FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U.S. Department of Energy

Office of Energy Efficiency and Renewable Energy

Fiscal Year 2013 Vehicle Technologies Program

Wide Funding Opportunity Announcement

Funding Opportunity Announcement (FOA) Number: DE-FOA-0000793
FOA Type: Amendment 000003
CFDA Number: 81.086

DRAFT FOA Issue Date:	February 1, 2013
Deadline for DRAFT FOA Comments	February 15, 2013 at 8:00 PM Eastern time
FINAL FOA Issue Date:	March 5, 2013
Amendment 000002 Issue Date:	March 19, 2013
Amendment 000003 Issue Date:	April 4, 2013
Submission Deadline for Letter of Intent:	Not Required
Submission Deadline for Optional Concept Papers:	March 19, 2013 at 8:00 PM Eastern time
Deadline for FINAL FOA Questions:	April 23, 2013 at 8:00 PM Eastern time
Submission Deadline for Full Applications:	April 29, 2013 at 8:00 PM Eastern time
Submission Deadline for Optional Replies to Reviewer Comments:	June 25, 2013 at 8:00 PM Eastern time

The purpose of this amendment is to specify additional Evaluation Criteria for Area of Interest 5, as outlined in Section V - Application Review Information, Part B. Item 3. Technical Merit Review of Full Application. The resultant changes are highlighted in YELLOW within the document.

EXECUTIVE SUMMARY

Federal Agency	U.S. Department of Energy
FOA Title	Fiscal Year 2013 Vehicle Technologies Program-Wide Funding Opportunity Announcement
FOA Type	FINAL
FOA Number	DE-FOA-0000793
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DRAFT FOA Issue Date	February 1, 2013
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Letter of Intent Submission Deadline:	Not Required
Optional Concept Papers Submission Deadline:	March 19, 2013 at 8:00 PM Eastern time
Optional Concept Paper Encourage/Discourage Letters:	March 29, 2013 at 8:00 PM Eastern time
Deadline for FINAL FOA Questions	April 23, 2013 at 8:00 PM Eastern time
Full Applications Submission Deadline:	April 29, 2013 at 8:00 PM Eastern time
Optional Replies to Reviewer Comments :	June 25, 2013 at 8:00 PM Eastern time
Means of Submission	Concept Papers must be submitted to the designated FOA email address: *FOA0000793@netl.doe.gov*. 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*.
Concept Paper (Optional)	A Concept Paper may be submitted in order to receive an EERE recommendation prior to submitting a Full Application. A separate Concept Paper may be submitted for each Full Application that an applicant intends to submit.
Total Amount to Be Awarded	Approximately $90,000,000 Total ($56,000,000 Federal Funds/$38,000,000 Non-Federal Funds)
Anticipated Awards	Minimum of 30 to a maximum of 50.
Types of Funding Agreements	Cooperative Agreements, Field Work Proposals, and Inter-Entity Work Orders.
Period of Performance	Ranging from Up to Two Years to Up to Four Years depending on the Area of Interest
Performance of Work in the United States / Eligibility	As a condition under this announcement, all applicants must propose that at least 100% of the direct labor cost for the project (including contractor/subrecipient labor) will be incurred in the United States and its territories. (See Sections III.A and IV.H.4 for more information)
Eligibility – Individuals	U.S. citizens and lawful permanent residents may apply in their individual capacity as Standalone Applicant, as lead for a Project Team, or as member of a Project Team. (See Sections III.A and IV.H.4 for more information) All

	work must be performed in the United States (including U.S. territories).
Eligibility – Domestic Entities	All domestic entities may apply as Standalone Applicant, as lead organization for a Project Team, or as member of a Project Team. All work must be performed in the United States (including U.S. territories). (See Sections III.A and IV.H.4 for more information)
Eligibility – Foreign Entities	Foreign Entities may apply as Standalone Applicant, lead organization for a Project Team, and may receive funding as a subrecipient, with the requirement that all work must be performed in the United States (including U.S. territories). (See Sections III.A and IV.H.4 for more information)
Eligibility – Consortium Entities	Incorporated consortia, which may include domestic and/or foreign entities, are eligible to apply for funding as a prime recipient or subrecipient. Unincorporated consortia, which may include domestic and foreign entities, must designate one member of the consortium to serve as the prime recipient/consortium representative. All work must be performed in the United States (including U.S. territories). (See Sections III.A and IV.H.4 for more information)
Cost Share Requirement	See the Cost Sharing table in Section III.B.
Submission of Multiple Applications	Applicants may submit more than one application to this FOA, provided that each application describes a separate and unique project. All applications must be for a standalone project that is not dependent or contingent upon another application submitted to this or any other FOA.
Agency Contact	See Section VII.A of the FOA for guidance on submitting questions to DOE.
Application Forms	Required forms for Full Applications are available on EERE Exchange at *https://eere-Exchange.energy.gov*. Applicants must use the templates available on EERE Exchange at *https://eere-Exchange.energy.gov*.

REGISTRATION REQUIREMENTS

There are several one-time actions before submitting an Application in response to this Funding Opportunity Announcement (FOA), as follows:

- 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.

  The applicant will receive an automated response when the Application is received by EERE. This will serve as a confirmation of receipt. Please do not reply to the automated response. The applicant will have the opportunity to correct and re-submit a revised Application for any reason as long as the relevant submission is submitted by the specified deadline. The Users' Guide for Applying to the Department of Energy EERE FOAs is found at *https://eere-exchange.energy.gov/Manuals.aspx*.

  Applicants should not wait until the last minute to begin the submission process. During the final hours before the submission deadline, Applicants may experience server/connection congestion that prevents them from completing the necessary steps in EERE-E Exchange to submit their applications. **EERE will not extend the submission deadline for Applicants that fail to submit required information and documents due to server/connection congestion.**

  The EERE Exchange registration does not have a delay; however, the remaining **registration requirements below could take several weeks to process and are necessary in order 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**.

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

- 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.

- 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*.

- Register in Grants.gov at *http://www.grants.gov/* to receive automatic updates when Amendments to this FOA are posted. However, please note that applications and/or concept papers will not be accepted through Grants.gov. **The full applications must be submitted**

through EERE EXCHANGE to be considered eligible for a Technical Merit Review and award.

- **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, constitutes the authorized representative's approval and electronic signature.

- **Questions Regarding the FINAL FOA.**

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

  Questions related to the FOA must be submitted to:
  FOA0000793@NETL.DOE.GOV and shall be submitted not later than 6 calendar days prior to the final application due date which is the close of this FOA. Therefore, **the deadline for submission of FINAL FOA questions is April 23, 2013 at 8:00 PM Eastern time.** Any questions submitted after that time will NOT be addressed. Questions regarding problems encountered with the application submittal will be answered as time permits. Applicants are encouraged to review the posted questions and answers daily. Please be as specific as possible when asking questions to insure that questions will be adequately addressed. All questions submitted must clearly identify the Area of Interest (AOI) to insure a timely and accurate response. Failure to identify the AOI or not being as specific as possible with a question may result in additional time to address the question or require further correspondence for further clarification regarding the submitted questions.

  All questions and answers related to the FINAL FOA will be posted at *http://eere.energy.gov/financing/Exchange*. EERE will try to respond to questions within 3 business days, unless a similar question and answer have already been posted on the website.

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REQUIRED DOCUMENTS CHECKLIST

This FOA requires one mandatory submission and two optional submissions. The mandatory submission is the Full Application. The two optional submissions are the Concept Papers and the Reply to Reviewer Comments.

Concept Papers must be submitted to the designated FOA email address: *FOA0000793@netl.doe.gov*. 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 Department of Energy EERE FOAs is found at *https://eere-Exchange.energy.gov/Manuals.aspx*. Required forms for Full Applications are available on EERE Exchange at *https://eere-Exchange.energy.gov*.

THE FOLLOWING COMPONENTS REQUIRED AS PART OF APPLICATION SUBMISSION ARE FULLY EXPLAINED IN SECTIONS I. THROUGH VII. OF THIS FOA.

SUBMISSION	COMPONENTS	DEADLINE
Concept Paper (Optional)	• Each Applicant may elect to submit a Concept Paper. This submission is optional, however, if applicants elect to submit a Concept Paper, they are to be submitted no later than the stated deadline in order to be reviewed. This submission must be in Adobe PDF format and include the following: o Cover Page (1 page max.) - see Section IV.C.2 o Technology Description (2 pages max.) – see Section IV.C.2 o Supporting Documentation (1 page max.) – see Section IV.C.2	March 19, 2013 at 8:00 PM Eastern time
Full Application (REQUIRED)	• Each Applicant must submit a Technical Volume in Adobe PDF format by the stated deadline. The Technical Volume must include the following sections: o Area of Interest (AOI) (0.5 page max.) - see Section IV.D.2.a o Project Description and Technical Approach (20 page max.) – see Section IV.D.2.a o Budget Summary (2 pages max.) – see Section IV.D.2.a o Bibliography & References Cited Appendix (no page limit) – see Section IV.D.2.a • The Technical Volume must be accompanied by: - o SF-424 (no page limit, Adobe PDF format) – see Section IV.D.2.b o Budget Information (SF-424A (no page limit, Microsoft Excel format) and Budget Justification PMC 123.1 – see Section IV.D.2.c o Statement of Project Objectives (10 page max.) – see Section IV.D.2.d o Project Management Plan (10 pages max.) – see Section IV.D.2.e o Summary/Abstract for Public Release (1 page max., Adobe PDF format) – see Section IV.D.2.f o Summary Slide (1 page max., Microsoft PowerPoint format) – Applicants must use the Summary Slide template available on EERE Exchange *https://eere-exchange.energy.gov*) – see Section IV.D.2.g o Resumes (3 pages max. for each person)- see Section IV.D.2.h o Letters of Commitment(signed letters of third party cost share commitments, if applicable)- see Section IV.D.2.i o Other Sources of Funding Disclosure – see Section IV.D.2.j o Sub-award Budget SF-424A (Must use PMC 123.1 for sub-awards greater than $100,000) – see Section IV.D.2.k	April 29, 2013 at 8:00 PM Eastern time

	○ Authorization from cognizant DOE Contracting Officer for FFRDC, if applicable – see Section IV.D.2.l ○ Environmental Impact Questionnaire – use template available on EERE Exchange (*https://eere-exchange.energy.gov*) – see Section IV.D.2.m ○ SF-LLL Disclosure of Lobbying Activities, if applicable – see Section IV.D.2.n	
Reply to Reviewer Comments (Optional)	• Each Applicant may submit a Reply to Reviewer Comments in Adobe PDF format. This submission is optional. The Reply may include: - see Section IV.E ○ Up to 2 pages of text; and ○ Up to 1 page of images.	June 25, 2013 at 8:00 PM Eastern time

SECTION I – FUNDING OPPORTUNITY DESCRIPTION

A. Description/Background

The mission of the Vehicle Technology Program (VTP) is to develop more energy-efficient and environmentally friendly technologies for highway transportation vehicles (cars and trucks) that will meet or exceed performance expectations and environmental requirements, and enable America to use significantly less petroleum and reduce greenhouse gas (GHG) emissions. The VTP focuses on highway vehicles, which account for 55 percent of total U.S. oil use ─ more than all U.S. domestic oil production. Cost-competitive, more energy-efficient and fuel diverse vehicles will enable individuals and businesses to accomplish their daily tasks while reducing consumption of gasoline and diesel fuels. This will reduce U.S. demand for petroleum, lower carbon emissions, and decrease energy expenditures.

The VTP funds the advanced technology Research & Development (R&D) needed to achieve these goals. In the near to mid-term, transportation energy use can be reduced through improved vehicle energy efficiency from more efficient advanced combustion engines, Hybrid-Electric Vehicle (HEV), Plug-In Hybrid Electric Vehicle (PHEV), and Electric Vehicle (EV) powertrains, and through reduced vehicle weight and ancillary load requirements.

This FOA supports the President's EV Everywhere Grand Challenge with the goal of enabling U.S. companies to be the first in the world to produce electric vehicles that are as affordable for the average American family as today's gas-powered vehicles within the next 10 years (by 2022).

Electric drive vehicles such as HEVs, PHEVs, and EVs have been identified as one important way to address the challenges of the nation's dependence on imported oil and to reduce greenhouse gas emissions. VTP's specific goals in this area include enabling the use of advanced electric drive technologies in vehicles by developing low-cost batteries, advanced power electronics and electric motors, along with the development and validation of models and simulation tools to predict the performance of advanced conventional and electric-drive vehicle systems.

Advanced materials are essential for reducing vehicle weight to boost the fuel economy of modern automobiles, while maintaining safety and performance. Replacing cast iron and traditional steel components with lightweight materials such as high-strength steel, magnesium, aluminum, and polymer composites allows vehicles to carry advanced emissions-control equipment, safety devices, and integrated electronic systems, without an associated weight penalty. Using lighter materials also reduces a vehicle's fuel consumption, because it takes less energy to accelerate a lighter object. For example, a 10% reduction in vehicle weight can yield a 6%–8% fuel-economy improvement.

Increasing the electric operating range of electric-drive vehicles is one of the keys to achieving mass market adoption in the U.S. High efficiency occupant heating and cooling systems have the potential to significantly increase vehicle electric driving range while providing superior occupant comfort. Because of the higher efficiency of electric-drive vehicles, auxiliary loads such as passenger cabin heating, cooling, and window defrosting/defogging have a more significant impact on efficiency than in vehicles using internal combustion engines as their primary source of power. Improving heating, ventilation and air conditioning systems is an essential component in the development of widely-accepted electric-drive vehicles.

This FOA contains a total of 12 areas of interest in the general areas of advanced lightweighting and propulsion materials; advanced battery development; power electronics; advanced heating, ventilation, air conditioning systems; and fuels and lubricants. These areas of interest apply to light, medium and heavy duty on-road vehicles.

Authority for this Funding Opportunity Announcement is from Public Law 102-486, Energy Policy Act (EPAct) of 1992, amended by Public Law 109-58, EPAct 2005. Additionally, the Energy Independence and Security Act (EISA, Public Law 110-140) and Continuing Appropriations Resolution, 2013 Public Law 112-175.

B. Technical Areas of Interest

The AOIs addressed in this FOA are as follows:

AOI Number	Title
1	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys – Kinetics
2	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys – Corrosion Behavior
3	Body-in-white Joining of Aluminum to Advanced High Strength Steel at Prototype Scale
4	Breakthrough Techniques for Dissimilar Material Joining
5	Development of High-Performance Cast Alloys and Processing Techniques for Engine Rotating Components
6	High Temperature DC Bus Capacitor Cost Reduction & Performance Improvements
7	Applied Battery Research for Improvements in Cell Chemistry, Composition, and Processing
8	Computer Aided Engineering for Electric Drive Batteries
9	Advanced Electrolytes for Next-Generation Lithium Ion Chemistries
10	Lubricant Formulations to Enhance Fuel Efficiency
11	Advanced Climate Control Auxiliary Load Reduction
12	Advanced, Integrated, Modular, and Scalable Wide Bandgap (WBG) Inverter R&D for Electric Traction Drive Vehicles

Area of Interest 1 - Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys - Kinetics

The objective of this AOI is to develop an improved understanding of the kinetics and diffusion behavior in advanced automotive cast magnesium alloys. While high performance cast magnesium alloys with improved strength and corrosion resistance are desirable for automotive applications, a major technical gap exists in the scientific foundation for developing such materials. By supporting improved scientific comprehension in the area of kinetics and diffusion behavior, this AOI will help to identify the development paths towards novel magnesium alloys and greater impact on weight reduction in the U.S. fleet.

While the thermodynamic characteristics and equilibrium phase diagrams for magnesium and its alloys are reasonably well understood, the phase transformation and diffusion behavior of these alloys has been explored to a far lesser extent. Kinetics far from equilibrium is of particular relevance to the development of high performance cast magnesium alloys for automotive applications owing to the severity of fluid flow, the high cooling rates, and the steep thermal gradients in the die-casting process. Applicants proposing kinetics research shall describe a plan for measuring and characterizing, modeling, and/or simulating the kinetic properties of magnesium alloys in conditions similar to those found during die-casting and solidification and during subsequent heat treatment. Applications should emphasize the behavior in automotive relevant magnesium alloy systems, such as those containing aluminum, zinc, tin, calcium, strontium, or manganese, however other magnesium alloy systems can be included. Applicants must articulate how output from this research will be made broadly available to the scientific and engineering community, and how the results can be used to support future development of high performance automotive die-casting alloys.

Dissemination of Data and Results

In support of the President's Materials Genome Initiative, and to ensure that the results supported by this AOI can make the broadest impact, awardees are required to disseminate the results of their work through infrastructure and methods identified by the National Institute of Standards and Technology (NIST). NIST will provide data schemas and informatics tools in accordance with the specific data types generated by the project; for example tracer, intrinsic and chemical diffusivity data; diffusion couple data; and phase transformation data from differential scanning calorimetry, differential thermal analysis, continuous cooling transformation data, and isothermal cooling transformation data. In addition to the specific tools for kinetic data, a variety of other data platforms will be offered. Specific file repositories will be provided for CALPHAD assessment files, first-principles files, and interatomic potentials (*http://www.ctcms.nist.gov/potentials/*). In addition to these specific file repositories, a general file repository platform will be established for all other data, which cannot be captured by the previously mentioned tools. In addition, dissemination of results via publication in peer-reviewed journals will be encouraged. Additionally, applications must describe how such data will be valuable in the development of high performance magnesium casting alloys.

AOI 1 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects that will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 1 as identified in Section V.B.3:

- The extent to which the project output will address distinct gaps in the scientific understanding of magnesium alloy kinetics;
- The uniqueness of the project objectives and project plan when compared to the existing body of magnesium research and development work;
- The detail and technical credibility of the described connection between the proposed research output and future high performance die cast magnesium alloy development;
- The extent to which the plan for disseminating data and results is credible in providing broad access to project output;
- The extent to which the proposed data format and content is useful in allowing other researchers to use project output;

AOI 1 Nonresponsive Applications

Applications submitted under AOI 1 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they include:

- research in material systems other than magnesium alloys;
- research in magnesium alloys where magnesium makes up less than 60% of the alloy by weight;
- research not generally categorized as kinetics, such as mechanical behavior.

AOI 1 Specific Deliverables

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for projects awarded under AOI 1.

Area of Interest 2 - Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys – Corrosion Behavior

The objective of this AOI is to develop an improved understanding of the corrosion behavior in advanced automotive cast magnesium alloys. While high performance cast magnesium alloys with improved strength and corrosion resistance are desirable for automotive applications, a major technical gap exists in the scientific foundation for developing such materials. By supporting improved scientific comprehension in the area of corrosion behavior, this AOI will help to identify the development paths towards novel magnesium alloys and greater impact on weight reduction in the U.S. fleet.

Magnesium is among the lightest structural metals and can therefore enable significant

vehicle weight reduction when compared to conventional materials. Magnesium is also among the most thermodynamically active metals and the current alloy systems do not form effective passive surface films which results in poor corrosion performance.

Applicants proposing corrosion research shall describe a plan for measuring and characterizing, modeling, and/or simulating the general and/or galvanic corrosion behavior in magnesium alloy systems relevant to use in automotive components. While the basic corrosion mechanisms in magnesium are known, there are significant gaps in the scientific understanding of the roles of alloying elements and microstructure in film formation and degradation, anodic dissolution, and cathodic reactions. Further, alloying or coating pathways towards low-cost, effective passive films, have not been sufficiently explored in a sound and scientific way.

Applicants should emphasize developing an understanding of the relationship between alloy/microstructure, coatings or surface conditions, and the physical processes during general and/or galvanic corrosion of magnesium alloys. Applicants should avoid phenomenological, bulk studies such as measuring bulk corrosion rates for a variety of coatings and conditions; rather, a scientific understanding of corrosion behavior is sought. Applicants must articulate how output from this research will be made broadly available to the scientific and engineering community, and how the results can be used to support future development of magnesium die casting alloys with significantly improved corrosion performance.

