospitals, or other Nonprofit Institutions;
* 10 CFR 600.231 to 600.233 for State and Local Governments; and
* 10 CFR 600.320 to 600.325 for For-Profit organizations.
	+ 1. Lobbying

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

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

* An officer or employee of any Federal agency;
* A Member of Congress;
* An officer or employee of Congress; or
* An employee of a Member of Congress.
1. Application Review Information
	1. Technical Review Criteria
		1. Concept Papers

Concept Papers will be evaluated against the following criteria:

**Responsiveness to the FOA Objectives (Weight: 100%)**

* Overall viability of the proposed technical concept and approach;
* Degree to which the proposed concept addresses the FOA objective(s) and likelihood of overcoming challenges and barriers;
* Uniqueness, innovation, and potential benefits of the proposed technology relative to the state of the art; and
* Potential of the proposed idea to meet the DOE Hydrogen Storage targets.

Submissions will not be evaluated against each other since they are not submitted in accordance with a common work statement.

* + 1. Full Applications

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

Criterion 1: Technical Concept (Weight: 50%)

* The overall relevance and applicability of the technical concept and approach in addressing the technical challenges and the specific objectives of the Topic Area, as described in this FOA.
* The feasibility and viability of the proposed technical concept including: supporting evidence, peer reviewed or collaborated data, and results of prior and ongoing work.
* The quantitative degree to which the applicant has provided a convincing technical argument for how the proposed technical concept will advance the technology toward the program’s technical objectives including the performance and cost targets in Appendix D.
* The degree to which the applicant has provided sufficient technical details to assess the scientific merit and innovation of the proposed concept.
* The degree of innovation of the proposed technology or methodology.
* The degree to which the key technical risk areas of the proposed project are identified and the reasonableness of the proposed strategies to address them.
* The potential of the proposed project to advance the technology beyond the current state-of-the-art and incumbent technology.

Criterion 2: Work Plan (Weight: 30%)

* The extent to which the planned tasks are clearly described, appropriate and sufficient to demonstrate the proposed technical concept.
* The extent to which each task contains a clear objective and output, is well structured, contains appropriate and sufficient activities and details that are clearly written with sound scientific basis, resulting in a high likelihood that the proposed tasks will succeed in meeting the project goals and reducing technical risk.
* The extent to which the schedule of each planned task is included and is reasonable and appropriate to accomplish all tasks within the proposed project life.
* The extent to which milestones, deliverables, down-select and go/no-go decision points are included with identified objective metrics that are specific, measurable, attainable, relevant, and timely (i.e. have a defined point in the project timeline that the milestone or decision point will be accomplished).
* The extent to which the proposed project management structure and participant responsibility assignments are clearly described, appropriate and effective to facilitate successful completion of the project.
* The inclusion of a well thought out commercialization plan or path to commercialization, as appropriate.

Criterion 3: Personnel and Organization Qualifications (Weight: 20%)

* Qualifications and relevant expertise, as well as time commitment of the project Principal Investigator (PI) and other key investigators of the team to address all aspects of the proposed work with a good chance of success.
* Adequacy (quality, availability, and appropriateness) of facilities and equipment, and their associated budget, to accommodate the proposed project.
* The extent of collaboration within, and among external institutions to leverage broad technical expertise and facility capabilities necessary to accomplish the project goal.
* The inclusion of an industrial partner for commercial knowledge and path to commercialization.
	+ 1. Criteria for Replies to Reviewer Comments

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

* 1. Standards for Application Evaluation

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

* 1. Other Selection Factors
		1. Program Policy Factors

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

* Selection of Applications to achieve a balance of complementary projects, in conjunction with existing projects funded by the DOE Fuel Cell Technologies Office.
* The degree to which the proposed project optimizes the use of available EERE funding and would best leverage EERE’s resources to achieve programmatic objectives.
* Whether the project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty.
* Whether the performance of the proposed project is financially viable for the Applicant.
* Selection of Applications involving participants that represent a diversity (e.g., types, sizes, geographic location) of organizations.
* Selection of Applications with Applicant cost share above the minimum level required.
	1. Merit Review and Selection Process
		1. Overview

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

* + 1. Pre-Selection Interviews

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

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

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

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

* + 1. Pre-Selection Clarification

EERE may determine that pre-selection clarifications are necessary from one or more applicants. These pre-selection clarifications will solely be for the purposes of clarifying the application, and will be limited to information already provided in the application documentation. The pre-selection clarifications may occur before, during or after the merit review evaluation process. Information provided by an applicant that is not necessary to address the pre-selection clarification question will not be reviewed or considered. Typically, a pre-selection clarification will be carried out through either written responses to EERE’s written clarification questions or video or conference calls with EERE representatives.

The information provided by Applicants to EERE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and EERE’s selection decisions. If EERE contacts an applicant for pre-selection clarification purposes, it does not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

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

* + 1. Selection

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

1. Award Administration Information
	1. Anticipated Notice of Selection and Award Dates

EERE anticipates notifying applicants selected for negotiation of award by May 2014 and making awards in the June to July timeframe of 2014.