Dissemination of Data and Results

In support of the President's Materials Genome Initiative, and to ensure that the results supported by this AOI can make the broadest impact, awardees are required to disseminate the results of their work through infrastructure and methods identified by the National Institute of Standards and Technology (NIST). NIST will provide data schemas and informatics tools in accordance with the specific data types generated by the project; for example tracer, intrinsic and chemical diffusivity data; diffusion couple data; and phase transformation data from differential scanning calorimetry, differential thermal analysis, continuous cooling transformation data, and isothermal cooling transformation data. In addition to the specific tools for kinetic data, a variety of other data platforms will be offered. Specific file repositories will be provided for CALPHAD assessment files, first-principles files, and interatomic potentials (*http://www.ctcms.nist.gov/potentials/*). In addition to these specific file repositories, a general file repository platform will be established for all other data, which cannot be captured by the previously mentioned tools. In addition, dissemination of results via publication in peer-reviewed journals will be encouraged. Additionally, applications must describe and how such data will be valuable in the development of high performance magnesium casting alloys.

AOI 2 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 2 as identified in

Section V.B.3:

- The extent to which the project output will address distinct gaps in the scientific understanding of magnesium alloy corrosion behavior;
- The uniqueness of the project objectives and project plan when compared to the existing body of magnesium research and development work;
- The detail and technical credibility of the described connection between the proposed research output and future high performance die cast magnesium alloy development;
- The extent to which the plan for disseminating data and results is credible in providing broad access to project output;
- The extent to which the proposed data format and content is useful in allowing other researchers to use project output;

AOI 2 Nonresponsive Applications

Applications submitted under AOI 2 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they include :

- research in material systems other than magnesium alloys;
- research in magnesium alloys where magnesium makes up less than 60% of the alloy by weight;
- research not generally categorized as being related to corrosion, such as mechanical behavior;

AOI 2 Specific Deliverables

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for projects awarded under AOI 2.

Area of Interest 3 - Body-in-white Joining of Aluminum to Advanced High Strength Steel at Prototype Scale

The objective of this Area of Interest (AOI) is to develop and demonstrate the capability of multi-material joining techniques for aluminum to advanced steel for light-duty, medium-duty or heavy-duty vehicle body-in-white (BIW) joints. In addition to applying and validating new techniques at a production-relevant scale, this AOI supports rigorous development of joining process-structure models and characterization of joints at a quality suitable for publication in peer-reviewed journals.

Applications within this AOI will apply multi-material joining techniques that have been demonstrated at coupon-scale or for non-body-in-white applications. The techniques should have been well characterized and understood in prior work with the technical challenges associated with body-in-white joining clearly explained in the application.

For the purpose of this AOI, “aluminum” is defined as 5000, 6000, or 7000 series automotive aluminum alloy sheet between 0.5 mm and 5 mm thick. “Advanced Steel” is defined as automotive sheet steel with tensile strength of greater than 580 MPa and thickness between 0.5 mm and 5 mm. “Body-in white joints” refers to joints between the materials described above in the body-in-white where constraining the assembly and access to the joint are limited by size of the assembly; these limits are manifest in such a way that the joining process must be performed on a robot-arm, or in such a way that the joining process can be performed on a full size BIW moving through the assembly floor (i.e. the BIW cannot be lifted or rotated significantly to accommodate the needs of the joining process).

Applications under this AOI must address three aspects - process development and demonstration; joint characterization; and model development and validation – in accordance with the following requirements:

1. **Process Development and Demonstration**

   Applicants shall select a single class of joining techniques for development and demonstration during the project; examples of a “class” of joining techniques includes friction stir welding or resistance spot welding (these are only examples, other classes may be proposed). After providing a description of the state-of-the-art for the selected technique, the applicant should provide a discussion of the key technical barriers that prevent application of the technique for dissimilar Al-Steel body-in-white joints; applications must include a discussion of how each technical barrier will be addressed in the project. While development and demonstration at a coupon-scale is an acceptable component of the proposed work, the emphasis for this AOI is on demonstration with prototype-scale parts. Applicants shall provide a schematic design for a prototype-scale assembly (or assemblies) of at least 2 components (one aluminum, one steel) that will at least include 4 adjacent joints (for “spot” techniques) or 6” of weld (for “linear” techniques). Applicants shall describe how the prototype-scale demonstration assembly (or assemblies) accurately portrays the access and constraint challenges associated with production body-in-white joining and **why the proposed demonstration assembly joints are unachievable** without further development of the proposed joining technique. Further, applicants can describe how the cost and performance of the proposed structure can be compared to a benchmark using a conventional technique.

   Demonstration assembly testing must include characterizing the failure mechanisms and loads for the following modes: quasi-static overload failure and dynamic/crash failure. Applicants may also include characterization of other failure modes, such as fatigue failure or corrosion failure.. The applicant shall provide quantitative metrics for the target performance of the assembly in each mode. The applicant must provide a detailed discussion on the proposed techniques for characterizing each mode and how the proposed testing technique will emulate the service conditions of production vehicle body-in-white joints.

2. Joint Characterization

A second aspect of this AOI is to develop a sound metallurgical understanding of joint characteristics using the proposed joining technique. Applicants shall include a discussion of how joint structure and mechanical properties will be characterized. Joint structure characterization must at least include microstructure and joint defect measurements. Joint mechanical property characterization must at least include quasi-static failure strength, high-rate (strain rate between 100 s^{-1} and 2000 s^{-1}) failure strength, failure mechanism, fatigue performance, and corrosion performance; these measurements can occur at the coupon-scale during process development and are distinct from the demonstration assembly characterization described above. The applicant shall provide quantitative targets (e.g. 5 kN quasi-static failure load in lap-shear, etc.) for each of the coupon-level characteristics listed above in the application. Joint formability and the interaction between forming processes and joining processes can also be assessed during the project; however, tasks focused particularly on forming base materials, without joints, are not desired.

3. Model Development and Validation

The third aspect of the AOI is to develop process-structure models for the proposed joining technique. The process-structure models should be sufficiently detailed to at least predict the post-weld microstructure based on the process parameters and input microstructure. Further, existing structure-property models should be applied to use output from the process-structure model developed during this project to predict the quasi-static overload failure strength to within 5% of the experimental value at the coupon scale and to within 10% of the experimental value at the prototype scale. Modeling and prediction of other joint performance characteristics such as fatigue or corrosion behavior is allowed but not required.

AOI 3 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 3 as identified in Section V.B.3:

- The extent to which the proposed joining technique has been demonstrated for other applications but is still unusable for body-in-white joints owing to specific assembly and production constraints for body-in-white joining;
- The detail and technical credibility of the described technical barriers to using the proposed technique for dissimilar Al-Steel body-in-white joints;
- The extent to which the proposed prototype scale demonstration assembly accurately emulates the access, constraint, and assembly challenges of body-in-white joining;
- Extent of involvement of automotive OEM or tier one suppliers in developing requirements for the joining technique and demonstration assembly.
- The extent to which the prototype scale demonstration assembly captures production scale performance challenges such as interaction of adjacent welds (spot) and the starting/ending points of the welds (linear);
- The extent to which the proposed prototype scale demonstration assembly and

testing methods emulates the service conditions and performance of a production body-in-white assembly;
- The extent to which the proposed quantitative joint and assembly performance metrics are sufficient to enable use of the joining technique in a production vehicle;
- The technical soundness of the proposed coupon scale development process and characterization techniques;
- The technical soundness of the proposed process-structure modeling techniques and the perceived usefulness in predicting post-weld properties.

AOI 3 Nonresponsive Applications

Applications submitted under AOI 3 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they:

- include materials other than aluminum (5000, 6000, or 7000 series automotive alloys) and advanced steel (automotive steel alloys with tensile strength of greater than 580 MPa);
- include material thinner than 0.5 mm or thicker than 5 mm;
- are for systems other than light-duty, medium-duty or heavy-duty vehicle body-in-white;
- do not include a Tier 1 supplier or automotive OEM as a partner for prototype design, demonstration, and validation.
- do not address all three technical areas of the scope: 1) Process Development and Demonstration; 2) Joint Characterization; and 3) Model Development and Validation.

AOI 3 Specific Deliverables

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for projects awarded under AOI 3.

Area of Interest 4 - Breakthrough Techniques for Dissimilar Material Joining

This area of interest is co-funded by the U.S. Department of Energy and the U.S. Army. The objective of this Area of Interest (AOI) is to establish new techniques for producing dissimilar material joints in vehicle structures. The EERE Vehicle Technologies Program supports weight reduction of passenger and commercial vehicles while the U.S. Army is interested in reducing the weight of military vehicles. Joining dissimilar materials is a critical technical barrier to weight reduction of both civilian and military vehicles however breakthrough ideas for methods to produce these joints are lacking. This AOI aims to seed exploration of many novel joining methods rather than to develop any single method. Promising techniques may be eligible for development funding in subsequent funding opportunity announcements.

Development of more established techniques such as conventional fusion welding, riveting, friction joining and ultrasonic joining is underway and not supported by this AOI; this AOI

seeks to support early stage development and demonstration of completely new techniques.

The mechanical and corrosion performance of the joints produced using the new technique will be characterized. Further, joint characteristics and failure modes will be characterized and reported.

Applications within this AOI will apply novel dissimilar material joining techniques to produce joined coupons of any two of the following materials:

- Aluminum (5000 or 6000 series automotive alloy)
- Steel (Mild, HSLA, AHSS, or Boron automotive alloy)
- Magnesium (AZ or AM series commercial alloy)
- Carbon Fiber Polymer Composite

The mechanical and corrosion performance of the joints produced using the new technique will be characterized. Further, joint characteristics and failure modes will be characterized and reported.

Joining Processes

Applicants shall propose a joining method that is significantly different from the conventional implementations of the following techniques:

- Friction stir welding
- Ultrasonic welding
- Arc Welding, and other conventional fusion techniques
- Laser Welding
- Plasma Welding
- Explosive welding/bonding using chemical explosives
- Conventional Brazing or Soldering
- Rivets, bolts, and other conventional mechanical fasteners
- Conventional adhesive joining
- Other conventional or well established joining techniques

Applications suggesting conventional implementations of these techniques, or any simple combinations of these techniques, such as laser assisted friction stir welding or rivets with adhesives, will be considered non-responsive. Applicants may propose significantly modified variations on these techniques provided that the modification results in a fundamental change to the mechanisms for forming the joint.

While a detailed, quantitative study of cost or production compatibility is not required, applicants should include a discussion outlining how the cost and processing details of the proposed technique could eventually be compatible with passenger, commercial, or military vehicle manufacturing. The discussion should provide sufficient detail to evaluate if the proposed technique could eventually be made compatible with the cost and processing requirements for high volume vehicle manufacturing.

Materials

Applicants shall produce dissimilar material joints between any two of the materials listed above. For the purpose of this AOI, "dissimilar" material refers to joints between different material systems (e.g. aluminum to magnesium) and does not refer to joints between different alloys within the same material system (e.g. 5000 series aluminum to 6000 series aluminum). Metal samples can be cast, sheet, or extrusion but must be between 0.5 mm and 12 mm thick. Polymer composite samples can be continuous or discontinuous fiber and must be between 0.5 mm and 12 mm thick.

Testing and Characterization

Testing and characterization **must** at least include all of the following. Failure to include these 5 tests will render applications non-responsive.

- As-joined quasi-static tensile failure for a 2t stack-up in lap-shear, butt-joint, or other appropriate configuration dependent on the joint geometry
- Exposure to standard corrosion environment for various exposure times with quasi-static lap shear failure tested after each increment
- Characterization of material microstructure in the joint region
- Characterization of joining-induced defects in the joint region
- Characterization of failure mechanisms for each of the mechanical tests described above

Though not required, testing and characterization may also include:

- As-joined or post-corrosion joint fatigue performance
- As-joined or post-corrosion dynamic (strain rate between 100 s^{-1} and 2000 s^{-1}) joint failure
- Other tests or characterization techniques as proposed by the applicant

Replicate tests should be conducted to establish statistically meaningful results. All results from testing and characterization, along with details from the project, should be made available to the general public via the academic literature, the Vehicle Technologies Program Annual Report, and the Vehicle Technologies Program Annual Merit Review.

AOI 4 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 4 as identified in Section V.B.3:

- Uniqueness of the proposed joining technique, including fundamental difference from the conventional techniques listed above;
- Technical credibility of the proposed technique to produce structural dissimilar material joints for vehicle applications;
- The extent to which the proposed technique simultaneously addressed mechanical

and corrosion performance challenges of dissimilar material joints;
- The feasibility that the proposed technique could eventually be made compatible with the cost and processing requirements for civilian and/or military vehicle manufacturing;
- The technical soundness of the proposed testing and characterization plan.

AOI 4 Nonresponsive Applications

Applications submitted under AOI 4 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they:

- include the conventional implementation of joining techniques listed in the "Joining Processes" section, or simple combinations of these techniques;
- include joints of two materials from within the same material system (e.g. DP steel to HSLA steel);
- include joints of materials thinner than 0.5 mm or thicker than 12 mm;
- do not include, at the very least, the testing and characterization techniques outlined in the section "Testing and Characterization";
- fail to include these 5 tests
    1. As-joined quasi-static tensile failure for a 2t stack-up in lap-shear, butt-joint, or other appropriate configuration dependent on the joint geometry
    2. Exposure to standard corrosion environment for various exposure times with quasi-static lap shear failure tested after each increment
    3. Characterization of material microstructure in the joint region
    4. Characterization of joining-induced defects in the joint region
    5. Characterization of failure mechanisms for each of the mechanical tests described above

AOI 4 Specific Deliverables

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for projects awarded under AOI 4.

Area of Interest 5 - Development of High-Performance Cast Alloys and Processing Techniques for Engine Rotating Components

The objective of Area of Interest (AOI) is to develop technologies that will enable the production of cast crankshafts that meet or exceed the performance of current state-of-the-art high performance forged crankshafts (800 MPa Ultimate tensile strength, 615 MPa Yield Strength (0.2% offset)) with cost targets no more than 110% of production cast units. Modifications to processing techniques may be included, but shall not include forging and should result in a finished product that meets all performance and cost targets.

Applications must include an existing baseline production assembly; specific targets for assembly mass; technical approach to meet targets; and a technology transfer /commercialization plan. Applications must include a Tier 1 or automotive OEM as a partner for prototype design, demonstration, and validation.

Process Development and Demonstration

A current baseline shall be established, including the assembly mass, material composition, material properties, and cost. Applications must include a discussion of how each technical barrier will be addressed in the project.

A prototype demonstration part shall be produced which reproduces, to the maximum extent practicable, the expected stresses, clearance, dimensional stability, and fatigue challenges of next generation high efficiency internal combustion engine rotating components. The prototype part should also capture expected performance challenges such as interaction of bearings, journals, oil passages, and life cycle fatigue requirements.

Material and Component Characterization

The proposed cast alloy and/or processing techniques shall be described, and a discussion of the key technical barriers that prevent their use for production crankshafts. Specific targets will be provided for the cast product to be produced through the proposed approach, including assembly mass, material composition, properties, and assembly cost.

The emphasis for this AOI is on demonstration with prototype-scale parts. However, development and demonstration at a coupon-scale is an acceptable component of the proposed work. Testing of the prototype assembly should emulate the service conditions and performance of next generation high efficiency internal combustion engines.

ICME Model Utilization, Cost Model Development, and Evaluation

Integrated Computational Materials Engineering (ICME) shall be utilized to model the prototype assembly. Process-structure modeling techniques should be utilized which are useful in predicting life cycle performance. However, this topic does not include the development of new ICME models. If an application includes tasks involved in the development of ICME models, those tasks will be out of scope and will not be funded.

A cost model will be developed which compares costs relative to the baseline assembly, and provides a pathway to meet incremental cost targets. Cost models must include materials production, component fabrication, finishing, and heat treatment costs for annual production runs up to 100,000 units, in increments of 25,000 units. A technology transfer/commercialization plan shall be developed for the assembly using the material properties and results of the cost model.

AOI 5 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 5 as identified in Section V.B.3:

- The existing team production, research and development, materials characterization, and computational capabilities;

- The completeness of data provided on existing team products, properties, applications, and limitations;
- The extent to which the proposed alloys and processing technique has been demonstrated for other applications but is still unavailable for internal combustion engine components;
- The detail and technical credibility of the described technical barriers to using the proposed technique for producing high performance low cost rotating components;
- The extent to which the proposed prototype scale demonstration assembly accurately emulates the expected stresses, clearance, dimensional stability, and fatigue challenges of next generation high efficiency internal combustion engine rotating components;
- The extent to which the prototype scale demonstration assembly captures expected performance challenges such as interaction of bearings, journals, oil passages, and life cycle fatigue;
- The extent to which the proposed prototype demonstration assembly and testing methods emulates the service conditions and performance of next generation high efficiency internal combustion engines;
- The technical soundness of the proposed coupon scale development process and characterization techniques;
- The extent to which the proposed solution can be modeled using DFT, FEM and other computational methods;
- The technical soundness of the proposed process-structure modeling techniques and the perceived usefulness in predicting life cycle performance.
- The technical soundness of the proposed cost modeling techniques and the ability of the solution to meet the stated cost targets.
- The technical soundness of the proposed technology transfer/commercialization plan.

AOI 5 Nonresponsive Applications

Applications submitted under AOI 5 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they :

- do not include cast metal alloys with Ultimate tensile strength greater than 700 MPA and Yield Strength greater than 600 MPA;
- require a forging process;
- are for systems other than internal combustion engine rotating components;
- do not include a Tier 1 or automotive OEM as a partner for prototype design, demonstration, and validation.
- do not address all three technical aspects of this AOI for the proposed alloys and processes: Process Development and Demonstration; Material and Component Characterization and Validation
- do not include Cost Models for the production quantities identified.
- include development of new ICME tools.

AOI 5 Specific Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for projects awarded under AOI 5.

Area of Interest 6 – High Temperature DC Bus Capacitor Cost Reduction & Performance Improvements

The development of less-expensive, more-efficient, smaller, and lighter power electronics and electric machines for electric traction systems is necessary to reduce the cost and improve the performance of electric drive vehicles. The specifications for the DC bus capacitor, including electrical performance and mechanical and thermal requirements must be based on an automotive power inverter application. In this AOI, solutions should be capable of being commercially manufactured. Therefore, it is highly encouraged to have a commercial capacitor or power electronics manufacturer as part of a cooperative or teaming arrangement.

Capacitors typically represent the second largest cost component of an inverter, and they also account for a major portion of inverter volume and weight. Currently, polymer-film wound capacitors are commonly used in inverters for electric traction drive systems, but they cannot tolerate sufficiently high temperatures for future applications that will require operation in ambient temperatures up to 140°C. Furthermore, the lack of high temperature tolerance and low energy density are barriers to meeting 2020 PEEM targets for inverter power density and cost.

The focus of this AOI is to lower the cost and improve the performance of high temperature capable DC bus capacitors that will be part of the next generation of power inverters for electric drive vehicles. These capacitors must meet demanding performance targets while achieving significant reductions in cost to meet future commercial demands. The major technical barriers to closing the gaps between the current status and the targets are the high cost of the materials and components, the weight and volume of the components, and the ability of the materials and components to withstand the temperatures that they will encounter. These specifications and performance targets also affect the power electronics components such as semiconductor switches, diodes, and packaging. Following are the capacitor target specifications:

DC Bus Capacitor Targets

Temperature range of ambient air, °C	-40 to +140
Volume requirement, L	≤0.6
Cost	≤$30
Failure mode	Benign
Life[1] @operating conditions, hr	>13,000

[1]Life is defined as less than 10% rated capacitance fade

AOI 6 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI

applications must specifically address the following aspects:

1. Proposed capacitor specifications including electrical performance and mechanical and thermal requirements must be based on an automotive power inverter design. Inverter designs should be DC voltage source designs rated for supplying at least 55kW of peak power in automotive applications.
2. Define and develop a manufacturing process for high temperature capacitor fabrication.
3. Initial estimates and plans including:
    a. Cost breakdown for packaged capacitors, terminations, and mounting/packaging.
    b. Expected capacitor specifications including: frequency range of operation, dissipation factor, equivalent series inductance, and nominal and peak voltage and ripple current. The capacitor requirements should correspond to a specific inverter application that does not provide any conductive cooling directly to the capacitor.
    c. Commercialization path to reach automotive applications. This should include the identification of potential supply and application entities that would be involved and a description of their current operations.
    d. Risk analysis and mitigation plans for the proposed project.
4. Applications shall utilize a two phased approach. Phase I shall focus on materials research and development and/or manufacturing process development. Phase I shall be between 9 months and 24 months duration. Phase II shall focus on material and/or manufacturing process scale-up and capacitor manufacturing scale-up for high volume capacitor manufacturing. Phase II shall be between 9 months and 24 months. The total project duration shall not exceed 36 months.
5. The minimum recipient cost share for Phase I is 30% and 40% for Phase II, unless your organization is eligible for a cost share waiver as described in section III.B.