* 1. Award Notices
		1. Rejected Submissions

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

* + 1. Concept Paper Notifications

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

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

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

* + 1. Full Application Notifications

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

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

* + 1. Successful Applicants

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

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

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

* + 1. Postponed Selection Determinations

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

* + 1. Unsuccessful Applicants

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

* 1. Administrative and National Policy Requirements
		1. Registration Requirements

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

* + - 1. EERE Exchange

Register and create an account on EERE Exchange at https://eere-Exchange.energy.gov.

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

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

* + - 1. DUNS Number

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

* + - 1. System for Award Management

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

* + - 1. Fedconnect

Register in FedConnect at <https://www.fedconnect.net/>. To create an organization

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

* + - 1. Grants.gov

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

* + - 1. Electronic Authorization of Applications and Award Documents

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

* + 1. Award Administrative Requirements

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

* + 1. Limitations on Salary Expenditures

Projects funded with EERE awards may not allocate more than $200,000 for the annual salary of any one individual. If the annual salary for an individual exceeds $200,000, the excess amount must be paid from a source other than project funds (i.e., cannot use federal or recipient cost share to pay the excess amount).

* + 1. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR Part 170. Prime Recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier Subrecipients. Prime Recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

* + 1. National Policy Requirements

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

* + 1. Environmental Review in Accordance with National Environmental Policy Act (NEPA)

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

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

* + 1. Applicant Representations and Certifications
			1. Lobbying Restrictions

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

* + - 1. Corporate Felony Conviction and Federal Tax Liability Representations (March 2012)

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

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

No officer or agent of the corporation have been convicted of a felony criminal violation for an offence arising out of actions for or on behalf of the corporation under Federal law in the past 24 months; or

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

For purposes of these representations, the following definitions apply:

A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

* + 1. Statement of Substantial Involvement

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

1. EERE shares responsibility with the Prime Recipient for the management, control, direction, and performance of work under this award.
2. EERE reviews and approves in a timely manner project plans, including project management, testing and technology transfer plans, and recommending alternate approaches, if the plans do not address the critical programmatic issues.
3. EERE participates in project management planning activities, including risk analysis, to ensure EERE Technology Office requirements or limitations are considered in performance of the work elements.
4. EERE conducts site visits, as required, to participate in recipient “kick off” meetings; gain clearer understanding of problems or issues; observe testing; meet with stakeholders/attend public meetings; verify equipment installations; validate reported progress; review confidential/proprietary information; participate in progress and cost/financial reviews; and conduct structured project review per programmatic direction.
5. EERE promotes and facilitates technology transfer activities, including disseminating Technology Office results through presentations and publications.
6. The Prime Recipient must adhere to EERE technical direction and comply with agency-specific and programmatic requirements.
7. EREE may intervene at any time in the conduct or performance of work under this Award.
8. EERE does not limit its involvement to the administrative requirements of the award.
9. EERE may modify or terminate projects that fail to achieve predetermined Go/No Go decision criteria.
10. EERE participates in major project decision-making processes.
	* 1. U.S. Manufacturing Commitments

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

* + - 1. Domestic Small Businesses, Educational Institutions and Nonprofits

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

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

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

* + - 1. Large Businesses, Foreign Entities, and State and Local Government Entities

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

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

* + - 1. FFRDCs

DOE FFRDCs are subject to the U.S. Manufacturing requirements set forth in their Management and Operating Contracts. All other FFRDCs are subject to the U.S. Manufacturing requirements as set forth above, based on their size and for-profit status.

* + 1. Subject Invention Utilization Reporting

To ensure that Prime Recipients and Subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE may require submission of annual reports (throughout the project period and for the duration of U.S. patents resulting from the EERE project) on the utilization of subject inventions and efforts made by Recipients or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Prime Recipient, and such other data and information as EERE may specify.

* + 1. Intellectual Property Provisions

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

* + 1. Reporting

Reporting requirements for projects selected from this FOA will include, but are not limited to:

* Quarterly Financial and Technical Reports
* Final Technical Report
* Yearly participation at the DOE Hydrogen Program Merit Review and Peer Evaluation (AMR) meeting, typically held in Washington, D.C.
* Yearly participation in the U.S. DRIVE Hydrogen Storage Technical Team Meetings as requested by DOE, typically held in Detroit, Michigan
* Attend any relevant hydrogen storage PI meetings or Hydrogen Storage Systems Analysis Working Group (SSAWG) Meetings related to the hydrogen storage technology proposed (approximately 1 meeting per year)
* DOE may request that material samples, components, and/or prototype systems resulting from the R&D effort be sent for independent, standardized testing at a facility specified by DOE, as appropriate
* Work with independent system and/or cost analysis projects within DOE Hydrogen Storage portfolio for independent performance and model validation as appropriate
* Material property data for all relevant hydrogen storage materials developed under each project must be submitted for inclusion in the Hydrogen Storage Materials Database (<http://hydrogenmaterialssearch.govtools.us/>)
* Draft project safety plan will be due 90 days after the start of each project and may require revisions based on review feedback from the Hydrogen Safety Panel.  The DOE document, “Safety Planning Guidance for Hydrogen and Fuel Cell Projects,” (<http://www1.eere.energy.gov/hydrogenandfuelcells/codes/oversight.html>) provides discussion of the elements of a good safety plan along with other references

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The checklist can be accessed at <http://energy.gov/sites/prod/files/FA_RepReqChecklist_033011_final.pdf>.