AOI 6 Nonresponsive Applications Criteria

Applications submitted under AOI 6 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2).

AOI 6 Specific Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required for awards made under AOI 6:

Phase I

1. Detailed cost and commercialization plan required to meet DOE's cost target. The plan must include an itemized cost breakdown for fully packaged capacitors including allocations for terminations and mounting/packaging.

2. Detail and justify capacitor requirements based on the specific inverter design including at least: frequency range of operation, dissipation factor, equivalent series inductance, and nominal and peak voltage and ripple current.
3. Deliver to DOE a minimum of 12 design specific prototype capacitors, commensurate with the capacitor requirements identified above, for independent assessment.

Phase II

4. Finalized detailed cost and commercialization plan required to meet DOE's cost target. The plan must include an itemized cost breakdown for fully packaged capacitors including allocations for terminations and mounting/packaging.
5. Test results confirming that prototype capacitors produced from this project meet the previously defined DOE targets and inverter design-specific capacitor specifications.
6. Deliver to DOE a minimum of 12 application specific prototype capacitors, commensurate with the capacitor requirements identified in Phase I, for independent validation testing.

All hardware deliverables will be provided to DOE for performance testing. Non-Destructive Performance Validation testing may be conducted on the deliverables to validate performance. This testing will be conducted outside the Statement of Project Objectives for this agreement and therefore should not be addressed in the SOPO nor included in the total estimated project costs associated with this application. Participation by DOE test agencies in test planning and execution will be addressed by a Non Disclosure Agreement (NDA) between the test agency and the end item manufacturer. Test procedures will incorporate specifications and limits supplied by the manufacturer for the specific technology such as voltage and current limits, state of charge, charging, and temperature recommendations, number of test sequences, or other relevant test conditions as appropriate. The results of the DOE laboratory testing will be documented in a publicly releasable Summary Test Report (to be approved by both DOE and the Recipient prior to release) that validates performance of the deliverables relative to the end item performance targets as well as the technology deployment impact relative to DOE strategic goals. The Summary Test Report will be approved by, and delivered to, the DOE (Vehicle Technologies Program) and end item manufacturer. Test materials, cells, modules, full battery systems (manufacturing end item), or special test equipment supplied by the end item manufacturer for the purposes of the test will be returned at the conclusion of testing at no cost to the recipient or the project.

Area of Interest 7 – Applied Battery Research for Improvements in Cell Chemistry, Composition, and Processing

The ABR program portfolio is and will continue to be comprised of high risk projects focused on cell-level opportunities for improved safety, performance, and life that can be realized and lead to cost reduction. Such improvements will be accomplished through innovative materials, particularly the active components of the cell,but also through innovative electrode composition.All ABR projects must be applicable to high-energy

batteries for use in PHEV40 (PHEVs with a 40 mile all electric range) or EV light-duty vehicles. Technological barriers associated with electric drive vehicle batteries include:

- insufficient gravimetric and volumetric energy density (Wh/kg and Wh/1);
- insufficient gravimetric and volumetric power density (W/kg and W/1);
- limited calendar and cycle life;
- insufficient tolerance to abusive conditions (heating, overcharging, etc.); and
- poor performance at low (<10°C) and elevated (>40°C) temperatures.

To ensure that ABR projects continue to support the near-term development of a U.S. electric vehicle battery industry, only projects involving high energy lithium-ion (Li-ion) electrochemical energy storage chemistries will be considered. The critical performance metrics for Li-ion batteries in EDVs are listed in the following table.

Summary PHEV and EV Cell Level Goals.

Energy Storage Requirements			
Characteristics	**Unit**	**PHEV40**	**EV**
Specific Discharge Pulse Power	W/kg	800	800
Discharge Pulse Power Density	W/l	1600	1200
Specific Regen Pulse Power	W/kg	430	400
Regen Pulse Power Density	W/l	860	600
Recharge Rate		C/3	C/3
Specific Energy	Wh/kg	200	400
Energy Density	Wh/l	400	600
Calendar Life	Year	10+	10
Cycle Life (at 30°C with C/3 charge and discharge rates)	Cycles	5,000	1,000
Operating Temperature Range	°C	-30 to +52	-30 to +65

The objective of this AOI is to attract and fund research efforts to understand and overcome the barriers impeding the successful utilization of high energy Li-ion couples that can meet the cell performance and life targets listed in the table above. One of the unique characteristics of the ABR program is the full design of experiment approach to identifying, diagnosing, and addressing issues with high-energy lithium ion cells. Applications shall identify an iterative, multi-mode applied R&D process that moves materials and advanced chemistries through design, fabrication, performance testing, and diagnostics. The outcome of this process will be advanced cell

chemistries that meet the ABR performance targets.

AOI 7 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 7 as identified in Section V.B.3:

1. Identify the cell chemistry – anode and cathode materials (electrochemical couple), electrolyte composition, and cell composition/construction – that will be used to demonstrate success in the research project. The cell chemistry must clearly show the potential to satisfy the PHEV 40 or EV requirements, including both energy and power. Delivery of full cells, with both the baseline cell chemistry and improved cell chemistry is expected to be built and tested.
2. Demonstrate an understanding of all major issues impeding the proposed cell chemistry, and clearly identify the particular barrier(s) that will be the target of the research effort.
3. Identify the testing and diagnostics to be performed to understand the causes of the issues being addressed, and identify methods and technologies to mitigate those issues.
4. Implement those mitigation methods and technologies, and test their effectiveness in relevant cell sizes. Note that, as mentioned above, the ABR program's supporting facilities enable and support a full design of experiment (DoEx) approach. A full characterization of cells with, for example, various electrolyte additives, electrode formations, binders, and active materials particle morphologies, can be carried out to determine the impact of the various cell components on the issue being investigated.
5. Produce both baseline (earlier in the project) and project demonstration (as technological gains are made) full cells for delivery to national labs for testing that will demonstrate the nature and scale of improvements. Cells should be a minimum of 250 mAhr in size.

AOI 7 Nonresponsive Applications:

Applications submitted under AOI 7 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2).

AOI 7 Specific Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required for awards made under AOI 7:

1. Construction of 12 baseline cells of a minimum capacity of 250 mAhr and delivery to a to-be-designated DOE testing laboratory for performance testing.
2. Construction of 12 improved cells of a minimum capacity of 250 mAhr and delivery to a to-be-designated DOE testing laboratory for performance testing.

All hardware deliverables will be provided to DOE for performance testing. Non-Destructive Performance Validation testing will be conducted on the deliverables to validate performance. This testing will be conducted outside the Statement of Project Objectives for

this agreement and therefore should not be addressed in the SOPO nor included in the total estimated project costs associated with this application. Participation by DOE test agencies in test planning and execution will be addressed by a Non Disclosure Agreement (NDA) between the test agency and the end item manufacturer. Test procedures will incorporate specifications and limits supplied by the manufacturer for the specific technology such as voltage and current limits, state of charge, charging, and temperature recommendations, number of test sequences, or other relevant test conditions as appropriate. The results of the DOE laboratory testing will be documented in a publicly releasable Summary Test Report (to be approved by both DOE and the Recipient prior to release) that validates performance of the deliverables relative to the end item performance targets as well as the technology deployment impact relative to DOE strategic goals. The Summary Test Report will be approved by, and delivered to, the DOE (Vehicle Technologies Program) and end item manufacturer. Test materials, cells, modules, full battery systems (manufacturing end item), or special test equipment supplied by the end item manufacturer for the purposes of the test will be returned at the conclusion of testing at no cost to the recipient or the project.

Area of Interest 8 – Computer Aided Engineering for Electric Drive Batteries

This area of interest is co-funded by the U.S. Department of Energy and the U.S. Army. The objective of this AOI is to expand upon the current state of electric drive vehicular battery modeling using the Computer Aided Engineering for Electric Drive Batteries (CAEBAT) open architecture. The CAEBAT activity was initiated by the Vehicle Technologies Program (VTP) and its objective was to introduce battery simulation and modeling design tools to the development of batteries early in the product life-cycle thereby reducing development time and accelerating time-to-market. Initial efforts focused on the development of multi-physics simulation models capturing realistic three-dimensional geometries and configurations of cell and pack level batteries or other electrochemical storage devices that could meet the requirements of electric drive vehicles. These models addressed the chemical, electrical, and thermal physics in the electrochemical cells, modules, and battery packs while trying to optimize computational efficiency.

In a parallel effort, the open architecture platform was developed to serve as a backbone that seamlessly allowed these different models to communicate with each other through a common language and agreed upon input and output standards. Combining this open architecture software with the electrochemical and thermal models, the CAEBAT program has begun to develop a suite of software tools that enable automobile and battery manufacturers, pack integrators, and other end-users to simulate and design battery packs, accelerating development of battery systems, ultimately reducing battery cost.

This AOI will expand upon the current state of electric drive vehicular battery modeling by developing and validating new advanced computational models. The models must use the CAEBAT open architecture platform and be compatible with the existing software tools. Specific areas of interest include but are not limited to:

- Dramatically improving the computation efficiency of current electrochemical and thermally coupled material, cell, module and battery pack models.

- Developing models capable of predicting the combined structural, electrical, and thermal responses to abusive conditions such as crash-induced-crush, overcharge/overdischarge, thermal ramp, and short circuits.
- Improving the accuracy of advanced life prediction modeling over different drive cycles and temperature conditions.

Modeling efforts will be evaluated based on their ability to incorporate multiple cathode and anode materials relative to industry such as, but are not limited to, $LiCoO_2$, NCA, NMC, $LiFePO_4$, Mn-spinel, graphite, titanate, and silicon; the ability to incorporate new materials as they are developed is highly desirable. All models must also be capable of modeling different form factors such as, but not limited to, spirally wound, wound prismatic, and stacked electrode that are enclosed in either a pouch or hard case. Modeling tools should be designed to run on a personal computer, therefore computational efficiency for all areas of interest is required. Models that require multiple processors will be accepted for review, but we do not intend for models selected to require supercomputers for adequate processing times. Proper model validation should be incorporated into all applications. Additionally, all models must function within the Open Architecture Software currently being developed at Oakridge National lab and funded by the Department of Energy.

AOI 8 Additional Application Requirements

Aside from the information provided in the narrative above specific to this AOI, there are no additional requirements for this AOI.

AOI 8 Nonresponsive Application Criteria

Applications submitted under AOI 8 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they :

- fail to utilize the CAEBAT open architecture platform.

AOI 8 Specific Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required for awards made under AOI 8:

1. Operation manual
    a. Basic operation including equations, inputs, outputs, assumptions, limitations, and accuracy.
    b. Software limitations including cell materials, cathode anode composition, electrolytes, insulators, current capabilities, thermal geometries, accuracy, etc.
2. Validation of model against measured results
    a. Accuracy of model
    b. Report detailing experiments and experimental data to validate and verify models. The report will provide comparisons of experimental data with the predicted model outputs. Real work, chemistries, geometries, scale-up

limitations.

c. Thermal analysis limitations – geometries, size, heat sinks, scalability, internal/external heat sources, etc.

d. Validation of open architecture design and compatibility with existing software tools.

3. Description of targeted area of software performance improvements such as:
   a. Methods and advantages of improvements
   b. Computational improvements – accuracy or decreased processing time.
4. Where applicable, measurable percentage of improvement, such as:
   a. Baseline of targeted improvement area for the existing model.
   b. Compare existing model baseline to the improved Computational time for improved model and percentage increase.
   c. Advantages and disadvantages of model – what applications are best suited for the improved model and any situations that my compromise the model.
5. Final, validated software provided on CD.

Area of Interest 9 - Advanced Electrolytes for Next-Generation Li-Ion Chemistries

The Energy Storage activity within the Vehicle Technology Program is being conducted in support of the US Drive Partnership, which is targeting more fuel-efficient light duty vehicles that can reduce U.S. dependence on petroleum without sacrificing performance. There is an emphasis on developing and improving energy storage technologies as they are one of the most critical components needed to enable the wide-spread commercialization of electric drive vehicles. One of the technologies that is impeding the commercialization of next-generation Li ion couples is advanced electrolytes that will enable the use of alloy anodes and or high voltage/high capacity cathodes.

The purpose of this AOI is to develop electrolytes that will significantly improve the performance, abuse, and cost capabilities of next generation lithium ion cells. These electrolytes will be for electric drive vehicle batteries, such as PHEV40s and EVs. The requirements for PHEV and EV batteries are available in the DOE VTP annual progress reports, *http://www1.eere.energy.gov/vehiclesandfuels/resources/fcvt_reports.html*.

Applications of particular interest are non-carbonate based electrolytes that can enable the commercialization of high-energy next generation lithium ion technologies. Examples of next gen technologies include silicon, tin or other high-energy alloy anodes (but does NOT include Li metal anodes), and high voltage and high capacity cathodes, such as the 5 Volt Ni/Mn spinel or the Li-rich layered/layered transition methal oxides. Carbonate-based electrolytes that show significant improvements over current electrolytes will also be considered.

One of the issues with current, carbonate based, electrolytes used with alloy anodes is the

apparent instability of the solid electrolyte interface (SEI). Thus, non-carbonate electrolytes that demonstrably address this issue are of particular interest.

Another and as equally important issue with current, carbonate-based electrolytes used with high voltage cathodes is the high voltage instability that leads to electrolyte breakdown and either rapid capacity or power fade. Thus, non-carbonate electrolytes that demonstrably address this issue are of particular interest.

Electrolytes developed through these contracts will be demonstrated in high-energy cells. The developer should plan to build and deliver high energy lab-scale cells that demonstrate the advantages of the new electrolyte. As mentioned above, the cell should ideally utilize either a high-energy alloy anode (which could be coupled against a more traditional cathode, like NMC) or an advanced high voltage and high capacity cathode (which could be coupled against a more traditional anode, like graphite).

The proposed electrolyte technology should provide a significant improvement over currently known electrolytes for lithium-ion batteries in one or more of the following areas: (1) high-voltage stability, (2) cycle life of alloy anodes, (3) low-temperature performance and/or high temperature life, (4) abuse tolerance, (5) and cost. Some goals for improved electrolytes are shown in the following table.

Goals for Improved Electrolytes

Parameter	**Unit**	**Goal**
Selling Price	$/kg	<15
Conductivity at 25^{o}C	mS/cm	>5
Low Temperature Conductivity (-30°C)	mS/cm	>1
High Voltage Stability	V vs. Li/Li+	>4.6

AOI 9 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 9 as identified in Section V.B.3:

- Identify the cell chemistry—anode & cathode materials, and the baseline and proposed electrolyte composition— that will be used to demonstrate the advantages of the electrolyte. The expectation is that full cells, with both the baseline electrolyte, and improved electrolyte, will be built and tested.

- Demonstrate an understanding of major issues impeding the proposed cell chemistry, and those issues impeding the proposed electrolyte, and clearly identify the barrier(s) that will be the target of the research effort. Identify how the new electrolyte will mitigate those issues.
- Produce both interim (earlier in the project) and project demonstration (near the end of the project) cells for delivery to national labs for testing that will demonstrate the improvements in the of the electrolyte technology compared to the baseline electrolyte.

AOI 9 Nonresponsive Application Criteria

Applications submitted under AOI 9 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2).

AOI 9 Specific Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required for awards made under AOI 9:

1. Construction of 10 interim cells with a minimum capacity of 10mAh and delivery to a to-be-determined DOE testing laboratory for performance testing.
2. Construction of 10 improved cells with a minimum capacity of 10mAh and delivery to a to-be- determined DOE testing laboratory for performance testing.

All hardware deliverables will be provided to DOE for performance testing. Non-Destructive Performance Validation testing will be conducted on the deliverables to validate performance. This testing will be conducted outside the Statement of Project Objectives for this agreement and therefore should not be addressed in the SOPO nor included in the total estimated project costs associated with this application. Participation by DOE test agencies in test planning and execution will be addressed by a Non Disclosure Agreement (NDA) between the test agency and the end item manufacturer. Test procedures will incorporate specifications and limits supplied by the manufacturer for the specific technology such as voltage and current limits, state of charge, charging, and temperature recommendations, number of test sequences, or other relevant test conditions as appropriate. The results of the DOE laboratory testing will be documented in a publicly releasable Summary Test Report (to be approved by both DOE and the Recipient prior to release) that validates performance of the deliverables relative to the end item performance targets as well as the technology deployment impact relative to DOE strategic goals. The Summary Test Report will be approved by, and delivered to, the DOE (Vehicle Technologies Program) and end item manufacturer. Test materials, cells, modules, full battery systems (manufacturing end item), or special test equipment supplied by the end item manufacturer for the purposes of the test will be returned at the conclusion of testing at no cost to the recipient or the project.

Area of Interest 10 – Lubricant Formulations to Enhance Fuel Efficiency

This area of interest is co-funded by the U.S. Department of Energy and the U.S. Army. The objective of this AOI is to develop novel lubricant formulations that are expected to improve the fuel efficiency of light-, medium-,heavy-duty, and/or military vehicles by at least 2% (improvement based on comparative results from engine dynamometer testing, chassis dynamometer testing or test track, e.g., SAE J1321)* without adverse impacts on vehicle performance or durability.

AOI 10 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 10 as identified in Section V.B.3.

- The formulations must be for a lubricant application that can be easily replaced in the legacy fleet. Engine lubricants, manual transmission lubricants, power transfer unit lubricants, lubricants for accessories (e.g., power steering) and axle/gear lubricants are acceptable applications.
- The comparison lubricant used as a baseline for demonstration/justification of the 2% fuel efficiency improvement should be commercially available, state-of-the-art technology for the intended application, e.g., GF-5 oil for gasoline engine applications or CJ-4 oil for diesel engine applications. Axle, power transfer unit, accessory, and manual transmission lubricants should also employ current, best-available technology as a baseline for demonstrating/justifying the proposed technology results in a 2% fuel efficiency improvement.
- The comparison hardware used as a baseline for demonstration/justification of the 2% fuel efficiency improvement calculations/demonstrations should be a product widely available in the field and available for sale within the past five years, i.e., no obsolete engines, transmissions, transfer units, accessory units or axles.
- Friction reduction analysis should include expected improvements to fuel economy with a breakdown for boundary, mixed and hydrodynamic friction.
- The proposed formulation(s) should use currently available technology, or have the potential to become commercially practical within the next 10 years.
- An analysis supporting assumptions associated with commercial practicality shall be addressed in the application.
- Project demonstrations should be limited to demonstrations of the technology researched and/or developed during the project.

AOI 10 Nonresponsive Applications

Applications submitted under AOI 10 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they include:

- Formulations that simply lower the viscosity of the lubricant without regard for increased solid-solid contact.
- Formulations that aren't expected to show a fuel efficiency improvement within 4000 miles or 50 hours of engine operation.

- Formulations that aren't expected to show a sustainable fuel efficiency improvement throughout the full useful life of the product.
- Formulations exclusively for use in off-road (rail, marine, construction, small engines) or motorcycle applications.
- Formulations exclusively for alternative fuel applications.
- Formulations that increase wear or reduce component durability (this may be waived for military-only formulations).
- Formulations that are not compatible with existing emissions control systems (this may be waived for military-only formulations)
- Formulations exclusively for automatic transmissions, however, automatic transmission fluid can be used in other applications.
- Projects focused solely on demonstration of a technology.
- Projects focused mainly on production methods for lubricants.

AOI 10 Specific Deliverables

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 10.

Area of Interest 11 – Advanced Climate Control Auxiliary Load Reduction

The objective of projects proposed under this AOI shall be to develop and demonstrate strategies that employ advanced technologies to significantly reduce the auxiliary loads that support passenger comfort and window defrost/defog for grid connected electric drive vehicles (GCEDVs). The research, development, and demonstration shall employ strategies for load reduction & management, improved or innovative heating, ventilation, and air conditioning (HVAC) equipment, and/or more efficient cabin preconditioning. The focus of the projects shall be on developing solutions for application in light duty GCEDVs, with the potential for these technologies to also be used in hybrid electric and conventional light duty vehicles as well as medium and heavy duty vehicles.

The technical strategies include thermal load reduction, advanced HVAC, and cabin preconditioning are focused on using less energy from the energy storage system (ESS) when the vehicle is in operation. This will allow for longer range or less range loss under certain environmental conditions. Applications submitted under this AOI shall address, at least one or more of the following specific technical strategies:

Energy Load Reduction and Energy Management strategies shall focus on minimizing auxiliary loads by reducing the thermal loads that the systems must address. The approaches considered may include optimizing and controlling heat transfer between the vehicle passenger cabin and the environment, and minimizing or managing the thermal loads that the HVAC systems must address to ensure passenger comfort. High priority investigations may include advanced windows and glazing, surface paints, thermal mass reduction and/or management, ventilation, seating, and advanced insulation.

Advanced HVAC Technologies shall focus on reducing the auxiliary loads impact on vehicle driving range. Development activities may include development of HVAC equipment with improved efficiencies and performance characteristics, such as advanced heat pumps or novel heating and/or cooling subsystems. Development activities may also include introduction of innovative or unique heating and cooling concepts to achieve passenger comfort such as infrared and thermo-electric devices and phase change materials.

Cabin Preconditioning strategies shall address improving the energy efficiency of thermally preconditioning the passenger cabin while the vehicle is connected to the grid. The end result of these strategies will be to reduce the amount of energy supplied by the ESS upon initial vehicle operation to either pull-down (hot conditions) or raise (cold conditions) the temperature in the cabin when the vehicle begins to operate after being connected to the grid. This is achieved by bringing the temperature inside the cabin closer to the operator's desired comfort level temperature while the vehicle is still connected to the grid in a manner that minimizes the use of grid energy. One potential approach to cabin preconditioning might be the utilization of waste heat generated within the battery and/or charging circuit during charging. This FOA will not address or consider reducing the amount of electricity from the grid used for ESS thermal management during charging unless this reduction resulted in a preconditioned cabin that lowered the auxiliary energy loads for cabin comfort when the vehicle was being operated.

Necessary attributes of the proposed strategies and technologies include potential for commercial viability, acceptance by consumers, minimal environmental impact, and compatibility with existing infrastructure and vehicle subsystems. Characteristics of commercially viable solutions include low cost, high efficiency, and high volume production of components. Technology solutions that are applicable to battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), extended range electric vehicles (EREVs), hybrid-electric vehicles (HEVs) and conventional vehicles have the potential to achieve high production volumes that achieve economies of scale. Proposed approaches must be acceptable to consumers for the concept to have the potential to be widely adopted in vehicles, and comply with applicable regulations related to safety, visibility, and other requirements (e.g., FMVSS 103). Proposed approaches must be implementable without imposing major changes to charging infrastructure standards and/or vehicle subsystem characteristics (E.g. operating temperatures of power electronics, nominal voltage levels of ESS or electric traction motors).

It is highly encouraged that the proposing applicant team includes an advanced climate control system technology developer partnered with a vehicle manufacturer currently producing vehicles in the United States, with either the vehicle or technology developer as the lead. Teaming with suppliers, universities, national laboratories, utilities, etc. is encouraged if it benefits the technology development and final product. Letters supporting teaming arrangements are to be included in the application.

AOI 11 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 11 as identified in Section V.B.3:

- The projects shall include two phases of work;
  - Phase I - Technology Design and Development - Phase I shall include the system design and development with a laboratory demonstration of the technology.
  - Phase II - Technology Integration and Validation - Phase II shall include the further development and integration of the system into a vehicle with validation testing performed in a vehicle. The vehicle level testing shall include hot and/or cold weather testing depending on the proposed technology. The number of vehicles and scope of testing should be sufficient to validate the technology and enable commercialization of the technology within one year of project completion. The validation work shall address any deficiencies identified during the testing. The duration of each phase should be appropriate for the technology readiness level.
- The technology shall be ready for production within one year of project conclusion. EERE highly encourages projects with a firm commitment to commercialization within one year of successful project completion.
- The application shall address project scope, organization, and teaming to perform all of the following:
  1. System requirements analysis, concept development, and component interface specification
  2. Design, build, and validate components in laboratory setting. The components shall be tested and performance validated by DOE.
  3. Integration of components into vehicles. The performance of the integrated technology shall be demonstrated in the presence of DOE staff and submitted for testing at a DOE Laboratory.
  4. Operational testing & validation of vehicle integrated technology. The technology will be demonstrated to validate performance claims in real-world climatic conditions.

AOI 11 Nonresponsive Application Criteria

Applications submitted under AOI 11 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they:

- contain strategies that do not include the separate two phases of work as identified above.
- contain strategies that require significant change to vehicle operating characteristics and/or component interfaces.
- contain strategies that negatively impact compliance to vehicle safety standards.
- include solutions that have significant potential to negatively impact the environment in terms of GHG emissions.
- do not address at least one of the specific technical strategies.

AOI 11 Specific Deliverables

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 11.

Area of Interest 12 – Advanced, Integrated, Modular, and Scalable Wide Bandgap (WBG) Inverter R&D for Electric Traction Drive Vehicles

The purpose of this AOI is to perform research and develop next generation WBG power inverters to meet demanding electric vehicle performance requirements and targets while achieving significant cost reductions. The inverter is a key component of the electric traction drive system along with the motor. The focus of this AOI is the inverter for the traction drive system, and does not include the motor, DC-DC converter, or energy storage. Inverter cost reduction and advancements are necessary to enable market-ready electric drive vehicles. The technology requirements for hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and battery electric vehicles (BEVs) represent a continuous spectrum of performance requirements.

Teaming arrangements with vertically integrated teams which may include OEM's, component suppliers, device manufacturers and supporting research organizations that demonstrate a path to product manufacturing and commercialization are highly encouraged.

Electric drive vehicles require advancements in power inverter technology, such as lower cost, weight, and volume to achieve a greater share of the vehicle market. The focus of this AOI is the development of a WBG inverter to accelerate the implementation of WBG devices (i.e. SiC and/or GaN) that meet efficiency targets and the required inverter cost, weight, volume, and performance targets as identified in Table 1, with the added attributes and requirements of modularity and scalability. All proposed concepts must address manufacturability, and provide a detailed cost and manufacturability assessment.

Table 1. Inverter Targets

Requirement	Target
Continuous power output (kW)	30
Peak power output for 18 seconds (kW)	55
Weight (kg)	≤3.9
Volume (l)	≤4.1
Efficiency	> 93%
Unit Cost for quantities of 100,000 ($)	≤182
Operating voltage (Vdc)	200 to 450; nominal: 325
Power factor of load	>0.8
Maximum current per phase (Arms)	400
Precharge time – 0 to 200 Vdc (sec)	2
Output current ripple – peak to peak (% of fundamental peak)	≤3
Maximum switching frequency (kHz)	20
Current loop bandwidth (kHz)	2
Maximum fundamental electrical frequency (Hz)	1000
Minimum isolation impedance-input and phase terminals to ground (Mohm)	1
Minimum motor input inductance (mH)	0.5
Ambient operating temperature (□C)	-40 to +140

Scalability and modularity is important since the proposed solution must be applicable to power levels ranging from 55 kW to 120 kW or higher. Current inverter technologies are not designed and packaged to enable the use of WBG devices for electric traction drive applications. WBG devices offer the potential for cost reduction of the inverter and the traction drive system, but require advancements to enable complete functional integration of all components to achieve higher temperature operation, improved reliability and modular/scalable designs. Proposed R&D should address synergistic packaging of power devices, bus capacitor(s), bus bars, current sensors, gate drivers and terminations. Integration should include thermal management for power module operation to 180^{o}C while enabling use of film bus capacitors rated to 85 ^{o}C.

Also, the inverter will occupy an under hood location. Under hood air temperatures can reach high ambient values, which results in the power devices within the inverter housing seeing extreme temperatures. Therefore, to yield maximum flexibility, it is highly desirable that the inverter design and packaging be capable of operating in an ambient environment of

up to 140^{o}C.

The inverter must be capable of operating reliably for 15 years. Analysis is required to demonstrate the calculated/experimental efficiencies for power levels ranging from 55kW to 120kW, or higher. Scalability must be demonstrated by designing a unit rated at 55 kW, and fabricating and testing an inverter to a power level that will meet requirements for the applicant's commercialization pathway. If the final deliverable is >55kW, the proposal must include a detailed explanation of the selected power level and identify the potential for scalability to enable broader power levels and ultimately a range of electric vehicle applications. Building on the latest advances in power electronics components, packaging, and topologies it is necessary that successful applicants clearly illustrate the potential advantages of the proposed innovative design in both cost and performance over commercially available technology. This may be demonstrated either by laboratory testing or mathematical modeling. The application must clearly demonstrate and quantify the commercial viability and reduced cost, volume, and mass.

The application must provide a plan for the delivery of three inverters for independent confirmatory testing to establish performance, and document pertinent characteristics (power, volume.etc.) of the inverter. The Statement of Project Objectives (SOPO) must contain one or more tasks to develop test plans and procedures for recipient validation testing and independent confirmation testing. The applicant must perform validation testing. Independent confirmation testing, however, is not included in the scope of this project.

The application must include a plan for conducting cost and manufacturability assessments to identify areas of technology change and the associated impacts on product costs. It must also document assumptions such as market penetration, market price, unit cost reduction, life cycle costs, returns to scale, and economics of scale, etc. that would provide analytical evidence of projected cost reduction. Work must also include a detailed production cost analysis for volumes of 100,000 units per year and a discussion of how costs will be reduced through manufacturing strategies. A detailed plan and path to commercialization must be included.

Ultimately, a cost-effective traction drive system that meets all performance requirements and targets is required to accelerate market penetration of electric traction drive vehicles. Therefore, in addition to the targets and requirements in Table 1, motor targets are provided in Table 2 to ensure proposed WBG inverter designs will meet the targets and requirements for the electric traction drive system. Proposed inverter R&D concepts must, when combined with a motor, meet the system-level requirements, noting that Table 2 is specifically for the 55kW power level and that scaling of these targets is appropriate for higher power level motors. Applications must clearly identify how the inverter will enable achievement of the system-level targets and requirements, and identify any assumptions regarding motor designs and technologies for the entire system.

Table 2. Motor Specifications

Requirement	**Target**
Maximum speed (rpm)	20,000

Peak power output at 20% of maximum speed for 18 seconds and nominal voltage (kW)	55
Continuous power output at 20% to 100% of maximum speed and nominal voltage (kW)	30
Weight (kg)	≤35
Volume (l)	≤9.7
Unit cost in quantities of 100,000 ($)	≤275
Operating Voltage (Vdc)	200 to 450; nominal 325
Maximum per phase current at motor (Arms)	400
Characteristic current (¥mag/Ld)*	< Maximum current
Back EMF at 100% of maximum speed, peak line-to-line voltage (V) for IPM	<600
Torque pulsations not to exceed at any speed, percent of peak torque (%)	<5
Ambient (outside housing) operating temperature (□C)	-40 to +140
Coolant inlet temperature (□C)	105
Maximum coolant flow rate (liters/min)	10
Maximum coolant pressure drop (psi)	2
Maximum coolant inlet pressure (psi)	20
Minimum isolation impedance-phase terminals to ground (Mohm)	1

AOI 12 Additional Application Requirements

In addition to the information provided in the narrative above specific to this AOI, applications must specifically address the following aspects. These will be reviewed and evaluated as part of the entire set of Technical Evaluation Criteria for AOI 12 as identified in Section V.B.3:

- research and development of advanced, WBG inverter is required including advanced packaging on the device and component level

AOI 12 Nonresponsive Application Criteria

Applications submitted under AOI 12 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Items a. through e. of Section III (C)(2) and if they:

- focus primarily on demonstration of an existing technology.
- contain strategies that do not include the integration and implementation of WBG devices (i.e. SiC and/or GaN).

- don't clearly identify and address design and concept to utilize WBG devices including passive components, interfaces, interconnects, and thermal and packaging challenges.
- contain strategies that require significant change to traction drive system design and/or operating characteristics.
- contain strategies that require significant change to the motor technology/design and performance, and/or component interfaces.
- do not clearly identify and describe approach to modular, scalable and manufacturable designs to enable the potential application across a range of electric vehicle applications.
- contain strategies that do not include the detailed plan to achieve cost reductions and a thorough cost analysis of proposed technology and concept.

AOI 12 Specific Deliverables

In addition to the deliverables required in the Federal Reporting Requirements Checklist, the following deliverables are required for awards made under AOI 12:

1. Deliver to DOE a minimum of three (3) inverters and results of recipient's validation testing showing the results meet DOE targets.
2. Explanation of inverter power level if >55kW with details regarding potential commercialization and vehicle applications.
3. Deliver detailed test plan and procedures for independent confirmation testing and analysis.
4. Detailed cost analysis and report to demonstrate and confirm cost reduction required to meet DOE's cost target for inverters and the traction drive system.
    a. Must include an itemized cost breakdown for fully packaged inverter.
    b. Must include detailed manufacturability and cost analysis.
5. Detailed analysis and report on manufacturing and commercialization plan for inverter as part of the traction drive system for electric vehicles.

All hardware deliverables will be provided to DOE for performance testing. Non-Destructive Performance Validation testing may be conducted on the deliverables to validate performance. This testing will be conducted outside the SOPO for this agreement and therefore should not be addressed in the SOPO nor included in the total estimated project costs associated with this application. Participation by DOE test agencies in test planning and execution will be addressed by a Non Disclosure Agreement (NDA) between the test agency and the end item manufacturer. Test procedures will incorporate specifications and limits supplied by the manufacturer for the specific technology such as voltage and current limits, state of charge, charging, and temperature recommendations, number of test sequences, or other relevant test conditions as appropriate.

The results of the DOE laboratory testing will be documented in a publicly releasable Summary Test Report (to be approved by both DOE and the Recipient prior to release) that validates performance of the deliverables relative to the end item performance targets as well as the technology deployment impact relative to DOE strategic goals. The Summary

Test Report will be approved by, and delivered to, the DOE (Vehicle Technologies Office) and end item manufacturer.

SECTION II – AWARD INFORMATION

A. Type of Award Instrument

EERE anticipates awarding cooperative agreements under this FOA (See Part VI.B.4 Statement of Substantial Involvement).

EERE may utilize the Field Work Proposal or Inter-Entity Work Order process to make awards to DOE/NNSA Federally Funded Research and Development Center (FFRDC) applicants.

B. Estimated Funding and Maximum/Minimum Award Size

Approximately $56,000,000 in Federal funding is expected to be available in total for all awards under all the AOIs of this FOA. Of this total Federal funding, approximately $3,500,000 is anticipated to be provided by the Department of Defense (DoD) Tank Automotive Research, Development, and Engineering Center (TARDEC). DoD funding will be made available for selected projects awarded under AOIs 4, 8 and 10 through the primary agreement awarded by EERE under this FOA. A separate agreement with DoD will not be required.

The anticipated total Federal funding and the approximate maximum and minimum Federal Share for any one individual award made under this announcement are set forth in the table below:

Area of Interest Number	Area of Interest	Anticipated Maximum Award Size for Any One Individual Award (Fed Share)	Anticipated Minimum Award Size for Any One Individual Award (Fed Share)	Anticipated Award Size (Fed Share)	Approximate Total Federal Funding Available for All Awards
1	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys - Kinetics	$0.6M	$0.4M	$0.5M	$1.5M
2	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys - Corrosion	$0.6M	$0.4M	$0.5M	$1.5M
3	Body-in-white Joining of Aluminum to Advanced High Strength Steel at Prototype Scale	$1.5M	$1.0M	$1.5M	$3.0M
4	Breakthrough Techniques for Dissimilar Material Joining	$0.6M	$0.4M	$0.5M	$3.0M (includes $1.0M from DoD/TARDEC)
5	Development of High-Performance Cast Alloys and Processing Techniques for Engine Rotating Components	$1.5M	$0.75M	$1.0M	$3.0M

6	High Temperature DC Bus Capacitor Cost Reduction & Performance Improvements	$4.0M	$2.0M	$2.0M - $4.0M	$6.0M
7	Applied Battery Research for Improvements in Cell Chemistry, Composition, and Processing	$6.0M	$1.5M	$2.0M - $3.0M	$12.0M
8	Computer Aided Engineering for Electric Drive Batteries	$1.5M	$0.25M	$0.5M -$1.0M	$4.0M (includes $1.0 M from DoD/TARDEC)
9	Advanced Electrolytes for Next-Generation Li Ion Chemistries	$1.0M	$0.5M	$0.5M - $1.0M	$2.0M
10	Lubricant Formulations to Enhance Fuel Efficiency	$1.0M	$0.5M	$0.6M	$4.0M (includes $1.5 M from DoD/TARDEC)
11	Advanced Climate Control Auxiliary Load Reduction	$8.0M	$1.0M	$3.0M	$14.0M
12	Advanced, Integrated, Modular, and Scalable Wide Bandgap (WBG) Inverter R&D for Electric Traction Drive Vehicles	$2.0M	$2.0M	$2.0M	$2.0M

Federal Funding for all awards is contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority for funds provided by both DOE and the DoD TARDEC.

C. Anticipated Number of Awards and Period of Performance

EERE anticipates making approximately 30-50 awards under this announcement depending on the amount of each award. The anticipated period of performance as outlined in the table below by AOI range from up to two (2) years to up to four (4) years. The anticipated number of awards and period of performance for each AOI are as follows:

Area of Interest Number	Area of Interest	Anticipated Number of Awards	Period of Performance
1	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys - Kinetics	2-4	Up To 4 Years
2	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys - Corrosion Behavior	2-4	Up To 4 Years

3	Body-in-white Joining of Aluminum to Advanced High Strength Steel at Prototype Scale	2-3	Up To 3 Years
4	Breakthrough Techniques for Dissimilar Material Joining	5-7	Up To 4 Years
5	Development of High-Performance Cast Alloys and Processing Techniques for Engine Rotating Components	1-2	Up To 4 Years
6	High Temperature DC Bus Capacitor Cost Reduction & Performance Improvements	2-3	Up To 3 Years
7	Applied Battery Research for Improvements in Cell Chemistry, Composition, and Processing	3-6	Up To 2 Years
8	Computer Aided Engineering for Electric Drive Batteries	3-6	Up To 2 Years
9	Advanced Electrolytes for Next-Generation Li Ion Chemistries	2-4	Up To 2 Years
10	Lubricant Formulations to Enhance Fuel Efficiency	3-4	Up To 3 Years
11	Advanced Climate Control Auxiliary Load Reduction	4-6	Up To 3 Years
12	Advanced, Integrated, Modular, and Scalable Wide Bandgap (WBG) Inverter R&D for Electric Traction Drive Vehicles	1	Up To 2 Years

D. Type of Application

EERE will accept only new applications under this FOA (i.e., applications for renewals of existing DOE funded projects will not be considered).

SECTION III - ELIGIBILITY INFORMATION

A. Eligible Applicants

As a condition under this announcement, all applicants must propose that 100% of the direct labor cost for the project (including contractor/subrecipient labor) will be incurred in the United States (including U.S. territories) unless the applicant can demonstrate to the satisfaction of the EERE that the United States economic interest will be better served through a greater percentage of work performed outside the United States. See Section IV.H.4 for waiver request information. Approval is at the sole discretion of EERE. For example, an Applicant may provide evidence that expertise to develop a technology exists only outside the United States, but that ultimate commercialization of the technology will result in substantial benefits to the United States such as improved electricity reliability, increased employment, increased exports of U.S.-manufactured products, etc**.** In these cases, the applicant must request a waiver of this requirement. This waiver must be included as part of the Full Application submitted to DOE. This requirement applies to all AOIs.