1. Questions/Agency Contacts

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with Applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted to: H2Storage@go.doe.gov no later than 3 business days prior to the application due date.

All questions and answers related to this FOA will be posted on EERE Exchange at: <https://eere-exchange.energy.gov>. **Please note that you must first select this specific FOA Number in order to view the questions and answers specific to this FOA**. EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website.

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

1. Other Information
	1. FOA Modifications

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

* 1. Informational Pre-Solicitation Meeting

A pre-solicitation meeting concerning this FOA was held on May 14, 2013 in conjunction with the 2013 Hydrogen and Fuel Cells Program Annual Merit Review and Peer Evaluation Meeting (AMR). During the pre-solicitation meeting, FCTO representatives presented the initial plans and answered questions from the public on draft FOA topic areas which resulted in this FOA. The complete set of questions and answers from that meeting are posted at: [**http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/st\_foa\_mtg\_q\_and\_a.pdf**](http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/st_foa_mtg_q_and_a.pdf). Also, the slides presented by DOE at that meeting are posted at: [**http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/st\_foa\_pre-solicit\_mtg\_slides.pdf**](http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/st_foa_pre-solicit_mtg_slides.pdf). These documents may help applicants solidify the goals and objectives of this FOA; however, these documents should only be considered preliminary. This FOA, any subsequent amendments or modifications to this FOA, and any questions and answers posted on the EERE Exchange website concerning this FOA (see Section VII) supersedes any of the information contained in the documents noted above.

* 1. Government Right to Reject or Negotiate

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

* 1. Commitment of Public Funds

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

* 1. Treatment of Application Information

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

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

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

Notice of Restriction on Disclosure and Use of Data:

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

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

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

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

All information submitted to EERE by a FOA applicant is subject to public release under the Freedom of Information Act, ( 5 U.S.C. § 552, amended by OPEN Government Act of 2007, Pub. L. No. 110-175, 121Stat. 2524), subject to the specific FOIA exemptions identified in 5 U.S.C. § 552(b) . If DOE cannot make an independent determination regarding the public release of the applicant’s information submitted for the FOA application, the FOA applicant will be contacted in accordance with 10 CFR Part 1004.11.

* 1. Evaluation and Administration by Non-Federal Personnel

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

* 1. Notice Regarding Eligible/Ineligible Activities

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

* 1. Notice of Right to Conduct a Review of Financial Capability

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

* 1. Notice of Potential Disclosure Under Freedom of Information Act

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

* 1. Requirement for Full and Complete Disclosure

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

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

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

* 1. Title to Subject Inventions

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

* Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions.
* All other parties: The Federal Non Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the Government obtains title to new inventions unless a waiver is granted (see below).
* Class Waiver: Under 42 U.S.C. § 5908, title to subject inventions vests in the U.S. Government and large businesses and foreign entities do not have the automatic right to elect to retain title to subject inventions. However, EERE may issue “class patent waivers” under which large businesses and foreign entities that meet certain stated requirements may elect to retain title to their subject inventions.
* Advance and Identified Waivers: Applicants may request a patent waiver that will cover subject inventions that may be invented under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to EERE within the timeframes set forth in the award’s intellectual property terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.
	1. Government Rights in Subject Inventions

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

* + 1. Government Use License

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

* + 1. March-In Rights

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

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

* The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;
* The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
* The owner has not met public use requirements specified by Federal statutes in a reasonably satisfied manner; or
* The U.S. Manufacturing requirement has not been met.
* Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision.  To date, DOE has never exercised its march-in rights to any subject inventions.
	1. Rights in Technical Data

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

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

Government rights in Technical Data Produced Under Awards: The U.S. Government normally retains unlimited rights in technical data produced under Government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated under EERE awards may be protected from public disclosure for up to five years after the data is generated (“Protected Data”). For awards permitting Protected Data, the protected data must be marked as set forth in the awards intellectual property terms and conditions and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause in the award. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

* 1. Copyright

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

* 1. Protected Personally Identifiable Information

In responding to this FOA, Applicants must ensure that Protected Personally Identifiable Information (PII) is not included in the following documents: Project Abstract, Project Narrative, Biographical Sketches, Budget or Budget Justification. These documents will be used by the Merit Review Committee in the review process to evaluate each application. PII is defined by the Office of Management and Budget (OMB) and EERE as:

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

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

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

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

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

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

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

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

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

<http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>

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

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

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

Appendix A – Definitions

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

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

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

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

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

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

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

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

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

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

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

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

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

“**EERE Exchange**” is the Department of Energy, Energy Efficiency and Renewable Energy’s web system for posting Federal FOAs and receiving applications.