1. Individuals

U.S. citizens and lawful permanent residents are eligible to apply for funding as a prime recipient or subrecipient.

2. Domestic Entities

For-profit entities, educational institutions, and nonprofits[1] 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.

DoD/DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) and DOE Government-Operated Government-Owned laboratories (GOGOs) are eligible to apply for funding as a prime recipient or subrecipient.

Non-DoD/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.

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

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

3. Foreign Entities

Foreign entities, whether for-profit or otherwise, are eligible to apply for funding under this FOA. Other than as provided in the "individuals" or "Domestic Entities" sections above, all prime recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a particular 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 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 this requirement in the Full Application. See Section IV.H.4 for waiver request information. The DOE Contracting Officer has the discretion to waive this requirement if he/she determines that it will further the purposes of this FOA and is otherwise in the interests of EERE.

A foreign entity may receive funding as a subrecipient.

4. Incorporated Consortia

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

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

5. Unincorporated Consortia

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

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

- Management structure;

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

B. Cost Sharing

Cost share is based on the total allowable costs of the project (i.e. 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.

The minimum cost share requirement is not the same for all AOIs and varies depending on the type of applicant:

- For all prime applicants who are a Federal Laboratory, FFRDC, or Educational Institution submitting to AOIs 1, 2 and 4-10, the cost share waiver was obtained and only applies when the applicant is selected for award, as the prime applicant. The combined value of the work to be performed by the prime applicant eligible for the cost share waiver must be at least 70% of the total project cost. Therefore, all other project partner efforts may NOT exceed 30% of the total project cost.
- When a prime applicant is eligible for the cost share waiver, all cost share requirements for any project partners, are also waived.
- Prime applicants **other** than educational institutions, Federal laboratories, and FFRDCs must meet the minimum cost share requirements for the total cost of the project (including that portion of the work performed by subawardees who are educational institutions, Federal laboratories, or FFRDCs) as established in the table below according to the AOI.

The mimimum cost share required for each AOI for different types of Applicants is as follows:

Area of Interest Number	Area of Interest	Required Minimum Non-Federal Cost Share for Applicants OTHER than Educational Institutions, Federal Laboratories, and FFRDCs	Required Minimum Non-Federal Cost Share for Educational Institutions, Federal Laboratories, and FFRDCs
1	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys - Kinetics	30%	0%
2	Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys – Corrosion Behavior	30%	0%

3	Body-in-white Joining of Aluminum to Advanced High Strength Steel at Prototype Scale	50%	50%**
4	Breakthrough Techniques for Dissimilar Material Joining	30%	0%
5	Development of High-Performance Cast Alloys and Processing Techniques for Engine Rotating Components	50%	0%
6	High Temperature DC Bus Capacitor Cost Reduction & Performance Improvements	30-40%*	0%
7	Applied Battery Research for Improvements in Cell Chemistry, Composition, and Processing	20%	0%
8	Computer Aided Engineering for Electric Drive Batteries	50%	0%
9	Advanced Electrolytes for Next-Generation Li Ion Chemistries	20%	0%
10	Lubricant Formulations to Enhance Fuel Efficiency	50%	0%
11	Advanced Climate Control Auxiliary Load Reduction	50%	50%**
12	Advanced, Integrated, Modular, and Scalable Wide Bandgap (WBG) Inverter R&D for Electric Traction Drive Vehicles	50%	50%**

* The cost share for Area of Interest 6 High Temperature DC Bus Capacitor Cost Reduction & Performance Improvements is a minimum of 30% for Phase 1 work and a minimum of 40% for Phase 2 work as defined in the AOI discussion in Section I.B.

** No cost share waiver or reduction is applicable to AOIs 3, 11 and 12.

Additional details on cost sharing, including calculations, valuations and samples, are shown in Appendix B.

1. Legal Responsibility

Although the cost share requirement applies to the Project Team as a whole, the assistance agreement makes the Recipient legally responsible for paying the entire cost share. The 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 Recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

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

2. Cost Share Allocation

Each Project Team is free to determine how much each Project Team member will contribute towards the cost share requirement. The amount contributed by individual Project Team members may vary, as long as the cost share requirement for the project as a whole is met.

3. Cost Share Types and Allowability

Every cost share contribution must be within scope of the proposed project and allowable under the applicable Federal cost principles, as described in Appendix B of the FOA.

Project Teams may provide cost share in the form of cash or in-kind contributions. Cash contributions may be provided by the 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 or property was not provided to the state or local government by the Federal Government. Please note that applicability and allowablilty of all cost share proposed is subject to final review and approval by the Contracting Officer prior to award.

The Recipient may <u>not</u> 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 program.
- Bank loans from financial institutions (loan meaning funds borrowed from a financial institution which will later be paid back in full.)

In addition, Project Teams may not use independent research and development (IR&D) funds to meet their cost share obligations under cooperative agreements. 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 Recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. All

sources of cost share are considered part of the 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 C.F.R. Parts 600 for additional guidance on cost sharing, specifically 10 C.F.R. §§ 600.30, 600.123, 600.224, 600.313.

4. Cost Share Contributions by FFRDCs

FFRDCs are funded by the Federal Government; therefore costs incurred by FFRDCs generally cannot 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 a non-Federal source.

5. 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.

C. Other Eligibility Requirements

1. Federally Funded Research and Development Center (FFRDC) Contractors.

A DoD/DOE/NNSA FFRDC is eligible to apply for funding as a prime recipient under this FOA if its cognizant Contracting Officer provides written authorization and this authorization is submitted with the application. If a DoD/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, will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory.

FFRDC contractors may be proposed as team members on another entity's application, subject to the following guidelines:

Authorization for non-DoD/DOE/NNSA FFRDCs. The Federal agency sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of a FFRDC contractor must be consistent with the contractor's authority under its award.

Authorization for DoD/DOE/NNSA FFRDCs. The cognizant Contracting Officer for the FFRDC must authorize in writing the use of a DoD/DOE/NNSA FFRDC contractor on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization:

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

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

Cost Share. Even if the FFRDC contractor 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 portions of the effort.

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

2. Initial Compliance Review of the Full Application

All Full Applications received through Exchange and by the submission deadline will be subject to an Initial Compliance Review. Full Applications that are submitted through other means or submitted after the applicable deadline will not receive a Compliance Review and will be eliminated from further consideration.

Full Applications that are submitted through the EERE Exchange and on-time will be deemed responsive and eligible for technical merit review if:

a. The Applicant meets the eligibility requirements in Section III.A of the FOA;
b. The Full Application complies with the content and form requirements in Section IV.D of the FOA; and
c. The Applicant entered all required information and clicked the "Submit" button in EERE Exchange by the deadline stated in the FOA;
d. All mandatory requirements as specified in Section I are satisfied;
e. The proposed project is responsive to the technical objectives of the FOA and;
f. The proposed project does not include any of the AOI-specific non-responsive criteria described in Section I. B and reiterated as follows:

- **AOI 1** - Applications submitted under AOI 1 will be considered nonresponsive if they include:
  - research in material systems other than magnesium alloys;
  - research in magnesium alloys where magnesium makes up less than 60% of the alloy by weight;
  - research not generally categorized as kinetics, such as mechanical behavior.
- **AOI 2** - Applications submitted under AOI 2 will be considered nonresponsive if they include:
  - research in material systems other than magnesium alloys;
  - research in magnesium alloys where magnesium makes up less than 60% of the alloy by weight;
  - research not generally categorized as being related to corrosion, such as mechanical behavior;
- **AOI 3** - Applications submitted under AOI 3 will be considered nonresponsive if they:
  - include materials other than aluminum (5000, 6000, or 7000 series automotive alloys) and advanced steel (automotive steel alloys with tensile strength of greater than 580 MPa);
  - include material thinner than 0.5 mm or thicker than 5 mm;
  - are for systems other than light-duty vehicle body-in-white;
  - do not include a Tier 1 supplier or automotive OEM as a partner for prototype design, demonstration, and validation;
  - do not address all three technical areas of the scope: 1) Process Development and Demonstration; 2) Joint Characterization; and 3) Model Development and Validation.
- **AOI 4** - Applications submitted under AOI 4 will be considered nonresponsive if they:
  - include the conventional implementation of joining techniques listed in the “Joining Processes” section, or simple combinations of these techniques;
  - include joints of two materials from within the same material system (e.g. DP steel to HSLA steel);
  - include joints of materials thinner than 0.5 mm or thicker than 12 mm;
  - do not include, at the very least, the testing and characterization techniques outlined in the section “Testing and Characterization”;
  - fail to include these 5 tests;
  - as-joined quasi-static tensile failure for a 2t stack-up in lap-shear, butt-joint, or other appropriate configuration dependent on the joint geometry;
  - exposure to standard corrosion environment for various exposure times with quasi-static lap shear failure tested after each increment;
  - characterization of material microstructure in the joint region;
  - characterization of joining-induced defects in the joint region;
  - characterization of failure mechanisms for each of the mechanical tests described above.

- **AOI 5** - Applications submitted under AOI 5 will be considered nonresponsive if they:
  - do not include cast metal alloys with Ultimate tensile strength greater than 700 MPA and Yield Strength greater than 600 MPA;
  - require a forging process;
  - are for systems other than internal combustion engine rotating components;
  - do not include a Tier 1 or automotive OEM as a partner for prototype design, demonstration, and validation;
  - do not address all three technical aspects of this AOI for the proposed alloys and processes: Process Development and Demonstration; Material and Component Characterization and Validation;
  - do not include Cost Models for the production quantities identified;
  - include development of new ICME tools.
- **AOI 6** - There are no additional nonresponsive criteria for AOI 6.
- **AOI 7** - There are no additional nonresponsive criteria for AOI 7.
- **AOI 8** - Applications submitted under AOI 8 will be considered nonresponsive if they:
  - fail to utilize the CAEBAT open architecture platform.
- **AOI 9** - There are no additional nonresponsive criteria for AOI 9.
- **AOI 10** - Applications submitted under AOI 10 will be considered nonresponsive if they include:
  - Formulations that simply lower the viscosity of the lubricant without regard for increased solid-solid contact.
  - Formulations that aren't expected to show a fuel efficiency improvement within 4000 miles or 50 hours of engine operation.
  - Formulations that aren’t expected to show a sustainable fuel efficiency improvement throughout the full useful life of the product.
  - Formulations exclusively for use in off-road (rail, marine, construction, small engines) or motorcycle applications.
  - Formulations exclusively for alternative fuel applications.
  - Formulations that increase wear or reduce component durability (this may be waived for military-only formulations).
  - Formulations that are not compatible with existing emissions control systems (this may be waived for military-only formulations)
  - Formulations exclusively for automatic transmissions, however, automatic transmission fluid can be used in other applications.
  - Projects focused solely on demonstration of a technology.
  - Projects focused mainly on production methods for lubricants.
- **AOI 11** - Applications submitted under AOI 11 will be considered nonresponsive if they:
  - contain strategies that do not include the separate two phases of work as identified above;
  - contain strategies that require significant change to vehicle operating characteristics and/or component interfaces;

- contain strategies that negatively impact compliance to vehicle safety standards;
- include solutions that have significant potential to negatively impact the environment in terms of GHG emissions;
- do not address at least one of the specific technical strategies.

AOI 12 - Applications submitted under AOI 12 will be considered nonresponsive if they:

- focus primarily on demonstration of an existing technology
- contain strategies that do not include the integration and implementation of WBG devices (i.e. SiC and/or GaN);
- don't clearly identify and address design and concept to utilize WBG devices including passive components, interfaces, interconnects, and thermal and packaging challenges;
- contain strategies that require significant change to traction drive system design and/or operating characteristics;
- contain strategies that require significant change to the motor technology/design and performance, and/or component interfaces;
- do not clearly identify and describe approach to modular, scalable and manufacturable designs to enable the potential application across a range of electric vehicle applications;
- contain strategies that do not include the detailed plan to achieve cost reductions and a thorough cost analysis of proposed technology and concept.

Applications that fail to pass the Initial Compliance Review will be found non-responsive to this FOA, will not be forwarded for comprehensive Technical Merit Review and will be ineligible for award.

D. 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.

SECTION IV – APPLICATION AND SUBMISSION INFORMATION

A. Overview of Application Process

The application process for this FOA includes the following:

- Submittal of a Concept Paper (Optional)
- Submittal of a Full Application (Required)
- Reply to Reviewer Comments (Optional).

Any Concept Paper, Full Application or Reply to Reviewer Comments that are submitted after the required deadlines stated in the FOA will not be considered for review. **Applicants are not required to submit a Concept Paper to be eligible to submit a Full Application.**

Concept Papers must be submitted by the specified deadline to the following FOA email address: *FOA0000793@netl.doe.gov*. Concept Papers will be reviewed in accordance with the criteria identified in Section V.B.1. Based on the results of this review, applicants will be either encouraged or discouraged from submitting a full application. The purpose of the Concept Paper is to save Applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

Full Applications must be submitted by the specified deadline through EERE Exchange (*https://eere-Exchange.energy.gov*), EERE's online application portal. All Full Applications received through Exchange and by the submission deadline will be subject to an Initial Compliance Review in accordance with the criteria identified in Section III. C.2. All Full Applications passing the Initial Compliance Review will be forwarded for Technical Merit Review. Applicants whose Full Application does not pass the Initial Compliance Review will be sent a notification via the FOE Email address: *FOA0000793@netl.doe.gov*.

Reply to Review Comments must be submitted by the specified deadline through EERE Exchange (*https://eere-Exchange.energy.gov*), EERE's online application portal. Each Applicant will have access only to comments on its own application(s). Replies to Reviewer Comments will be evaluated as an extension of the Full Application using the established Merit Review Criteria by AOI as outlined in Section V.3. Applicant Replies to Reviewer Comments are limited to clarifying aspects of the application and correcting misunderstandings. The reply may not be used to modify or materially change the submitted application.

B. Address to Request 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 single 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 single 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.

C. Concept Paper (OPTIONAL)

If the applicant elects to submit a Concept Paper, the submission must conform to the following form and content requirements, including maximum page lengths, described below. Concept Papers must be submitted to the designated FOA email address: *FOA0000793@netl.doe.gov* .

Each Concept Paper should be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated into a single Concept Paper. Applicants may submit more than one Concept Paper for an AOI, but it must be for a distinct and unique project.

1. Concept Paper – Format

The Concept Paper must conform to the following requirements:

- The Concept Paper must be submitted in Adobe PDF format.
- The Concept Paper must be written in English.
- All pages must be formatted to fit on 8-1/2 by 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 points or larger (except in figures and tables). A Symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies.
- The Concept Paper must not exceed four pages, including cover page, charts, graphs, maps, and photographs when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right), 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.

2. Concept Paper – Content

The Concept Paper must conform to the following content requirements:

SECTION	PAGE LIMIT	DESCRIPTION

Cover Page	1 page maximum	• Applicant Name
		• Point of Contact Information
		  ▪ Name
		  ▪ Telephone Number
		  ▪ Email
		• Project Title
		• Area of Interest
		• Estimated Total Project Cost
		• Estimated DOE Cost
		• Estimated Recipient Cost
		• Projected Period of Performance

Technology Description	2 pages maximum	• Applicants are required to describe succinctly:
		  o The proposed technology, including its basic operating principles and how it is unique and innovative
		  o 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)
		  o The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges
		  o How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application
		  o The potential impact that the proposed project would have on the

		relevant field and application o The key technical risks/issues associated with the proposed technology development plan o The impact that DOE funding would have on the proposed project
Supporting Documentation	1 page maximum	• Applicants are required to describe succinctly the qualifications, experience, and capabilities of the anticipated Principal Investigator and Project Team, including: o Project Team members and their roles o Principal Investigator qualifications and expertise as needed to successfully execute the project plan o Availability and suitability of facilities • Graphs, charts, or other data to supplement their Technology Description

D. Full Application - Content and Form

You must complete the following application forms found on the EERE Exchange website at: *https://eere-Exchange.energy.gov/*, in accordance with the instructions. **Applicants must include the Control Number assigned by EERE Exchange, in the file name for each required application document.**

1. Full Application Format Requirements

Full Applications must conform to the following requirements:

- Each document must be submitted in the file format prescribed. If no file format is prescribed, an Adobe PDF file format is required.
- All Full Applications must be written in English.
- All pages must be formatted to fit on 8-1/2 by 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 points or larger (except in figures and tables). A Symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies.
- 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 section of the Full Application must conform to the page limits stated below. If Applicants exceed the maximum page lengths indicated below, evaluators will review only the authorized number of pages and disregard any additional pages.

2. Full Application Content Requirements

EERE will not review or consider noncompliant and/or nonresponsive Full Applications (see Section V.B.2 of the FOA).

Each Full Application must be limited to a single concept or technology. Unrelated concepts and technologies must not be consolidated in a single Full Application. Applicants may submit more than one Full Application for an AOI, but it must be for a distinct and unique project.

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

In order to be responsive to this FOA, Full Applications must conform to the following

requirements:

a. 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.B.3 of the FOA.

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).

SECTION	PAGE LIMIT	DESCRIPTION
Area of Interest	0.5 page max.	Each Full Application must identify the Area of Interest and the Applicant's proposed technology.
Project Description and Technical Approach	20 pages max.	This section of the Technical Volume must include the following subsections: A. Project Objectives: This subsection should provide a clear, concise statement of the specific objectives/aims of the proposed project. B. Project Summary: This subsection should provide a concise summary of the proposed technology and project approach. C. Merit Review Criterion Discussion The section should be formatted to address each of the merit review criterion and sub-criterion indicated in the respective AOI in Section V.B.3. Provide sufficient information so that reviewers will be able to evaluate the application in accordance with these merit review criteria. EERE WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH OF THE MERIT REVIEW CRITERION AND SUB-CRITERION. Applicants should present supporting references, data, calculations, estimates, and/or projections to justify each set of claims, explicitly stating any variables and assumptions. D. Relevance and Outcomes/Impacts: This subsection should explain the relevance of the effort to the objectives in the program announcement and the expected outcomes and/or impacts. E. Roles of Participants: For multi-organizational or multi-investigator projects, this subsection should describe the roles and the work to be performed by each participant/investigator, business agreements between the applicant and participants, and how the various efforts will be integrated and managed. Multiple Principal Investigators: The applicant, whether a single organization or team/partnership/consortium, must indicate if the project will include multiple PIs. This

		decision is solely the responsibility of the applicant. If multiple PIs will be designated, the application must identify the Contact PI/Project Coordinator and provide a "Coordination and Management Plan" that describes the organization structure of the project as it pertains to the designation of multiple PIs. This plan should, at a minimum, include: • process for making decisions on scientific/technical direction • publications • intellectual property issues • communication plans • procedures for resolving conflicts • PIs' roles and administrative, technical, and scientific responsibilities for the project F. Facilities And Other Resources: This subsection should identify the facilities (e.g., office, laboratory, computer, etc.) to be used at each performance site listed and, if appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Provide any information describing the other resources available to the project such as machine and electronics shops. G. Equipment: This subsection should list important items of equipment already available for this project and, if appropriate, note the location and pertinent capabilities of each. If you are proposing to acquire equipment, describe comparable equipment, if any, already at your organization and explain why it cannot be used.
Budget Summary	2 pages max.	Applicants are required to provide a two-page budget summary, broken down by the following budget categories. • Personnel • Fringe Benefits • Travel • Supplies/Materials • Equipment (greater than $5,000) • Contractual (identified by major contractor) • Other Directs Costs • Indirect Costs
Bibliography & References Cited Appendix	No page limit	Applicants shall provide a bibliography of any references cited in the Technical Volume. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. In order to reduce the number of files attached to your application, please provide the Bibliography and References Cited information as an appendix to your project narrative. Do not attach a file in field 8. This appendix will not count in the project narrative page limitation.

b. SF-424 – Application for Federal Assistance

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

c. Budget Information (SF-424A/PMC 123.1)

Applicants are required to complete the Budget Summary SF-424A Excel spreadsheet. This form is available on EERE Exchange at *https://eere-Exchange.energy.gov/*.