EERE Exchange website

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

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

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

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

"**Grant**" means a Financial Assistance instrument used by EERE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and no Substantial Involvement is anticipated between EERE and the Applicant during the performance of the contemplated activity.

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

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

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

“**Marketing Partner Identification Number (MPIN)**” is a very important password designated by your organization when registering in SAM. The E-Business Point of Contact will need the MPIN to assign privileges to the individual(s) authorized to perform SAM transactions on behalf

of your organization. The MPIN must have 9 digits containing at least one alpha character (must be in capital letters) and one number (no spaces or special characters permitted).

“**Modification**” means a revision to a FOA.

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

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

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

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

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

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

“**Responsiveness**” is an eligibility determination that refers to the objective technical requirements (not goals or targets) outlined in a FOA, such as a technology type or technical parameters. For example, submission of a photovoltaic solar panel design in response to a FOA calling for innovative geothermal drilling technologies should be found nonresponsive. Likewise, an application with a design that incorporates rare earth materials to a FOA that prohibits the use of rare earth materials should be found nonresponsive. Conversely, the belief that a technology will not achieve the technical targets of the FOA will never be used as a proper basis for a rejection as nonresponsive.

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

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

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

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

“**Technology Investment Agreement (TIA)**” is a type of assistance instrument used to support or stimulate research projects involving for-profit firms, especially commercial firms that do business primarily in the commercial marketplace. TIAs are different from grants and cooperative agreements in that the award terms may vary from the Government-wide standard terms (See DOE TIA regulations at 10 CFR Part 603). The primary purposes for including a TIA in the type of available award instruments are to encourage non-traditional Government contractors to participate in an R&D program and to facilitate new relationships and business practices. A TIA can be particularly useful for awards to consortia (See 10 CFR 603.225(b) and 603.515, Qualification of a consortium).

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

Appendix B – Cost Share Information

**Cost Sharing or Cost Matching**

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

**How Cost Sharing Is Calculated**

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

* Formula: Federal share ($) divided by Federal share (%) = Total Project Cost

Example: $1,000,000 divided by 80% = $1,250,000

* Formula: Total Project Cost ($) minus Federal share ($) = Non-federal share ($)

Example: $1,250,000 minus $1,000,000 = $250,000

* Formula: Non-federal share ($) divided by Total Project Cost ($) = Non-federal share (%)

Example: $250,000 divided by $1,250,000 = 20%

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

**What Qualifies For Cost Sharing**

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

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

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

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

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

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

DOE Financial Assistance Rules (10 CFR 600)

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

1. Acceptable contributions. All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the Prime Recipient's cost sharing if such contributions meet all of the following criteria:
2. They are verifiable from the recipient's records.
3. They are not included as contributions for any other federally-assisted project or program.
4. They are necessary and reasonable for proper and efficient accomplishment of project or program objectives.
5. They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:
6. For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the Federal Acquisition Regulation, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations
7. Other types of organizations. Allowability of costs incurred by other types of organizations that may be Subrecipients under a prime award is determined as follows:
8. Institutions of higher education. Allowability is determined in accordance with: 2 CFR 220 Cost Principles for Educational Institutions
9. Other nonprofit organizations. Allowability is determined in accordance with: 2 CFR 230 Cost Principles for Nonprofit Organizations
10. Hospitals. Allowability is determined in accordance with the provisions of: Title 45 Appendix E to Part 74—Principles for Determining Costs Applicable to Research and Development Under Grants and Contracts With Hospitals
11. Governmental organizations. Allowability for State, local, or federally recognized Indian tribal government is determined in accordance with: PART 225—Cost Principles for State, Local, and Indian Tribal Governments (OMB Circular A–87)
12. They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.
13. They are provided for in the approved budget.
14. Valuing and documenting contributions
15. Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:
16. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
17. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.
18. Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.
19. Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.
20. Valuing property donated by third parties.
21. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.
22. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:
23. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.
24. The value of loaned equipment must not exceed its fair rental value.
25. Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:
26. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.
27. The basis for determining the valuation for personal services and property must be documented.

Appendix C – Sample Cost Share Calculation for Blended Cost Share Percentage

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

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

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

Each task must be calculated individually as follows:

Task 1

$1,000,000 divided by 80% = $1,250,000 (Task 1 Cost)

Task 1 Cost minus federal share = Non-federal share

$1,250,000 - $1,000,000 = $250,000 (Non-federal share)

Task 2

$500,000 divided 80% = $625,000 (Task 2 Cost)

Task 2 Cost minus federal share = Non-federal share

$625,000 - $500,000 = $125,000 (Non-federal share)

Task 3

$400,000 / 50% = $800,000 (Task 3 Cost)

Task 3 Cost minus federal share = Non-federal share

$800,000 - $400,000 = $400,000 (Non-federal share)

Task 4

Federal share = $100,000

Non-federal cost share is not mandated for outreach = $0 (Non-federal share)

The calculation may then be completed as follows:

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

Blended Cost Share %

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

Federal share ($2,000,000) divided by Total Project Cost ($2,775,000) = 72.1% (Federal)

|  |
| --- |
| Appendix D – Hydrogen Storage Technical System Targets |
|  **Onboard Hydrogen Storage for Light-Duty Fuel Cell Vehicles a**  |
| **Storage Parameter** | **Units** | **2017** | **Ultimate** |
| **System Gravimetric Capacity:** | kWh/kg | 1.8 | 2.5 |
| Usable, specific-energy from H2 (net useful energy/max system mass) b | (kg H2/kg system) | (0.055) | (0.075) |
| **System Volumetric Capacity:**  | kWh/L | 1.3 | 2.3 |
| Usable energy density from H2 (net useful energy/max system volume) b | (kg H2/L system) | (0.040) | (0.070) |
| **Storage System Cost:** | $/kWh net | 12 | 8 |
|  | ($/kg H2 stored) | 400 | 266 |
| * Fuel cost c
 | $/gge at pump | 2-4 | 2-4 |
| **Durability/Operability:** |  |  |  |
| * Operating ambient temperature d
 | ºC | -40/60 (sun) | -40/60 (sun) |
| * Min/max delivery temperature
 | ºC | -40/85 | -40/85 |
| * Operational cycle life (1/4 tank to full)
 | Cycles | 1500 | 1500 |
| * Min delivery pressure from storage system
 | bar (abs) | 5 | 3 |
| * Max delivery pressure from storage system
 | bar (abs) | 12 | 12 |
| * Onboard Efficiency e
 | % | 90 | 90 |
| * “Well” to Powerplant Efficiency e
 | % | 60 | 60 |
| **Charging / Discharging Rates:** |  |  |  |
| * System fill time (5 kg)
 | min | 3.3 | 2.5 |
|  | (kg H2/min) | (1.5) | (2.0) |
| * Minimum full flow rate
 | (g/s)/kW | 0.02 | 0.02 |
| * Start time to full flow (20 °C)
 | s | 5 | 5 |
| * Start time to full flow (-20 °C)
 | s | 15 | 15 |
| * Transient response at operating temperature 10%-90% and 90%-0%
 | s | 0.75 | 0.75 |
| **Fuel Quality (H2 from storage)** f: | % H2 | SAE J2719 and ISO/PDTS 14687-2 (99.97% dry basis) |
| **Environmental Health & Safety:** |  | Meets or exceeds applicable standards, for example SAE J2579 |
| * Permeation & leakage g
 | - |
| * Toxicity
 | - |
| * Safety
 | - |
| * Loss of usable H2 h
 | (g/h)/kg H2 stored | 0.05 | 0.05 |

a Targets are based on the lower heating value of hydrogen, 33.3 kWh/kg H2. Targets are for a complete system, including tank, material, valves, regulators, piping, mounting brackets, insulation, added cooling capacity, and all other balance-of-plant components. All capacities are defined as usable capacities that could be delivered to the fuel cell power plant. All targets must be met at the end of service life (approximately 1500 cycles or 5000 operation hours, equivalent of 150,000 miles).

b Capacities are defined as the usable quantity of hydrogen deliverable to the powerplant divided by the total mass/volume of the complete storage system, including all stored hydrogen, media, reactants (e.g., water for hydrolysis-based systems), and system components. Tank designs that are conformable and have the ability to be efficiently package onboard vehicles may be beneficial even if they do not meet the full volumetric capacity targets. Capacities must be met at end of service life.

c Hydrogen threshold cost is independent of pathway and is defined as the untaxed cost of hydrogen produced, delivered and dispensed to the vehicle. [http://hydrogen.energy.gov/pdfs/11007\_h2\_threshold\_costs.pdf ] For material-based storage technologies, the impact of the technology on the hydrogen threshold cost, e.g., off-board cooling, off-board regeneration of chemical hydrogen storage materials, etc., must be taken into account.

d Stated ambient temperature plus full solar load (i.e., full exposure to direct sunlight). No allowable performance degradation from –20 °C to 40 °C. Allowable degradation outside these limits is to be determined.

e Onboard efficiency is the energy efficiency for delivering hydrogen from the storage system to the fuel cell powerplant, i.e., accounting for any energy required for operating pumps, blowers, compressors, heating, etc. required for hydrogen release. Well-to-powerplant efficiency includes onboard efficiency plus off-board efficiency, i.e., accounting for the energy efficiency of hydrogen production, delivery, liquefaction, compression, dispensing, regeneration of chemical hydrogen storage materials, etc. as appropriate. H2A and HDSAM analyses should be used for projecting off-board efficiencies.

f Hydrogen storage systems must be able to deliver hydrogen meeting acceptable hydrogen quality standards for fuel cell vehicles (see SAE J2719 and ISO/PDTS 14687-2). Note that some storage technologies may produce contaminants for which effects are unknown and not addressed by the published standards; these will be addressed by system engineering design on a case-by-case basis as more information becomes available.

g Total hydrogen lost into the environment as H2; relates to hydrogen accumulation in enclosed spaces. Storage system must comply with applicable standards for vehicular tanks including but not limited to SAE J2579 and the United Nations Global Technical Regulation. This includes any coating or enclosure that incorporates the envelope of the storage system.