Applicants must also complete each tab of the Budget Justification PMC 123.1for the project as a whole, including all work to be performed by the Recipient and its Subrecipients, 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.

Applicants must carefully read the "Instructions and Summary" tab provided within the Budget Justification PMC 123.1.

d. Statement of Project Objectives (SOPO)

The SOPO should provide a clear and concise statement of the project goals and expected outcomes. If the Applicant is selected for award negotiations, the DOE funding agreement will incorporate this SOPO that may be released to the public. **It is therefore required that the SOPO shall not contain proprietary or confidential business information. The SOPO shall not exceed 10 pages.**

The SOPO must address how the project objectives will be met. The SOPO must contain a clear, concise description of all activities to be completed during project performance and follow the structure discussed below. The SOPO may be released to the public by EERE in whole or in part at any time. It is therefore required that it shall not contain proprietary or confidential business information. Applicants shall prepare the SOPO in the following format:

********BEGINNING OF SOPO FORMAT********

TITLE OF WORK TO BE PERFORMED

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

A. OBJECTIVES

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

B. SCOPE OF WORK

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

C. TASKS TO BE PERFORMED

(Tasks, concisely written, should be provided in a logical sequence and should be divided into the phases of the project, as appropriate. This section provides a brief summary of the planned approach to this project.)

Task1. Overall Program Management (mandatory first task for all projects)

The objectives for the Project Management portion of the work are to provide project planning, coordination, and reporting as required to successfully achieve the overall objectives of the project.

Project Management Plan

Work will be conducted to develop and maintain the Project Management. The purpose of the Project Management Plan is to manage and report on activities in accordance with the plan. This task includes the writing of reports, presentation slides, invoice control for subcontractors, and expense tracking. Other aspects include technical updates from subcontractors and attendance at review meetings. The Recipient will maintain an up-to-date Project Management Plan designed to achieve the project objectives, covering the entire Project Period, but focusing on the current project phase.

PHASE I

Task 2.0 - (Title)

Subtask 2.1

(Description)

Task 3.0 - (Title)

PHASE II (Optional)

Task 4.0 - (Title)

D. DELIVERABLES

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

[Note: The Recipient shall provide a list of deliverables other than those identified on the "Federal Assistance Reporting Checklist" that will be delivered. At a minimum the following specific deliverables shall be included:

1. Summary of accomplishments and project work report shall be prepared for inclusion in the annual Vehicle Technologies programmatic progress report. Report shall be due by October 31 of each year.
2. Upon completion of a milestone, a brief milestone report shall be provided to verify and document the completion of the milestone.
3. The Project Management Plan shall be updated quarterly.

In addition to the above specific deliverables, additional reports shall be identified in this section and also identified within the text of the Statement of Project Objectives. See the following examples:

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

NOTE: Please refer back to Section I of the announcement for other specific deliverables that may be required as outlined in the AOI to which you are applying for.

E. BRIEFINGS AND PRESENTATIONS

The Recipient shall prepare detailed briefings for presentation to the Project Officer at the Project Officer's facility located in Pittsburgh, PA or Morgantown, WV or Washington, DC. Briefings shall be given by the Recipient to explain the plans, progress, and results of the technical effort approximately twice a year. The Recipient shall provide and present a technical paper(s) at the DOE/NETL Annual Contractor's Review Meeting to be held at the NETL facility located in Pittsburgh, PA or Morgantown, WV or DOE Headquarters in Washington, DC.

********END OF SOPO FORMAT********

e. Project Management Plan (PMP)

The purpose of the PMP is to manage and report on activities in accordance with the plan. Save the PMP in a single file titled "ControlNumber_LeadOrganization_AOI_PMP".

The PMP should be formatted to include the following sections with each section to include the information as described below:

********BEGINNING OF PMP FORMAT********

A. Executive Summary: Provide a description of the project that includes the objective, project goals, and expected results. The description should include a high level description of the technology, potential use or benefit of the technology, location of work sites and a brief discussion of work performed at each site, along with a description of project phases (if the project includes phases). For purposes of the application, this information is included

in the Project Narrative (Field 7) and should be simply copied to this document for completeness, so that the Project Management Plan is a stand-alone document.

B. Risk Management: Provide a summary description of the proposed approach to identify, analyze, and respond to perceived risks associated with the proposed project. Project risk events are uncertain future events that, if realized, impact the success of the project. As a minimum, include the initial identification of significant technical, resource, and management issues that have the potential to impede project progress and strategies to minimize impacts from those issues.

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

The following are examples of the type of milestones that should be included in the Project Management Plan. These should be tailored to meet the specific work tasks of the project (some may be deleted if not applicable):

- Initial Simulation and Modeling Complete
- Initial (Material, Component, or Process) Specifications Complete
- Initial (Material, Component, or Process) Design Complete
- Commercialization Plan Complete
- Initial (Material, Component, or Process) Development & Testing Complete
- (Material, Component, or Process) Downselection Complete
- Test Cell (Material, Component, or Process) and Systems Demonstrations Initiated
- Test Cell (Material, Component, or Process) and Systems Demonstrations Complete
- Delivery of Technology or Material for Government Confirmatory Testing Completed (AOIs 4 and 5 only)
- Systems Integration Design Complete
- Vehicle Integration and Demonstration Initiated
- Vehicle Integration and Demonstration 50% Complete
- Vehicle Integration and Demonstration 100% Complete

[Note: During project performance, the Recipient will report the Milestone Status as part of the required quarterly Progress Report as prescribed in the award document under Attachment 4, Reporting Requirements Checklist.]

D. Funding and Costing Profile: Provide a table (the Project Funding Profile) that shows, by budget period, the amount of government funding going to each project team member. The table should also include total project information (DOE share and recipient share) and cost share percentages. Provide a second table (the Project Government Payment Profile) that projects, by month, the government payments or disbursements planned for the first budget period, at a minimum. The "Project Government Payment Profile" should account for billing delays associated with the recipient billing process prior to requested reimbursement by the DOE.

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

interdependencies between tasks and include the milestones that are identified in the Milestone Log (see Section C above).

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

G. Key Partnerships or Teaming Arrangements: Provide a list of key team members in the project as well as the role of each team member. A hierarchical project organization and structure chart should be provided along with a description of the role and responsibilities of each team member in terms of contribution to project scope. The section should also include key team members who fulfill single or multiple roles within a project as well as the contact information for each.

H. Facilities and Resources: Provide a list of project locations along with a discussion of capabilities and activities performed at each site in terms of contribution to project scope. The address of each work site should be provided.

********END OF PMP FORMAT********

f. 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 the selections are made.*** The project summary must not exceed 1 page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point.

g. 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. A summary slide template is available on EERE Exchange (*https://eere-Exchange.energy.gov/*). *Applicants must use the Summary Slide template to complete their Summary Slide.*

The Summary Slide template requires the following information:

- area of interest;
- applicant name;
- project title:
- principal investigator information;

- key partners;
- project cost and requested DOE funds and proposed applicant funds;
- proposed project duration;
- technology summary;
- description of the technology's impact;
- key graphics (illustrations, charts and/or tables);
- proposed project objectives/goals; and
- project's key idea/takeaway.

h. Resumes

Applicants are required to provide a resume for the PI and other Key Personnel. Each resume is limited to 3 pages maximum. Curriculum vitae will not be considered. Each resume must include:

- Education/training;
- Employment history;
- Awards and honors;
- Up to 10 peer-reviewed publications specifically related to the proposed project;
- Up to 10 other peer-reviewed publications demonstrating capabilities in the broad field; and
- Up to 10 non-peer reviewed publications and patents demonstrating capabilities in the broad field.

Please combine all individual resumes into a single file.

i. Letters of Commitment

If cost share is required, 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. Identify the following information for each third party contributing cost share: (1) the name of the organization; (2) the proposed dollar amount to be provided; (3) the amount as a percentage of the total project cost; and (4) the proposed type of cost share – cash, services, or property.

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. Examples include participation support letters from OEMs and Tier 1 suppliers.

Please combine each individual Letter of Commitment into a single file.

j. Other Sources of Funding Disclosure

EERE requires the PI to complete the Other Sources of Funding Disclosure and submit it with the Full Application. Save the Other Sources of Funding Disclosure in a single file.
In the Other Sources of Funding Disclosure, the PI is required to:

- Describe the additionality and risks associated with the proposed projects
- Disclose whether the PI or any Co-PI(s) have submitted the same application to any Federal or non-Federal entities
- Disclose whether the PI or any Co-PI(s) have submitted any applications for related work to any Federal or non-Federal entities within the last 24 months

- Disclose all financial assistance from any Federal entity that the PI or any Co-PI(s) is currently receiving or has received within the last 5 years
- Disclose any funding from non-Federal entities for related work that the PI or any Co-PI(s) is currently receiving or has received within the last 5 years

k. Subaward Budget Information

Applicants must provide a separate budget, SF-424A and PMC 123.1 (i.e., budget for each budget year and a cumulative budget) for each subawardee (including FFRDCs) that is expected to perform work estimated to be more than $100,000 or 50 percent of the total work effort (whichever is less). The SF424A provides columns for each individual budget-year as well as the cumulative project-budget. The total project cost, including cost share (if applicable) and Federal funding, must be represented in this document. These forms are available on EERE Exchange at ***https://eere-Exchange.energy.gov/***

l. Authorization for non-DOE/NNSA or DOE/NNSA FFRDCs

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

m. Environmental Impact Questionnaire

You must complete the Environmental Impact Questionnaire found at *https://eere-Exchange.energy.gov/*

n. SF-LLL Disclosure of Lobbying Activities

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

Summary of Required Forms and Files:

Full Application (REQUIRED)	• Each Applicant must submit a Technical Volume in Adobe PDF format by the stated deadline. The Technical Volume must include the following sections: o Area of Interest (AOI) (0.5 page max.) - see Section IV.D.2.a o Project Description and Technical Approach (20 page max.) – see Section IV.D.2.a o Budget Summary (2 pages max.) – see Section IV.D.2.a o Bibliography & References Cited Appendix (no page limit) – see Section IV.D.2.a • The Technical Volume must be accompanied by: - o SF-424 (no page limit, Adobe PDF format) – see Section IV.D.2.b o Budget Justification (PMC 123.1.xlsx) and SF-424A (no page limit, Microsoft Excel format) – see Section IV.D.2.c o Statement of Project Objectives (10 page max.) – see Section IV.D.2.d	April 29, 2013 at 8:00 PM Eastern time

	o Project Management Plan (10 pages max.) – see Section IV.D.2.e o Summary/Abstract for Public Release (1 page max., Adobe PDF format) – see Section IV.D.2.f o Summary Slide (1 page max., Microsoft PowerPoint format) – Applicants must use the Summary Slide template available on EERE Exchange (*https://eere-exchange.energy.gov*) – see Section IV.D.2.g o Resumes (3 pages max. for each person)- see Section IV.D.2.h o Letters of Commitment(signed letters of third party cost share commitments, if applicable)- see Section IV.D.2.i o Other Sources of Funding Disclosure – see Section IV.D.2.j o Sub-award Budget SF-424A (Must use PMC 123.1 for sub-awards greater than $100,000) – see Section IV.D.2.k o Authorization from cognizant DOE Contracting Officer for FFRDC, if applicable – see Section IV.D.2.l o Environmental Impact Questionnaire – use template available on EERE Exchange (*https://eere-exchange.energy.gov*) – see Section IV.D.2.m o SF-LLL Disclosure of Lobbying Activities, if applicable – see Section IV.D.2.n	

E. Replies to Reviewer Comments - Content and Form

Written feedback on Full Applications will be made available to Applicants at least four (4) working days before the submission deadline for Replies to Reviewer Comments. Applicants will have a brief opportunity to prepare a short Reply to Reviewer Comments responding to one or more comments. Applicant Replies to Reviewer Comments are limited to clarifying aspects of the application and correcting misunderstandings. The reply may not be used to modify or materially change the submitted application. Applicants must use this Reply to Reviewer Comments format to complete their Reply to Reviewer Comments.

Reply to Reviewer Comments must conform to the following requirements:

- The Reply to Reviewer Comments must be submitted in Adobe PDF format. Save the Reply to Reviewer Comments as "ControlNumber_LeadOrganization_AOI_CommentResponse".
- The Reply to Reviewer Comments must be written in English.
- All pages must be formatted to fit on 8-1/2 by 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 points or larger (except in figures and tables). A Symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies.
- 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.

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 maximum	• Applicants may respond to one or more reviewer comments.

Images	1 page maximum	• Applicants may provide graphs, charts, or other data to respond to reviewer comments.

F. Submissions from Successful Applicants

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

- Indirect cost information
- Other budget information
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Updated Environmental Information
- Necessary award related Intellectual Property Information

G. Intergovernmental Review

Program Not Subject to Executive Order 12372

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

H. Funding Restrictions

1. Allowable Costs

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

Refer to the applicable Federal cost principles referenced in: 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 organizations.

2. Pre-Award Costs

Recipients may charge to an award resulting from this FOA pre-award costs for research and development activities 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 of applications selected under this FOA, if the costs are allowable in scope project related cost and in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600. Recipients must obtain the prior approval of the Contracting Officer for any pre-award costs that are for periods greater than this 90 day calendar period, but not earlier than the selection date. If recipients are State, Local Governments, or the activities are for non-research and development activities and demonstration type activities they may not incur pre-award costs prior to award, without prior approval of the Contracting Officer.

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

National Environmental Policy Act (NEPA) Requirements. The federal funds distributed under this FOA are 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 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 recipient elects to undertake activities that are not authorized for Federal funding by the Contracting Officer in advance of the NEPA determination, the 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 regarding a final NEPA determination prior to taking any action that may have an adverse effect on the environment or limit the choice of reasonable alternatives.

3. 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 U.S.C. 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.

4. Performance of Work in the United States

EERE strongly encourages interdisciplinary and cross-sectoral collaboration spanning organizational and national boundaries. Such collaboration enables the achievement of scientific and technological outcomes that were previously viewed as extremely difficult, if not impossible.

EERE requires all work under EERE funding agreements to be performed in the United States – i.e., prime recipients must expend 100% of the direct labor cost in the United States.

Applicants and Recipients may request a waiver of this requirement. These requests should include the Countries in which work will be performed, description of work to be performed and the rationale for performing work overseas. If requesting a waiver, Applicants must include it in the Full Application. Recipients must submit any waiver requests in writing to the assigned DOE Contracting Officer. The DOE Contracting Officer has discretion to waive this requirement if he/she determines that it will further the purposes of this FOA and is otherwise in the interests of EERE. See Section III. A of the FOA for waiver request information.

5. 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 Recipient for the objectives of the project, and the fair market value of property exceeds $5,000. Consistent with 10 CFR 600.134 (Non-Profits), 10 CFR 600.232 (States and Local Governments), and 10 CFR 600.321 (For Profits), title to all real property, equipment and supplies (excluding Government-furnished property) acquired by or on behalf of the Recipient in connection with performance of the project will not vest in the Recipient unconditionally. The Government retains its equitable interest in the property purchased by the Recipient in connection with performance of the project. During the term of the award, the Recipient may, with the DOE Contracting Officer's prior approval, encumber its title to or dispose of such property. If the property is sold or Recipient otherwise receives financial benefit from the property disposition, during the term of the award, the Recipient shall share the financial benefit with the Government in the same share ratio as the total project cost sharing.

6. Lobbying

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

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

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

I. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. Where to Submit

Concept Papers must be submitted by the specified deadline to the following FOA email address: *FOA0000793@netl.doe.gov*.

APPLICATIONS MUST BE SUBMITTED THROUGH THE EERE EXCHANGE SYSTEM (*http://eere-exchange.energy.gov/*) TO BE CONSIDERED FOR AWARD UNDER THIS ANNOUNCEMENT. Applications submitted by any other means will not be accepted. You cannot submit an application unless you are registered.

Reply to Review Comments must be submitted by the specified deadline through EERE Exchange (*https://eere-Exchange.energy.gov*), EERE's online application portal.

2. **Registration Process**

There are several one-time actions the Applicant should complete. The applicant should:

- Register through the EERE eXCHANGE at *http://eere-exchange.energy.gov*
- Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number at *http://fedgov.dnb.com/webform*
- Register with the System for Award Management (SAM) at *http://www.sam.gov/*. SAM is the government-wide system that replaced the CCR. If you had an active registration in the CCR, you likely have an active registration in SAM.
- Register in FedConnect at *https://www.fedconnect.net*. Use the "Register as a Vendor" link. Refer to the FedConnect Quick Start guide at the website

Besides the eXCHANGE registration system, which does not have a delay, these registration requirements could take several weeks to process and are necessary in order for a potential Applicant to receive an award under this announcement. Therefore, although not required in order to submit an Application, all potential Applicants lacking a DUNS number or not yet registered with SAM should complete them as soon as possible.

EERE Web-Based Submission Information

All application submissions are to be made via the EERE eXCHANGE at *http://eere-exchange.energy.gov.* To gain access to the EERE eXCHANGE system, the applicant must first register and create an account on the main EERE eXCHANGE site. This account will then allow the user to register for FOAs. It is recommended that each organization or business unit, whether acting as a team or a single entity, utilize one account as the appropriate contact information for each submission.

The Applicant will receive an automated response when the application is received; this will serve as a confirmation of EERE receipt. Please do not reply to the automated response. The Applicant will have the opportunity to re-submit an application for any reason as long as the relevant submission is submitted before the specified due date and time. A "User Guide" for the EERE eXCHANGE can be found at *https://eere-exchange.energy.gov/Manuals.aspx* after logging in to the system.

3. **Electronic Authorization of Applications and Award Documents**

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

Submission of award documents, including modifications, through electronic systems used by the Department of Energy, including FedConnect, constitutes the authorized representative's approval and acceptance of the terms and conditions of the award. Award acknowledgement via FedConnect constitutes the authorized representative's electronic signature.

SECTION V - APPLICATION REVIEW INFORMATION

A. Overview of Application Review Process

The Application Review Process will be carried out in multiple steps, as per the following:

1. Technical Merit Review of Concept Paper (If submitted)
2. Initial Compliance Review of the Full Application
3. Technical Merit Review of the Full Applications
4. Review of Applicant's Replies to Reviewer Comments (If submitted)
5. Selection Process

B. Review Process

1. Technical Merit Review of Concept Paper

All Concept Papers submitted will be reviewed based on the following criteria that are of approximately equal importance:

a. the impact of the technology would substantially improve performance relative to the state-of-the-art;
b. the proposed technology is unique and innovative;
c. the proposed R&D approach is without major flaws; and
d. the technology concept is limited to a single concept or technology

The purpose of the Concept Paper step is to save Applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

Applicants with projects that are determined to have a high impact to the DOE FOA objectives will be encouraged to submit a full application per the instructions contained in the FOA. 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.H.2 of the FOA for guidance on pre-award costs.

Applicants with projects that are determined to have a low impact to the DOE FOA objectives will be discouraged from submitting a full application. Applicants receiving a letter of discouragement may still submit a full application even if they receive a notification discouraging them from doing so. By discouraging the submission of a full application, the 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.

2. Initial Compliance Review of the Full Application

All Full Applications received through Exchange and by the submission deadline will be subjected to an Initial Compliance Review. Full Applications that are submitted through other means or submitted after the applicable deadline will not receive a Compliance Review and will be eliminated from further consideration.

Applications that include any of the AOI-specific non-responsive criteria described in Section I. B or application that fail to pass the Initial Compliance Review as outlined in SECTION III (C)(2) will be found non-responsive to this FOA, will not be forwarded for comprehensive Technical Merit Review and will be ineligible for award.

3. Technical Merit Review of the Full Applications

Merit Review Criteria for Full Application
All applications that satisfactorily pass the Initial Compliance Review will be forwarded for comprehensive Technical Merit Review in accordance with 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* All forwarded Full Applications will be evaluated in accordance with the Technical Merit Review Criteria established for the AOI under which the application was submitted. **Each AOI has its own set of technical evaluation criteria consisting of three main technical evaluation criteria, each with numerous subcriteria**. The importance of the main technical evaluation criterion is weighted, totaling 100% for each AOI, as outlined in the criterion below.