h Total hydrogen lost from the storage system, including leaked or vented hydrogen; relates to loss of range.

|  |
| --- |
| **Onboard Hydrogen Storage Systems for Material Handling Equipment a** |
| **Storage Parameter** | **Units** | **2015** | **2020** |
| **Hydrogen Capacity** | kg | 2 | 2 |
| **System Volumetric Capacity** | kWh/L | 1.0 | 1.7 |
| * Usable energy density from H2 (net useful energy/max system volume) b
 | (kg H2/L system) | (0.03) | (0.05) |
| **Storage System Cost** | $/kWh net | 20 | 15 |
|  | ($/kg H2 stored) | (667) | (500) |
| **Durability/Operability** |  |  |  |
| * External operating temperature range c
 | ºC | -40/60 | -40/60 |
| * Min/max delivery temperature d
 | ºC | -40/85 | -40/85 |
| * Operational cycle life (1/10 tank to full)
 | Cycles | 5000(5 yr) | 10,000(10 yr) |
| * Min delivery pressure from storage system
 | bar (abs) | 3 | 3 |
| * Max delivery pressure from storage system
 | bar (abs) | 12 | 12 |
| **Shock & Vibration** |  |  |  |
| * Shock
 | g | 40 | 40 |
| * Vibration
 | g | 5@10Hz – 0.75@200Hz | 10@10Hz – 1@200Hz |
| **Charging / Discharging Rates** |  |  |  |
| * System fill time (2 kg)
 | min | 4.0 | 2.8 |
|  | (kg H2/min) | (0.5) | (0.7) |
| * Minimum full flow rate
 | (g/s)/kW | 0.02 | 0.02 |
| * Start time to full flow (20 °C)
 | s | 5 | 5 |
| * Start time to full flow (-20 °C)
 | s | 15 | 15 |
| * Transient response 10%-90% and 90%-0%
 | s | 0.75 | 0.75 |
| **Fuel Purity (H2 from storage)** e  | % H2 | SAE J2719 & ISO/PDTS 14687-2 (99.97% dry basis) |
| **Environmental Health & Safety** |  | Meets or exceeds applicable standards, for example CSA HPIT 1 |
| * Permeation & Leakage f
* Toxicity
* Safety
 | --- |
| * Loss of useable H2 g
 | (g/h)/kg H2 stored  | 0.1 | 0.05 |

a The targets are based on the lower heating value of hydrogen, without consideration of the conversion efficiency of the fuel cell power plant. Targets are for the complete hydrogen storage and delivery system, including tank, material, valves, regulators, piping, mounting brackets, insulation, added cooling or heating capacity, and/or other balance-of-plant components. All capacities are defined as usable capacities that could be delivered to the fuel cell power plant during normal use. All targets must be met at the end of service life. Since most applications of material handling equipment (MHE) require extra mass as a counterbalance, the system gravimetric capacity is not specified as it can vary widely among types of MHE. However, system gravimetric capacity should be considered when developing hydrogen storage systems for MHE applications. All targets must be met at the end of service life.

b “Net useful energy” or “net” excludes unusable energy (i.e., hydrogen left in a tank below minimum fuel cell power plant pressure, flow, and temperature requirements) and hydrogen-derived energy used to extract the hydrogen from the storage medium (e.g., fuel used to heat a material to initiate or sustain hydrogen release).

c Stated ambient temperature. No allowable performance degradation from –20 °C to 40 °C. Allowable degradation outside these limits is to be determined.

d Delivery temperature refers to the inlet temperature of the hydrogen to the fuel cell.

e Hydrogen storage systems must be able to deliver hydrogen meeting acceptable hydrogen quality standards, such as: CSA HPIT 1: Compressed Hydrogen Powered Industrial Trucks (forklifts) On- Board Fuel Storage and Handling Components. Note that some storage technologies may produce contaminants for which effects are unknown and not addressed by the published standards; these will be addressed by system engineering design on a case by case basis as more information becomes available.

f Total hydrogen lost into the environment as H2; relates to hydrogen accumulation in enclosed spaces. Storage system must comply with appropriate standards, for example CSA HPIT 1: Compressed Hydrogen Powered Industrial Trucks (forklifts) On- Board Fuel Storage and Handling Components. This includes any coating or enclosure that incorporates the envelope of the storage system.

g Total hydrogen lost from the storage system, including leaked or vented hydrogen; relates to loss of operational time.

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| **Hydrogen Storage Systems for Low Power (≤2.5W) Portable Equipment a** |
| **Storage Parameter** | **Units** | **2015** | **2020** |
| **Single-Use** | **Rechargeable** | **Single-Use** | **Rechargeable** |
| **Hydrogen Capacity** | g H2 | ≤1 |
| **System Gravimetric Capacity** b | kWh/kg | 0.7 | 0.5 | 1.3 | 1.0 |
| * Usable, specific-energy from H2 (net useful energy/max system mass) c
 | (kg H2/kg system) | (0.02) | (0.015) | (0.04) | (0.03) |
| **System Volumetric Capacity**  | kWh/L | 1.0 | 0.7 | 1.7 | 1.3 |
| * Usable energy density from H2 (net useful energy/max system volume)
 | (kg H2/L system) | (0.03) | (0.02) | (0.05) | (0.04) |
| **Storage System Cost** | $/Wh net | 0.09 | 0.75 | 0.03 | 0.4 |
|  | ($/g H2 stored) | (3.0) | (25) | (1.0) | (13) |

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| **Hydrogen Storage Systems for Medium Power (>2.5W-150W) Portable Equipment a** |
| **Storage Parameter** | **Units** | **2015** | **2020** |
| **Single-Use** | **Rechargeable** | **Single-Use** | **Rechargeable** |
| **Hydrogen Capacity** | g H2 | >1 - 50 |
| **System Gravimetric** **Capacity** b | kWh/kg | 0.7 | 0.5 | 1.3 | 1.0 |
| * Usable, specific-energy from H2 (net useful energy/max system mass) c
 | (kg H2/kg system) | (0.02) | (0.015) | (0.04) | (0.03) |
| **System Volumetric Capacity** * Usable energy density from H2 (net useful energy/max system volume) c
 | kWh/L(kg H2/L system) | 1.0(0.03) | 0.7(0.02) | 1.7(0.05) | 1.3(0.04) |
| **Storage System Cost** | $/Wh net($/g H2 stored) | 0.2(6.7) | 1.0(33) | 0.1(3.3) | 0.5(17) |

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| **Portable Power Durability & Operational Targets a** |
| **Storage Parameter** | **Units** | **2015** | **2020** |
| **Single-Use &****Rechargeable** | **Single-Use &****Rechargeable** |
| **Durability/Operability** |  |  |  |
| * External operating temperature range d
 | ºC | -40/60 | -40/60 |
| * Min/max delivery temperature e
 | ºC | 10/85 | 10/85 |
| * Min delivery pressure from storage system;
 | bar (abs) | 1.5 | 1.5 |
| * Max delivery pressure from storage system
 | bar (abs) | 3 | 3 |
| * External temperature f
 | ºC | ≤40 | ≤40 |
| **Discharging Rates** |  |  |  |
| * Minimum full flow rate
 | (g/s)/kW | 0.025105 | 0.025102 |
| * Start time to full flow (20 °C)
 | s |
| * Start time to full flow (-20 °C)
 | s |
| * Transient response10%-90% and 90%-0%
 | s |
| **Fuel Purity (H2 from storage)** g | % H2 | Meets applicable standards |
| **Environmental Health & Safety*** Toxicity
* Safety
* Loss of usable H2 h
 |  |  |
|  | Meets ISO-16111:2008; IEC 62282 Part 6; or other applicable standards as appropriate or required for the application and targeted usage |
|  |
|  |
|  |

a The targets are based on the lower heating value of hydrogen, without consideration of the conversion efficiency of the fuel cell power plant. Targets are for the complete hydrogen storage and delivery system, including tank, material, valves, regulators, piping, mounting brackets, insulation, added cooling or heating capacity, and/or other balance-of-plant components. All capacities are defined as usable capacities that could be delivered to the fuel cell power plant during normal use. All targets must be met at the end of service life.

b Generally the ‘full’ mass (including hydrogen) is used; for systems that gain weight on hydrogen release, the highest mass during discharge is used (e.g., hydrogen release through hydrolysis reaction resulting in the formation of oxides/hydroxides). All capacities are net usable capacity able to be delivered to the fuel cell power plant. Capacities must be met at end of service life.

c “Net useful energy” or “net” excludes unusable energy (i.e., hydrogen left in a tank below minimum fuel cell powerplant pressure, flow, and temperature requirements) and hydrogen-derived energy used to extract the hydrogen from the storage medium (e.g., fuel used to heat a material to initiate or sustain hydrogen release).

d Stated ambient temperature plus full solar load (i.e., if exposed to direct sunlight or stored within a container exposed to direct sunlight for extended periods of time). No allowable performance degradation from –20 °C to 40 °C. Allowable degradation outside these limits is to be determined.

e Delivery temperature refers to the inlet temperature of the hydrogen to the fuel cell.

f The external device temperature is the maximum temperature generated at the external surface of the hydrogen storage container during operation.

g Hydrogen storage systems must be able to deliver hydrogen meeting acceptable hydrogen quality standards, such as: ISO-16111:2008 and IEC 62282 Part 6. Note that some storage technologies may produce contaminants for which effects are unknown and not addressed by the published standards; these will be addressed by system engineering design on a case by case basis as more information becomes available.

h Total hydrogen lost into the environment as H2; relates to hydrogen accumulation in enclosed spaces. Storage system must comply with appropriate standards, such as ISO-16111:2008 and IEC 62282 Part 6. This includes any coating or enclosure that incorporates the envelope of the storage system.