The technical evaluation criteria for each individual AOI are as follows:

Area of Interest 1: Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys - Kinetics

Criterion 1: Technical Merit of Technology (50%)

- The extent to which the project output will address distinct gaps in the scientific understanding of magnesium alloy kinetics;
- The uniqueness of the project objectives and project plan when compared to the existing body of magnesium research and development work;
- The detail and technical credibility of the described connection between the proposed research output and future high performance die cast magnesium alloy development;
- The extent to which the plan for disseminating data and results is credible in providing broad access to project output;
- The extent to which the proposed data format and content is useful in allowing other researchers to use project output;
- Responsiveness and relevance of the application to the goals and requirements identified in this announcement;
- Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands from these prior efforts;
- Identification of the degree and nature of the risks associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;

- Adequacy of the current and projected technology readiness levels to support the goals identified in this announcement;
- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc. of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc.
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector.

Criterion 2: Project Approach (30%)

- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of greenhouse gasses;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and
- Extent of work performed in the United States

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- Appropriateness and depth of qualifications and capabilities of key personnel;
- Appropriateness of the team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;

- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

AOI 2 Developing the Scientific Foundation for Advanced Automotive Cast Magnesium Alloys – Corrosion Behavior

Criterion 1: Technical Merit of Technology (50%)

- The extent to which the project output will address distinct gaps in the scientific understanding of magnesium alloy corrosion behavior;
- The uniqueness of the project objectives and project plan when compared to the existing body of magnesium research and development work;
- The detail and technical credibility of the described connection between the proposed research output and future high performance die cast magnesium alloy development;
- The extent to which the plan for disseminating data and results is credible in providing broad access to project output;
- The extent to which the proposed data format and content is useful in allowing other researchers to use project output;
- Responsiveness and relevance of the application to the goals and requirements identified in this announcement;
- Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands from these prior efforts;
- Identification of the degree and nature of the risks associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;
- Adequacy of the current and projected technology readiness levels to support the goals identified in this announcement;
- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc.
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector.

Criterion 2: Project Approach (30%)

- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of greenhouse gasses;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and
- Extent of work performed in the United States

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- Appropriateness and depth of qualifications and capabilities of key personnel;
- Appropriateness of the team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

Area of Interest 3 - Body-in-white Joining of Aluminum to Advanced High Strength Steel at Prototype Scale

Criterion 1: Technical Merit of Technology (50%)

- The extent to which the proposed joining technique has been demonstrated for other applications but is still unusable for body-in-white joints owing to specific assembly and production constraints for body-in-white joining;
- The detail and technical credibility of the described technical barriers to using the proposed technique for dissimilar Al-Steel body-in-white joints;

- The extent to which the proposed prototype scale demonstration assembly accurately emulates the access, constraint, and assembly challenges of body-in-white joining;
- The extent to which the prototype scale demonstration assembly captures production scale performance challenges such as interaction of adjacent welds (spot) and the starting/ending points of the welds (linear);
- Responsiveness and relevance of the application to the goals and requirements identified in this announcement;
- Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands from these prior efforts;
- Identification of the degree and nature of the risks associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;
- Adequacy of the current and projected technology readiness levels to support the goals identified in this announcement;
- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector.

Criterion 2: Project Approach (30%)

- The extent to which the proposed prototype scale demonstration assembly accurately emulates the access, constraint, and assembly challenges of body-in-white joining;
- The extent to which the proposed prototype scale demonstration assembly and testing methods emulates the service conditions and performance of a production body-in-white assembly;
- The extent to which the proposed quantitative joint and assembly performance metrics are sufficient to enable use of the joining technique in a production vehicle;
- The technical soundness of the proposed coupon scale development process and characterization techniques;
- Extent of involvement of automotive OEM or tier one suppliers in developing requirements for the joining technique and demonstration assembly.

- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of greenhouse gasses;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and
- Extent of work performed in the United States

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- Appropriateness and depth of qualifications and capabilities of key personnel;
- Appropriateness of the team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

Area of Interest 4 - Breakthrough Techniques for Dissimilar Material Joining

Criterion 1: Technical Merit of Technology (50%)

- Uniqueness of the proposed joining technique, including fundamental difference from the conventional techniques listed above;
- Technical credibility of the proposed technique to produce structural dissimilar material joints for vehicle applications;
- The extent to which the proposed technique simultaneously addressed mechanical and corrosion performance challenges of dissimilar material joints;
- The feasibility that the proposed technique could eventually be made compatible with the cost and processing requirements for high volume vehicle manufacturing;
- Responsiveness and relevance of the application to the goals and requirements identified in this announcement;

- Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands from these prior efforts;
- Identification of the degree and nature of the risks associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;
- Adequacy of the current and projected technology readiness levels to support the goals identified in this announcement;
- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc.
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector.

Criterion 2: Project Approach (30%)

- The technical soundness of the proposed testing and characterization plan.
- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of greenhouse gasses;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and

- Extent of work performed in the United States

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- Appropriateness and depth of qualifications and capabilities of key personnel;
- Appropriateness of the team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

Area of Interest 5 - Development of High-Performance Cast Alloys and Processing Techniques for Engine Rotating Components

Criterion 1: Technical Merit of Technology (50%)

- The completeness of data provided on existing team products, properties, applications, and limitations;
- The extent to which the proposed alloys and processing technique has been demonstrated for other applications but is still unavailable for internal combustion engine components;
- The detail and technical credibility of the described technical barriers to using the proposed technique for producing high performance low cost rotating components;
- The extent to which the proposed prototype scale demonstration assembly accurately emulates the expected stresses, clearance, dimensional stability, and fatigue challenges of next generation high efficiency internal combustion engine rotating components;
- The extent to which the prototype scale demonstration assembly captures expected performance challenges such as interaction of bearings, journals, oil passages, and life cycle fatigue;
- The extent to which the proposed solution can be modeled using DFT, FEM and other computational methods;
- Responsiveness and relevance of the application to the goals and requirements identified in this announcement;
- Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands from these prior efforts;
- Identification of the degree and nature of the risks associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;
- Adequacy of the current and projected technology readiness levels to support the goals identified in this announcement;
- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc.

- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector.

Criterion 2: Project Approach (30%)

- The extent of involvement of a Tier 1 or automotive OEM as a partner for prototype design, demonstration, and validation.
- The extent to which the proposed prototype demonstration assembly and testing methods emulates the service conditions and performance of next generation high efficiency internal combustion engines;
- The technical soundness of the proposed coupon scale development process and characterization techniques;
- The technical soundness of the proposed process-structure modeling techniques and the perceived usefulness in predicting life cycle performance.
- The technical soundness of the proposed cost modeling techniques and the ability of the solution to meet the stated cost targets.
- The technical soundness of the proposed technology transfer/commercialization plan.
- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of greenhouse gasses;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and
- Extent of work performed in the United States

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- The existing team production, research and development, materials characterization, and computational capabilities;
- Appropriateness and depth of qualifications and capabilities of key personnel;
- Appropriateness of the team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members
- The completeness of data provided on existing team products, properties, applications, and limitations.

Area of Interest 6 – High Temperature DC Bus Capacitor Cost Reduction & Performance Improvements

Criterion 1: Impact of the Proposed Technology Relative to State of the Art (40%)

- The use of quantitative material and/or technology R&D that demonstrates the potential for measureable and significant advancement.
- Demonstration of a profound understanding of the current state-of-the-art and presents an innovative technical approach to significantly improve performance over the current state-of-the-art.
- Demonstration of an awareness of competing commercial and emerging technologies and identifies how its proposed concept/technology provides significant improvement over these other solutions.

Criterion 2: Overall Scientific and Technical Merit (30%)

- Degree that proposed technology is innovative and unique.
- Demonstration of a sound technical approach to accomplish the proposed RD&D objectives;
- Clearly defined project outcome and deliverables.
- Submission of a technology development plan that demonstrates credible and well-justified technical potential to meet or exceed any defined technical target.
- Validity of the approach and likelihood of success based on the level of maturity and commercial acceptance of the proposed technology/solution; reasonableness and adequacy of the proposed manufacturing and commercialization strategy.
- Capacitor specifications including electrical performance and mechanical and thermal requirements are based on an automotive power inverter application. Inverter applications should be DC voltage source designs rated for supplying at least 55kW of peak power in automotive applications.
- Proposal includes the following initial estimates or plans:

- Cost breakdown for packaged capacitors, terminations, and mounting/packaging.
- Expected capacitor requirements including: energy density, frequency range of operation, nominal and peak voltages, and energy losses. The capacitor requirements should correspond to a specific inverter application.
- Commercialization path to reach automotive applications.

Criterion 3: Qualifications, Experience, Capabilities, and Soundness of Management Plan for the Proposed Project Team (30%)

- Degree to which the roles and responsibilities of the project team members are clearly defined and an effective plan to manage the resources.
- Demonstrated experience and commitment of the project team to demonstrate their ability to manage and implement projects of similar risk and complexity (all project aspects, including scope, cost, and schedule) that have led to successful development and commercialization.
- Collaboration of teaming partners on past projects.
- Credentials, capabilities, and experience of proposed team members/key personnel.
- Access to the facilities and equipment necessary to accomplish the RD&D effort or clearly define how the necessary equipment and facilities will be obtained.
- Adequacy of the project timetable/schedule and milestones to successfully accomplish project objectives on time and within the proposed budget.
- Clarity of the identified technical risks and planned mitigation efforts as outlined in the Project Management Plan.

Area of Interest 7 – Applied Battery Research for Improvements in Cell Chemistry and Construction

Criterion 1: Impact of the Proposed Technology Relative to State of the Art (40%)

- The use of quantitative material and/or technology R&D that demonstrates the potential for measureable and significant advancement.
- Demonstration of a profound understanding of the current state-of-the-art and presents an innovative technical approach to significantly improve performance over the current state-of-the-art.
- Demonstration of an awareness of competing commercial and emerging technologies and identifies how its proposed concept/technology provides significant improvement over these other solutions.

Criterion 2: Overall Scientific and Technical Merit (30%)

- Degree that proposed technology is innovative and unique.
- Demonstration of a sound technical approach to accomplish the proposed RD&D objectives;

- Clearly defined project outcome and deliverables.
- Submission of a technology development plan that demonstrates credible and well-justified technical potential to meet or exceed any defined technical target.
- Validity of the approach and likelihood of success based on the level of maturity and commercial acceptance of the proposed technology/solution; reasonableness and adequacy of the proposed manufacturing and commercialization strategy.

Criterion 3: Qualifications, Experience, Capabilities, and Soundness of Management Plan for the Proposed Project Team (30%)

- Degree to which the roles and responsibilities of the project team members are clearly defined and an effective plan to manage the resources.
- Demonstrated experience and commitment of the project team to demonstrate their ability to manage and implement projects of similar risk and complexity (all project aspects, including scope, cost, and schedule) that have led to successful development and commercialization.
- Collaboration of teaming partners on past projects.
- Credentials, capabilities, and experience of proposed team members/key personnel.
- Access to the facilities and equipment necessary to accomplish the RD&D effort or clearly define how the necessary equipment and facilities will be obtained.
- Adequacy of the project timetable/schedule and milestones to successfully accomplish project objectives on time and within the proposed budget.
- Clarity of the identified technical risks and planned mitigation efforts as outlined in the Project Management Plan.

Area of Interest 8 – Computer Aided Engineering for Electric Drive Batteries

Criterion 1: Impact of the Proposed Technology Relative to State of the Art (40%)

- The use of quantitative material and/or technology R&D that demonstrates the potential for measureable and significant advancement.
- Demonstration of a profound understanding of the current state-of-the-art and presents an innovative technical approach to significantly improve performance over the current state-of-the-art.
- Demonstration of an awareness of competing commercial and emerging technologies and identifies how its proposed concept/technology provides significant improvement over these other solutions.

Criterion 2: Overall Scientific and Technical Merit (30%)

- Degree that proposed technology is innovative and unique.
- Demonstration of a sound technical approach to accomplish the proposed RD&D

objectives;

- Clearly defined project outcome and deliverables.
- Submission of a technology development plan that demonstrates credible and well-justified technical potential to meet or exceed any defined technical target.
- Validity of the approach and likelihood of success based on the level of maturity and commercial acceptance of the proposed technology/solution; reasonableness and adequacy of the proposed manufacturing and commercialization strategy.

Criterion 3: Qualifications, Experience, Capabilities, and Soundness of Management Plan for the Proposed Project Team (30%)

- Degree to which the roles and responsibilities of the project team members are clearly defined and an effective plan to manage the resources.
- Demonstrated experience and commitment of the project team to demonstrate their ability to manage and implement projects of similar risk and complexity (all project aspects, including scope, cost, and schedule) that have led to successful development and commercialization.
- Collaboration of teaming partners on past projects.
- Credentials, capabilities, and experience of proposed team members/key personnel.
- Access to the facilities and equipment necessary to accomplish the RD&D effort or clearly define how the necessary equipment and facilities will be obtained.
- Adequacy of the project timetable/schedule and milestones to successfully accomplish project objectives on time and within the proposed budget.
- Clarity of the identified technical risks and planned mitigation efforts as outlined in the Project Management Plan.

Area of Interest 9 - Advanced Electrolytes for Next-Generation Li Ion Chemistries

Criterion 1: Impact of the Proposed Technology Relative to State of the Art (40%)

- The use of quantitative material and/or technology R&D that demonstrates the potential for measureable and significant advancement.
- Demonstration of a profound understanding of the current state-of-the-art and presents an innovative technical approach to significantly improve performance over the current state-of-the-art.
- Demonstration of an awareness of competing commercial and emerging technologies and identifies how its proposed concept/technology provides significant improvement over these other solutions.

Criterion 2: Overall Scientific and Technical Merit (30%)

- Degree that proposed technology is innovative and unique.

- Demonstration of a sound technical approach to accomplish the proposed RD&D objectives;
- Clearly defined project outcome and deliverables.
- Submission of a technology development plan that demonstrates credible and well-justified technical potential to meet or exceed any defined technical target.
- Validity of the approach and likelihood of success based on the level of maturity and commercial acceptance of the proposed technology/solution; reasonableness and adequacy of the proposed manufacturing and commercialization strategy.

Criterion 3: Qualifications, Experience, Capabilities, and Soundness of Management Plan for the Proposed Project Team (30%)

- Degree to which the roles and responsibilities of the project team members are clearly defined and an effective plan to manage the resources.
- Demonstrated experience and commitment of the project team to demonstrate their ability to manage and implement projects of similar risk and complexity (all project aspects, including scope, cost, and schedule) that have led to successful development and commercialization.
- Collaboration of teaming partners on past projects.
- Credentials, capabilities, and experience of proposed team members/key personnel.
- Access to the facilities and equipment necessary to accomplish the RD&D effort or clearly define how the necessary equipment and facilities will be obtained.
- Adequacy of the project timetable/schedule and milestones to successfully accomplish project objectives on time and within the proposed budget.
- Clarity of the identified technical risks and planned mitigation efforts as outlined in the Project Management Plan.

Area of Interest 10 – Lubricant Formulations to Enhance Fuel Efficiency

Criterion 1: Technical Merit of Technology (50%)

- Responsiveness and relevance of the application to the goals and requirements identified in this announcement;
- Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands from these prior efforts;
- Identification of the degree and nature of the risks associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;
- Adequacy of the current and projected technology readiness levels to support the goals identified in this announcement;

- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc.
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector.

Criterion 2: Project Approach (30%)

- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of greenhouse gasses.
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and
- Extent of work performed in the United States

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- Appropriateness and depth of qualifications and capabilities of key personnel;
- Appropriateness of the team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

Area of Interest 11 – Advanced Climate Control Auxiliary Load Reduction

Criterion 1: Technical Merit of Technology (50%)

- Responsiveness and relevance of the application to the goals and requirements identified in this announcement;
- Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands from these prior efforts;
- Identification of the degree and nature of the risks associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;
- Adequacy of the current and projected technology readiness levels to support the goals identified in this announcement;
- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc.
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Applicability of the technology(s) across different regions;
- Ability of the technology to comply with applicable safety standards;
- Potential to reduce the climate control auxiliary loads energy use to improve vehicle efficiency;
- Potential for high volume production of the technology;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector.

Criterion 2: Project Approach (30%)

- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;

- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of petroleum consumption;
- Degree of commitment and capability to commercialize the technology;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and
- Extent of work performed in the United States

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- Appropriateness and depth of qualifications and capabilities of key personnel;
- Appropriateness of the team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;
- Extent of involvement of an OEM and/or technology commercialization partner;
- Completeness of the team to develop, integrate, and commercialize the technology;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

Area of Interest 12 – Advanced, Integrated, Modular, and Scalable Wide Bandgap (WBG) Inverter R&D for Electric Traction Drive Vehicles

- Criterion 1: Technical Merit of Technology (55%)
  - Responsiveness and relevance of the application to the goals, targets, and requirements identified in this announcement for development of a WBG inverter for electric traction drives;
  - Knowledge and understanding of past and current work in the technology area proposed and how the proposed effort builds on or expands integration and implementation of WBG devices from prior efforts;
  - Extent that the description and analysis demonstrate advanced WBG inverter design and will not only meet VTO/APEEM power electronic targets, goals and requirements, but will also describe conformance to traction drive system targets and requirements for electric vehicle applications;
  - Comprehensiveness of description and analysis of the proposed inverter technology and integration into a traction drive system. Must include assumptions and rationale, as well as identify other components necessary for a complete traction drive system.
  - Adequacy of the cost analysis to confirm cost target will be achieved at the inverter and traction drive system levels;

- Identification of the degree and nature of the risks, barriers and challenges associated with the proposed technology and the project, their probability and impact, and proposed mitigation measures;
- Soundness of the proposed approach and likelihood of success as demonstrated through scientific or engineering merit and feasibility of the proposed approach;
- Adequacy of the current and projected technology readiness levels to support the goals, targets and requirements identified in this announcement;
- Realism of technology state of development claims as supported by modeling, simulation, analysis, laboratory tests, etc.
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Potential of the proposed technology to reduce or support the reduction of transportation sector petroleum consumption;
- Potential for the proposed technology to reduce or support the reduction of the environmental impacts of the transportation sector;
- Potential to provide or support economic benefits to end-use consumers; and
- General applicability, timeliness, and economic viability of the proposed technology and potential to improve competitiveness of the transportation sector specifically electric traction drive vehicles.

o Criterion 2: Project Approach (25%)

- Adequacy and thoroughness of the approach to meet the project objectives, including plans to comprehensively address key problems and hurdles to integration and use of WBG devices as well as the viability of the technology;
- Adequacy of the proposed testing to address key operational and performance aspects of the technology, including the level of detail for proposed test matrices, data acquisition, and sampling and analysis protocols;
- Demonstration of prior success in conducting research and development, similar to the project being proposed through the FOA and the successful commercialization of new technologies;
- Adequacy and appropriateness of the schedule including the duration and sequencing of tasks and the scheduling of project milestones and decision points;
- Clarity, completeness, and adequacy of the SOPO;
- Adequacy and alignment of the proposed tasks and products with the scope of the project;
- Adequacy and clarity of the path to commercialization to positively impact the reduction of greenhouse gasses;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work;
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and
- Extent of work performed in the United States

o Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities (20%)

- Appropriateness and depth of qualifications and capabilities of key personnel;

- Appropriateness of the team members, team, and the degree of their commitment to the project;
- Availability and adequacy of equipment, facilities, and other support necessary for the successful performance of the proposed work;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

4. Review of Applicant's Reply to Reviewer Comments

Once EERE has completed its review of Full Applications, reviewer comments on compliant and responsive Full Applications will be made available to Applicants via EERE Exchange. Each Applicant will have access only to comments on its own application(s). Applicants may submit an optional Reply to Reviewer Comments, which must be submitted by the deadline stated in the FOA. The assigned Control Number must be marked in the header of the Reply. Section IV.E of the FOA provides instructions on submitting a Reply to Reviewer Comments. Applicants will have 4 days from the time reviewer comments are posted to prepare and submit a Reply to the Reviewer Comments. The Reply to Reviewer Comments consists of up to two pages of text and up to one page of visual displays of data. EERE will not review any information provided beyond the stated page limits.