Appendix E – Example Milestones and Deliverable Table



1. US DOE EERE Fuel Cell Technologies Office: <http://www.eere.energy.gov/hydrogenandfuelcells/> [↑](#footnote-ref-1)
2. DOE Hydrogen Storage Program: <http://www.eere.energy.gov/hydrogenandfuelcells/storage> [↑](#footnote-ref-2)
3. Metal Hydride Center of Excellence Final Report: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/metal_hydride_coe_final_report.pdf> [↑](#footnote-ref-3)
4. Chemical Hydrogen Storage Center of Excellence Final Report: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/chemical_hydrogen_storage_coe_final_report.pdf> [↑](#footnote-ref-4)
5. Hydrogen Sorption Center of Excellence Final Report: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/hydrogen_sorption_coe_final_report.pdf> [↑](#footnote-ref-5)
6. Hydrogen Storage Engineering Center of Excellence website: <http://hsecoe.srs.gov/> [↑](#footnote-ref-6)
7. FCTO Data Record #13010: “Onboard Type IV Compressed Hydrogen Storage Systems – Current Performance and Cost,” <http://www.hydrogen.energy.gov/pdfs/13010_onboard_storage_performance_cost.pdf> [↑](#footnote-ref-7)
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9. Kurtz, J., Sprik, S., Ramsden, T., Saur, G., Ainscough, C., “What We’ve Learned from 2.5 Years of Early Market Fuel Cell Operation,” <http://www.nrel.gov/hydrogen/cfm/pdfs/57759.pdf> [↑](#footnote-ref-9)
10. FCTO’s Hydrogen Storage Multi-Year Research, Development, and Demonstration Plan: <http://www1.eere.energy.gov/hydrogenandfuelcells/mypp/index.html> [↑](#footnote-ref-10)
11. U.S. DRIVE: <http://www.uscar.org/guest/partnership/1/us-drive> [↑](#footnote-ref-11)
12. C. D. Warren, F. L. Paulauskas, “Development of low-cost, high strength commercial textile precursor,” Annual Progress Report to the U.S. DOE Fuel Cell Technologies Office, 2012, <http://www.hydrogen.energy.gov/pdfs/progress12/iv_f_3_warren_2012.pdf> [↑](#footnote-ref-12)
13. Technical Reference for Hydrogen Compatibility of Materials, Sandia National Laboratory, <http://www.sandia.gov/matlsTechRef/> [↑](#footnote-ref-13)
14. Technical Reference and Technical Database for Hydrogen Compatibility of Materials, OpenEnergyInfo, <http://en.openei.org/datasets/node/927> [↑](#footnote-ref-14)
15. ##  Hydrogen Storage Materials Requirements Webinar, July 2013:

<http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/webinarslides_hydrogen_storage_materials_requirements_062513.pdf> [↑](#footnote-ref-15)
16. Anton, DA, Motyka, T. Hydrogen Storage Engineering Center of Excellence. 2012 US DOE Hydrogen Program Annual Merit Review Proceedings. Arlington (VA); 2012. <http://www.hydrogen.energy.gov/pdfs/review12/st004_anton_2012_o.pdf> [↑](#footnote-ref-16)
17. Ahluwalia, R.K., Hua, T.Q., Peng, J-K., Roh, H.S., System Level analysis of Hydrogen Storage Options, 2013 US DOE Hydrogen Program Annual Merit Review Proceedings. Arlington (VA); 2013. <http://www.hydrogen.energy.gov/pdfs/review13/st001_ahluwalia_2013_o.pdf> [↑](#footnote-ref-17)
18. J.M. Pasini, et. al. IJHE, in press, 2013 <http://www.sciencedirect.com/science/article/pii/S0360319912019623> [↑](#footnote-ref-18)
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20. Hydrogen Storage Materials Database: <http://www.hydrogenmaterialssearch.govtools.us/> [↑](#footnote-ref-20)
21. About the Materials Genome Initiative: <http://www.whitehouse.gov/mgi> [↑](#footnote-ref-21)
22. Go/No-Go Decision: Sodium Borohydride for Onboard Vehicular Hydrogen Storage: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/42220.pdf> [↑](#footnote-ref-22)
23. Go/No-Go Decision: Pure, Undoped Single Wall carbon nanotubes for Vehicular Hydrogen Storage: <http://www.hydrogen.energy.gov/pdfs/go_no_go_nanotubes.pdf> [↑](#footnote-ref-23)
24. Go/No-Go Decision: Onboard Fuel Processing: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/committee_report.pdf> [↑](#footnote-ref-24)
25. H. Oh, et. al., Micropor. Mesopor. Mater., 177 (2013) 66-77. [↑](#footnote-ref-25)
26. Go/No-Go Decision: Sodium Borohydride for Onboard Vehicular Hydrogen Storage: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/42220.pdf> [↑](#footnote-ref-26)
27. Go/No-Go Decision: Pure, Undoped Single Wall carbon nanotubes for Vehicular Hydrogen Storage: <http://www.hydrogen.energy.gov/pdfs/go_no_go_nanotubes.pdf> [↑](#footnote-ref-27)
28. Go/No-Go Decision: Onboard Fuel Processing: <http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/committee_report.pdf> [↑](#footnote-ref-28)
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