Submitting a Reply to Reviewer Comments is optional.

EERE has NOT established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are evaluated as an extension of the Full Application using the established Merit Review Criteria by AOI as outlined in Technical Merit Review of Full Applications outlined above.

EERE will not review Replies to Reviewer Comments submitted through other means and Replies submitted after the applicable deadline.

5. Selection Process

Selection Official Consideration

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

Program Policy Factors

In addition to technical merit review criteria outlined above, EERE may consider the following program policy factors in determining which Full Applications to select for award negotiations.

1. **Optimization of Federal Funds** - It may be desirable to select projects for award of less technical merit than other projects, if such a selection will optimize use of available Federal funds by allowing more projects to be supported while not being detrimental to the overall objectives of the program.
2. **Diversity of Organizations** - It may be desirable to select projects that collectively represent diverse types and sizes of applicant organizations, while not being detrimental to the overall objectives of the program.
3. **Diversity of Technologies** - It may be desirable to select projects for award that represent a diversity of technology concepts and applications, as well as technical approaches, while not being detrimental to the overall objectives of the program.
4. **Federal Investment** -It may be desirable to select project(s) that reduce Federal investment and maximize corporate commitment as demonstrated by cost share levels that exceed the minimum required, while not being detrimental to the overall objectives of the program.

Government Discussions with Applicant

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

C. Anticipated Notice of Selection and Award Dates

Selection and Award Date

EERE anticipates notifying applicants selected for award by **August 30, 2013** and making awards by **September 30, 2013.**

SECTION VI - AWARD ADMINISTRATION INFORMATION

A. Notifications

1. Concept Paper Notifications

The purpose of the Concept Paper step is to save Applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

If an applicant chooses to submit a concept paper, the applicant will be notified of the results of DOE's review via a brief letter either encouraging or discouraging their submittal of a full application. EERE will send a notification letter from the designated FOA email address to the technical and administrative points of contact designated by the Applicant in EERE Exchange.

2. Noncompliant and Nonresponsive Full Applications Notifications

Noncompliant and nonresponsive Full Applications will not be forwarded for comprehensive technical merit review and will not be considered for award negotiations.

The Contracting Officer will send a notification letter using the designated email address to the technical and administrative points of contact designated by the Applicant in EERE Exchange. The notification letter states the basis upon which the Full Application was rejected.

3. Notification of Reviewer Comments

Applicants with projects that were forwarded for comprehensive technical merit review will be contacted when reviewer comments are available for their review and reply.

4. Selection Notifications

EERE will promptly notify Applicants of the determination on the Full Application. EERE will send a notification letter using the designated email address to the technical and administrative points of contact designated by the Applicant in EERE Exchange.

a. Successful Applicants

A notification letter selecting a Full Application for award negotiations does not authorize the Applicant to commence performance of the project. EERE **selects Full Applications for award negotiations, not for award.** Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement.

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

b. 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.

c. 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.

5. Award Notifications

An Assistance Agreement issued by the Contracting Officer is the authorizing award document. It normally includes, either as an attachment or by reference: (1) Assistance Agreement Form; (2) Special Terms and Conditions; (3) Intellectual Property Provisions; (4) Statement of Project Objectives; (5) Reporting Checklist and Instructions; (6) Budget Information; (7) National Policy Assurances; (8) Applicable program regulations, if any; (9) Application as approved by DOE; and (10) DOE assistance regulations at 10 CFR part 600.

For grants and cooperative agreements made to universities, non-profits and other entities subject to OMB Circular A-110, the Award also includes the Research Terms and Conditions and the DOE Agency Specific Requirements located at: *http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp*.

B. Administrative National Policy Requirements

1. Administrative Requirements

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

2. DUNS and SAM Requirements

Additional administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR, Part 25 (See: *2 CFR 25*). Recipients must keep their data at the System for Award Management (SAM) current at *https://www.sam.gov*. SAM is the government-wide system that replaced the CCR. If you had an active registration in the CCR, you have an active registration in SAM. Subawardees at all tiers must obtain DUNS numbers and provide the DUNS to the Recipients before the subaward can be issued.

3. 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. (See: *2 CFR 170*). Recipients must register with the new FSRS database and report the required data on their first tier subawardees. Recipients must report the executive compensation for their own executives as part of their registration profile in the System for Award Management (SAM).

4. Special Terms and Conditions, National Policy Requirements, and Applicant Representations and Certifications

a. The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Award Terms.

b. The National Policy Assurances To Be Incorporated as Award Terms are located at: *http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-form under Award Terms*.

c. Statement of Substantial Involvement

There will be substantial involvement between the EERE and the Recipient during the performance of the resultant cooperative agreement. The EERE program goals and objectives addressed by the project are of a degree of 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.

The following substantial involvement language is anticipated by EERE for applications leading to award under this FOA. However, it may be revised during negotiations leading to award if EERE deems necessary.

RECIPIENT'S RESPONSIBILITIES. The Recipient is responsible for:

Performing the activities supported by this award, including providing the required personnel, facilities, equipment, supplies and services;

Defining approaches and plans, submitting the plans to the DOE Project Officer for review, and incorporating EERE comments;

Managing and conducting the project activities;

Providing all deliverables specified in the award on a timely basis;

Participating in all briefings specified in the award Statement of Project Objectives and attending and reporting project status at program/project review meetings as deemed necessary by the DOE Project Officer;

Submitting technical reports to the DOE Project Officer and incorporating EERE comments; and;

Presenting the project results at appropriate technical conferences or meetings as directed by the DOE Project Officer.

EERE RESPONSIBILITIES. EERE is responsible for:

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

Suggesting specified kinds of direction or redirection of the work because of interrelationships with other projects.

Reviewing in a timely manner, technical reports and other deliverables and providing comments to the Recipient;

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

Review of Continuation Application materials and concurrence for continuation into subsequent budget periods;

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

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

Please refer to *10 CFR 600.5 (b)* for additional information describing substantial involvement.
"DOE 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". Refer to *10 CFR 600.5 (d)* for additional language and citations.

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

The federal funds distributed under this FOA are subject to the National Environmental Policy Act [42 United States Code (U.S.C.) 4321 et seq.; NEPA]. NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions.

While NEPA compliance is a Federal agency responsibility and the ultimate decisions remain with the federal agency, all projects 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. This includes submitting the following information: a detailed description of all activities and facilities proposed; a detailed description of the affected environment; and best management practices and measures to be implemented to reduce or eliminate impacts to environmental and socioeconomic resources and conflicts with other uses of the area.

By law, EERE is required to evaluate the potential environmental impact of projects that it is considering for funding. In particular, EERE must determine before funding a project whether the project qualifies for a categorical exclusion under 10 C.F.R. § 1021.410 or whether it requires further environmental review (i.e., an environmental assessment or an environmental impact statement). In limited circumstances, EERE may fund preliminary activities associated with the proposed project (e.g., preliminary design, environmental studies, preparation of documentation for the environmental review process, and permitting). However, such preliminary activities cannot significantly impact the environment and cannot constitute an irreversible or irretrievable commitment by DOE.

Recipients are required to complete the Environmental Impact Questionnaire for the project as a whole, including all work to be performed by the Recipient and its Subrecipients and

Contractors. Recipients may not limit their responses to work performed by the Recipient.

In completing the Environmental Impact Questionnaire, Recipients must provide specific information regarding the nature of the Project Team's proposed action, including information on their size, operations, and the types and quantities of air emissions, wastewater discharges, solid wastes, land disturbances, etc. Recipients should identify the location(s) of the proposed action and specifically describe the activities that would occur at each location.

Upon request, the Recipient or Subrecipients are required to provide additional information to the DOE NEPA Compliance Officer.

For additional background on NEPA, please see EERE's NEPA website, at *http://nepa.energy.gov/*.

5. **Applicant Representations and Certifications**

Lobbying Restrictions.

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

Corporate Felony Conviction and Federal Tax Liability Representations (March 2012)

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

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

(2) **No** officer or agent of the corporation 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,

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

For purposes of these representations the following definitions apply:

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

6. U.S. Manufacturing Requirement

DOE 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 Recipient may request a modification or waiver of the U.S. Manufacturing Requirement to the DOE Contracting Officer.

a. Small Business Firms and Nonprofits

Small business firms (including Small Business Concerns), domestic nonprofit organizations (including domestic universities) 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 invention(s). This requirement does not apply to articles that are manufactured for use or sale overseas.

Small businesses, domestic universities and nonprofit organizations 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.

b. 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 and 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.

c. 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.

7. **Subject Invention Utilization Reporting**

To ensure that Recipients and Subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE may require Recipients to submit 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 Recipient, and such other data and information as EERE may specify.

8. **Intellectual Property Provisions**

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at *http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms.*

9. **Foreign National Involvement**

All applicants selected for an award resulting from this FOA may be required to provide information to the Department of Energy (DOE) in order to facilitate our responsibilities associated with foreign national access to DOE sites, information, technologies, and equipment. Foreign national is defined as any person who was born outside the jurisdiction of the United States, is a citizen of a foreign government, and has not been naturalized under U.S. law. If the selected applicant, including subrecipients/contractors, anticipates utilizing a foreign national person in the performance of an award, the selected applicant may be responsible for providing to the DOE representative specific information of the foreign national(s) to satisfy compliance with all of the requirements for access approval.

C. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, which are located at *http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms* and will be attached to the award agreement.

SECTION VII - QUESTIONS/AGENCY CONTACTS

A. Questions Regarding the Final FOA

Upon the issuance of a FOA, DOE 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 and whenever reviewer comments are available for review and reply. Specifically, questions regarding the content of this FOA must be submitted to: *FOA0000793@NETL.DOE.GOV* not later than 6 calendar days prior to the application due date. Questions submitted after that date may not allow the government sufficient time to respond.

Therefore, **the deadline for submission of FINAL FOA related questions will be April 23, 2013 at 8:00 PM Eastern time.** Any questions submitted after that deadline will NOT be addressed. Questions regarding problems encountered with the application submittal will be answered as time permits. Applicants are encouraged to review the posted questions and answers daily. Please be as specific as possible when asking questions to insure that questions will be adequately addressed. All questions submitted must clearly identify the Area of Interest (AOI) to insure a timely and accurate response. Failure to identify the AOI, or not being as specific as possible with a question, may result in additional time to address the question or require further correspondence for further clarification regarding the submitted questions.

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*

B. Agency Contacts

Name:	Meghaan D. Hampton
E-mail:	*FOA0000793@NETL.DOE.GOV*

SECTION VIII - OTHER INFORMATION

A. Amendments

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

B. Government Right to Reject or Negotiate

DOE 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.

C. Commitment of Public Funds

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

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

D. Proprietary Application Information

DOE will use data and other information contained in applications strictly for evaluation purposes. Applicants should not include patentable ideas, trade secrets, confidential, proprietary, or privileged information in their applications unless such information is necessary to convey an understanding of the proposed project.

Applications containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act. 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.

The cover sheet of the application must be marked as follows and identify the specific pages containing confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:
Pages [list applicable pages] of this document may contain confidential, proprietary, or privileged information that 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.

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure."
In addition, every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

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

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

G. Notice of Right to Conduct a Review of Financial Capability
DOE 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).

H. 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.

I. Requirement for Full and Complete Disclosure
Applicants are required to make a full and complete disclosure of the information requested in the Other Sources of Funding Disclosure. Disclosure of the requested information is mandatory. Any failure to make a full and complete disclosure of the requested information may result in:

- The rejection of a Full Application; 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.

J. Retention of Submissions
DOE will retain copies of all Concept Papers, Full Applications, Replies to Reviewer Comments, and other submissions. No submissions will be returned. By applying to DOE for funding, Applicants consent to DOE's retention of their submissions.

K. Title to Subject Inventions

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

- Domestic Small Business Firms, and Nonprofit Organizations (including Universities): Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small business firms and nonprofit organizations may elect to retain title to their subject inventions subject to the provisions of the Bayh-Dole Act.
- 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: The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. **Pursuant to 10 CFR Part 784, DOE intends to execute a class patent waiver for all AOIs of this announcement. Any entity other than a domestic small business or domestic nonprofit organization, which do not need to request a waiver, can elect to participate in the class waiver if they meet the requirements set forth in the waiver determination.** Under this determination, it will not be necessary for that entity to apply for a patent waiver.
- 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 DOE 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.

L. Government Rights in Subject Inventions

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

M. 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.

N. 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 Recipient or Subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a non-exclusive, partially exclusive, or exclusive license in any field of use to a responsible applicant or applicants, upon terms that are reasonable under the circumstances. If the Recipient, assignee, or exclusive licensee refuses such a request, the Government has a right to grant such a license itself if the Government determines that:

- The Recipient or assignee has not taken or is not expected to take effective steps to achieve

practical application of the invention within a reasonable time;

- Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by the Recipient, assignee or their licensees;

- Such action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by the Recipient, assignee, or licensee; or

- The U.S. Manufacturing requirement has not been obtained or waived or because a licensee of the exclusive right to use or sell any subject invention has not met the requirement.

O. 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.

- First Produced Data: The U.S. Government normally retains unlimited rights in technical data first 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 DOE awards may be protected from public disclosure for up to five (5) 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 must be inserted into the data clause in the cooperative agreement. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

- Special Protected Data: This program is covered by a special protected data statute. The provisions of the statute provide for the protection from public disclosure, for a period of up to **five (5) years** from the development of the information, of data that would be trade secret, or commercial or financial information that is privileged or confidential, if the information had been obtained from a non-Federal party. Generally, the provision entitled, Rights in Data Programs Covered Under Special Protected Data Statutes (10 CFR 600 Appendix A to Subpart D), would apply to an award made under this announcement. This provision will identify data or categories of data first produced in the performance of the award that will be made available to the public, notwithstanding the statutory authority to withhold data from public dissemination, and will also identify data that will be recognized by the parties as protected data.

P. Copyright

The Recipient and Subrecipients may assert copyright in copyrightable data, such as software, first produced under the award without DOE 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. In addition, for those awards requiring distribution of software as OSS, the additional information in Appendix C must be addressed in the application.

Q. 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 DOE as:

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

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

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

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

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

- Social Security Numbers in any form
- Place of Birth associated with an individual
- Date of Birth associated with an individual
- Mother's maiden name associated with an individual
- Biometric record associated with an individual
- Fingerprint
- Iris scan
- DNA
- Medical history information associated with an individual
- Medical conditions, including history of disease
- Metric information, e.g. weight, height, blood pressure
- Criminal history associated with an individual
- Employment history and other employment information associated with an individual
- Ratings
- Disciplinary actions

- Performance elements and standards (or work expectations) are PII when they are so intertwined with performance appraisals that their disclosure would reveal an individual's performance appraisal
- Financial information associated with an individual
- Credit card numbers
- Bank account numbers
- Security clearance history or related information (not including actual clearances held)

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

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

R. Annual Compliance Audits

If a for-profit entity is a Recipient of a DOE award and has expended greater than $500K of DOE 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 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 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. DOE will share in the cost of the audit at its applicable cost share ratio.

REFERENCE MATERIAL

Appendix A – Definitions

"Amendment" means a revision to a FOA

"**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 document executed by a DOE Contracting Officer, after an application is approved, which contains the terms and conditions for providing financial assistance to the recipient.
"**Budget**" means the cost expenditure plan submitted in the Application, including both the DOE contribution and the Applicant Cost Share.

"**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 DOE official authorized to execute Awards on behalf of DOE and who is responsible for the business management and non-program aspects of the Financial Assistance process.

"**Cooperative Agreement**" means a Financial Assistance instrument used by DOE 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 DOE and the Applicant during the performance of the contemplated activity. Refer to *10 CFR 600.5* for additional information regarding cooperative agreements and substantial involvement.

"**Cost Sharing**" means that portion of project or programs costs not borne by the Federal Government.

"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 Grants.gov. *http://www.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. *https://eere-Exchange.energy.gov*

"**Financial Assistance**" means the transfer of money or property to a recipient or subrecipient to accomplish a public purpose of support or stimulation authorized by Federal statute.

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

“Federally Funded Research and Development Center (FFRDC)” means a research laboratory as defined by Federal Acquisition Regulation 35.017.

“Funding Opportunity Announcement (FOA)” is any issuance used to announce funding opportunities that would result in the award of a discretionary grant, cooperative agreement, or technology investment agreement, whether it is called a program announcement, program notice, solicitation, broad agency announcement, research announcement, notice of program interest, or something else.

"Grant" means an award of financial assistance, including cooperative agreements, in the form of money, or property in lieu of money, by the Federal Government to an eligible grantee. The term does not include technical assistance which provides services instead of money, or other assistance in the form of revenue sharing, loans, loan guarantees, interest subsidies, insurance, or direct appropriations. Also, the term does not include assistance, such as a fellowship or other lump sum award, which the grantee is not required to account for.

“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. *http://www.grants.gov*

"**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).

"**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 DOE for Financial Assistance (whether such Financial Assistance represents all or only a portion of the support necessary to carry out those activities).

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

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

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

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

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

"**Total Project Cost**" means all all allowable costs, as set forth in the applicable Federal cost principles, incurred in accomplishing the objective of the project during the project period, including the value of contributions made by third parties and costs incurred by Federally Funded Research and Development Centers.

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. DOE 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*, and 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 a DOE 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.

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, DOE 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, DOE generally does not allow pre-award costs prior to the signing of the Selection Statement by the DOE Selection Official.

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

DOE Financial Assistance Rules (10 CFR 600)

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

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

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

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

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

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

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

(b) *Other types of organizations.* Allowability of costs incurred by other types of

organizations that may be subrecipients under a prime award is determined as follows:

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

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

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

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

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

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

(B) *Valuing and documenting contributions*

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

(a) The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or

(b) The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.

(2) *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.

(3) *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.

(4) *Valuing property donated by third parties.*

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

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

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

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

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

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

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

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	Required Federal Share %	Non-federal Cost 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)	100,000	100%	0%
	$2,000,000		

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:

Task	Proposed Federal Share	Federal Share %	Required Non-federal Cost Share $	Required Non-federal Cost 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
	$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 C - Open Source Software

This Appendix must be attached to all FOAs that require software produced under at least one Topic Area of the Award to be distributed as open source.

Open Source Software Distribution Plan

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

1. A complete description of any existing software that will be modified or incorporated into software produced under this FOA, including a description of the license rights. The license rights must allow the modified or incorporated software to be distributed as open source.
2. A discussion of the open source license that the Applicant plans to use for the software it plans to produce under the FOA, and how that choice furthers the goals of this FOA. The discussion must also address how the license conforms to the conditions listed below.
3. A method for depositing the software in a source code repository.
4. A method for sharing and disseminating the software and other information to team members or others when multiple parties will contribute to the development of the software or the FOA requires that the software or other information be shared or disseminated to others.

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

- **Free Redistribution**

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

- **Source Code**

  The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, *e.g.*, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code and intermediate forms such as the output of a preprocessor or translator are not allowed.

- **Derived Works**

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

- **Integrity of the Author's Source Code**

  The license may restrict source-code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of

software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

- **No Restriction Against Fields of Endeavor**
  The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.
- **License Must Not Be Specific to a Product or Technology**
  The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution. No provision of the license may be predicated on any individual technology or style of interface.

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

Examples of Acceptable Licenses

- **Apache License, 2.0**
  http://www.apache.org/licenses/

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

  The result is a license that is compatible with other open source licenses, while remaining true to and supportive of collaborative development across both nonprofit and commercial organizations.
  All packages produced by the ASF are implicitly licensed under the Apache License, Version 2.0, unless otherwise explicitly stated.

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

  The GNU General Public License (GNU GPL or simply GPL) is the most widely used free

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The GPL is the first copyleft license for general use, which means that derived works must be distributed under the same license terms. Under this philosophy, the GPL grants the recipients of a computer program the rights of the free software definition and uses copyleft to ensure the freedoms are preserved, even when the work is changed or additions are made. This aspect distinguishes the GPL from permissive free software licenses, including the BSD licenses.
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  The LGPL is primarily used for software libraries, although it is also used by some stand-alone applications, most notably Mozilla and OpenOffice.org.

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

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

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